REPORT OF

THE COMMITTEE TO STUDY DEVELOPMENT IN HILL STATES ARISING FROM MANAGEMENT OF FOREST LANDS WITH SPECIAL FOCUS ON CREATION OF INFRASTRUCTURE, LIVELIHOOD AND HUMAN DEVELOPMENT

Planning Commission
Government of India
New Delhi

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FORWARDING LETTER

The Report of the "Committee to study Development in Hill States arising from Management of Forest Lands with Special Focus on Creation of Infrastructure, Livelihood and Human Development" is presented as under:-

B.K. Chaturvedi

New Delhi
6th November, 2013

(B.K. Chaturvedi)
Chairman of the Committee &
Member, Planning Commission

THE COMMITTEE

To study

Development in Hill States arising from Management of Forest Lands with Special focus on Creation of Infrastructure, Livelihood and Human Development

Members of the Committee

i)	**Shri B.K. Chaturvedi** Member, Planning Commission	Chairperson – (In charge of North Eastern States, Jammu & Kashmir and Energy Division)
ii)	**Shri Saumitra Chaudhuri** Member Planning Commission.	In charge of Himachal Pradesh & Uttarakhand (up to end-2012)
iii)	**Dr. K. Kasturirangan** Member, Planning Commission.	In charge of Environment & Forests
iv)	**Dr. Mihir Shah** Member, Planning Commission.	In charge of Rural Development
v)	**Prof. Abhijit Sen** Member, Planning Commission	In charge of Financial Resources
vi)	**Smt. Sindhushree Khullar** Secretary, Planning Commission	
vii)	**Dr. M. Govinda Rao** *(up to January 7, 2013)* Director, National Institute of Public Finance & Policy, now Member 14th Finance Commission	
viii)	**Prof. Atul Sarma,** Former Member, 13th Finance Commission & Former Vice Chancellor, Rajiv Gandhi University, Itanagar.	
ix)	**Shri R.S. Tolia,** Former Chief Secretary, Uttarakhand	
x)	**Smt. Anjali Goyal**, Adviser, PAMD, Planning Commission	Convenor

ACKNOWLEDGEMENTS

The Committee takes this opportunity to thank the Hon'ble Prime Minister at whose instance this Committee was set up to look into the issues pertaining to the development in Hill States arising from Management of Forest Lands with Special focus on Creation of Infrastructure, Livelihood and Human Development. The Committee expresses its gratitude towards Dr. M Govinda Rao, the then Director, NIPFP who served as the member of the Committee upto January 2013 and contributed towards developing the framework for providing special assistance to hilly States of India particularly those in the Himalayan Region. Special thanks to Dr. K Radhakrishnan, Chairman, Indian Space Research Organisation; Dr. Y V N Krishnamurthy, Director, Indian Institute of Remote Sensing and their colleagues for providing valuable inputs for the deliberations of the Committee and preparation of the Report.

The Committee takes this opportunity to thank Dr. Rita Pandey, Professor, NIPFP for providing valuable inputs including towards developing a model for ascertaining developmental disabilities of various States. The Committee also acknowledges the contribution of various officials of Planning Commission particularly Dr. Nagesh Singh, the then Adviser (PAMD), Ms. Anjali Goyal, Adviser (PAMD), Dr. Yogesh Suri, Adviser (Development Policy), Dr. Savita Sharma, Adviser (Perspective Planning) and Shri Shatrughan Lal, Consultant (PAMD) for their excellent support in organizing the meetings of the committee, development of the analytical model and preparation of the Report of the Committee. It is sincerely hoped that this Report would serve its purpose in addressing both the process issues and also fiscal compensation for Himalayan and North Eastern States for maintaining valuable eco-systems, the benefits of which are shared by the country at large.

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ABBREVIATIONS USED IN THE REPORT

AAI : Airports Authority of India
AWS : Automatic Weather Stations.
BARC : Bhabha Atomic Research Centre
BULI : Barren & Unculturable Land Index
CAMPA : Compensatory Afforestation Fund Management and Planning Authority
CEA : Central Electricity Authority
CGWB : Central Ground Water Board
CWC : Central Water Commission
DDI : Developmental Disability Index
DONER : Department of Development of North Eastern Region
DRR : Disaster Risk Reduction
DST : Department of Science & Technology
DWR : Doppler Weather Radar
E&F : Environment & Forest
EIA : Environment Impact Assessment
EMP : Environment Management Plan
FAO : Food and Agricultural Organisation
FCA : Forest Conservation Act
FCA : Forest Cover Area
FCI : Forest Cover Index
FPC : Forest Protection Committee
FR : Financial Resources
GA: Geographical Area
GADI : Geographical Area Disadvantage Index
GBS : Gross Budgetary Support
GDP : Gross Domestic Product
GFRA : Global Forest Resources Assessment
GIS : Geological Information System
GLOF : Glacial Lake Outburst Flood
GSI : Geological Survey of India
IDI : Infrastructure Deficit Index
IFA : Indian Forest Act
IIRS : Indian Institute of Remote Sensing
IMD : Indian Meteorological Department
NCMRWF : National Centre for Medium Range Weather Forecasting
IMSD : Integrated Mission for Sustainable Development
ISRO : Indian Space Research Organization
IRS : Institute of Remote Sensing
IWMP : Integrated Watershed Management Programme
JFMR : Joint Forest Management Resolution
LHMP : Landslide Hazard Mitigation Programme
LHZ : Landslide Hazard Zonation
LUS : Land Use Statistics
LWE : Left Wing Extremism
MDF : Moderately Dense Forest
MoE&F : Ministry of Environment & Forest
NAPCC : National Action Plan on Climate Change
NEP : National Environment Policy
NER : North Eastern Region
NFP : National Forest Policy
NGLM : National Geomorphological and Lineament Mapping
NIH : National Institute of Hydrology
NIPFP : National Institute of Public Finance & Policy
NLCPR : Non-Lapsable Central Pool of Resources
NNRMS : National Natural Resources Management System
NPV : Net Present value
NRSA : National Remote Sensing Agency
NRSC : National Remote Sensing Centre
NTFP : Non-timber forest produce
NWP : Numerical Weather Prediction
OF : Open Forest
R&R : Reconstruction & Rehabilitation
RGDWM : Rajiv Gandhi National Drinking Water Mission
SDMC : SAARC Disaster Management Centre
SAC : Space Applications Centre
SDP : State Domestic Product
SEOC : State Emergency Operation Centre
DMMC : Disaster Mitigation &Management Centre
SOI : Survey of India
SP : State Plan
SPP : Special Project Plan
USAC : Uttarakhand Space Application Centre
VDF : Very Dense Forest

EXECUTIVE SUMMARY

INTRODUCTION

1. The Twelfth Five Year Plan, while striving for faster and more inclusive growth, lays significant emphasis on the issue of sustainability. The Plan document recognizes that the development process cannot afford to neglect the environmental consequences of economic activity, or allow unsustainable depletion and deterioration of natural resources. The Twelfth Plan must, therefore, have a strategy of development which effectively reconciles the objective of development with the objective of protecting the environment.

2. All States in India have State-specific requirements to meet their developmental aspirations and targets of which poverty alleviation and the creation of infrastructure command high priority. However, certain States such as those in the Himalayan region stretching from Jammu & Kashmir to North East are at disadvantageous situation in terms of difficult terrain, severe weather conditions, large forest land, dispersed habitations, small and under-developed markets, long international borders, poor connectivity and inadequate general infrastructure. The cost of delivery of public services in these States is higher compared to other States due to their typical topography. These acts as constraints in terms of development compared to other States. With the procedures for environmental clearances being generally identical for all States, the States having a large forest cover find it difficult to get environmental clearances, even for infrastructural projects which hamper their developmental initiatives. There is no free or open land to take up compensatory afforestation, which by definition means converting open land into a forest by planting trees/seeds. As a result, the funds available under compensatory Afforestation Fund Management and Planning Authority (CAMPA) are also not available to these States, even though it is they who have put the money on NPV basis. Besides, these States are unable to use forest resources for raising revenue and at the same time have to incur significant expenditure for maintaining the forests.

3. In order to address the specific needs of these States, certain mechanisms are already in place such as through the tax devolution formulae used by the Finance Commissions; budgetary support provided by the Planning Commission; special schemes, packages and policy measures; fiscal incentives in terms of income tax/ excise duty concessions, and so on. However, these may still be inadequate and may need to be expanded keeping taking into account their geographical, topographical and socio-political characteristics on the one hand and the constant pressure on hill states for conservation of resources on the other.

4. Many of these States have represented to the Government of India that it is not appropriate to apply the same yardstick for statutory requirements and while considering central assistance to the States which have a large forest cover. These have argued that they should be given some kind of compensation in form of a “Green Bonus” for having more forests and other valuable eco-system, the benefits of which are shared with the country at

large. It has been suggested that this can be done by explicitly changing the Gardgil Mukherjee Formula or by having some alternate compensation mechanism. Besides, the States like Jammu & Kashmir, Himachal Pradesh and Uttarakhand have raised these issues with the Honorable Prime Minister indicating that they should be treated at par with North Eastern States and be allowed to contribute only 10 per cent as their share in the Centrally Sponsored Schemes. In this background, with the approval of the Honorable Prime Minister, a Committee was constituted by the Planning Commission on 25 November 2011 to study the development in Hill States arising from Management of Forest Lands with special focus on creation of infrastructure, livelihood and human development.

5. The Committee held six meetings and deliberated on various issues with the representatives of the State Governments of Hill States and the concerned Ministries. The scope of this study has been confined to the Himalayan Hill States of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and seven North Eastern States (viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura). During the deliberations of the Committee, a study was assigned to National Institute of Public Finance and Policy (NIPFP) to work out a suitable methodology for estimation of compensation to be paid to the Hill states for maintaining the forest cover. Accordingly, NIPFP prepared a study on the Developmental Disability Index for Hill States in India. Subsequently, the Planning Commission carried out extensive in-house computation to independently arrive at infrastructure and related Disability Indices. The computations indeed show that these States are worse off in terms of Developmental Disability Index and there is a case for devolving funds to them based on the higher transaction costs that they face due to bio-geographical reasons such as forest land in hilly terrain. Since the notion of disability stems from the motivation of inclusiveness and sustainable development, it is desirable that such devolution is closely monitored and linked to outputs/outcomes that address the disability and help in overcoming these.

6. In order to compensate the States for maintaining high forest cover, the Twelfth Finance Commission had provided a grant of Rs.1,000 crore to States, to be disbursed in accordance with the share of State in the total forested acreage in the country. The Thirteenth Finance Commission has also recognized the need for incentivizing forest conservation and compensating states for economic disadvantages arising from the maintenance of forest cover. The Commission has recommended a forest formula designed to take into consideration various factors and allocated a sum of Rs.5,000 crore for compensating States for these purposes. However, it is seen that apart from Arunachal Pradesh which has been given an allocation of Rs.728 crore over the 5 year period, the allocation to other States is much lower with Sikkim getting Rs.40.56 crore and Uttarakhand Rs.205.44 crore. Though the Finance Commission grant is in addition to Compensatory Afforestation and Fund Management Authority (CAMPA) funds, the releases under CAMPA funds have been through an ad hoc arrangement with the amount released at Rs.100 crore. Thus, both Finance Commission grants as well as CAMPA funds taken together appear insufficient to provide resources on a scale which would enable these State Governments to take up major infrastructure projects.

7. At present, Government is providing large amount of funds for the Special Category States. In addition to funds transferred by Planning Commission, 10 per cent of the Plan outlay of the non-exempted Ministries is to be spent in the NE States. The non-lapsable pool for certain Plan resources are also made available to Department of NER to make investments in infrastructure, the allocation of which ranges between Rs. 650 to 800 crore per annum in the recent years. The accrual in NLCPR at present would be close to Rs. 8,000 crore. A window has already been opened under NLCPR which has become operational since April 2012 under which central ministries dealing with infrastructure projects can get access to these funds from NLCPR (Central) for projects in the North East Region (NER). However, making available resources is not enough to meet the desired objectives. There are equally important issues such as those pertaining to land acquisition, forest clearances, disturbed law & order conditions and inadequate capability of the institutions to implement major projects in the region.

8. Keeping in view all these aspects, the Committee feels that there is a need to compensate the Himalayan and North Eastern States for maintaining valuable eco-systems, the benefits of which are shared by the country at large. The recommendations are made in two parts. The first part covers the Process Issues and the second part covers the special financial dispensation, which are as under.

RECOMMENDATIONS – PROCESS ISSUES

9. These issues essentially comprise those initiatives which are required to speed up the development process and may not require any special financial compensation. These include the following:

i) While due emphasis on environment needs to be continued, relaxation in norms should be made for Himalayan & North Eastern States. The Committee has observed that the procedures which are in place for environmental clearances of various projects in the country are generally identical for all States. This is a constraint for States which have large forest lands or hilly terrains. There is a need to take a view on the relaxation of forest clearance norms for Himalayan States in line with Left Wing Extremism (LWE) affected districts in order to ensure fast tracking of clearance for infrastructure projects.

ii) The MoE&F should scrutinize specific proposals in this regard in consultation with the respective States. Besides, it is essential to fast track the proposals for environmental approvals/forest clearance to impart efficiency and transparency to the entire system. There must be a time bound approach for providing clearances, within a time frame of 3 to 6 months. A co-ordination committee could be formed with representatives of both Central and State Governments at least for large projects, which could sort out issues, if any.

iii) The decision to permit the use of CAMPA funds for densification of forests with low canopy cover has already been given in some cases and this provision should be made applicable generally.

iv) For developmental projects the extant provisions must be relaxed, allowing for automatic diversion of forest land up to 10 ha from the current limits of 1 ha.

v) In the case of infrastructure projects, a large number of such projects are held up due to non-availability of forest clearances. The Committee feels that the respective States should be provided greater flexibility to accord approval for projects involving diversion of forest land up to an area of 10 ha from the present limit of 5 ha.

vi) There is also a need to streamline the policy and procedures by cutting down on the multiple stages in processing the forest/ environment clearance projects.

vii) There should be at least one office of the Ministry of Environment and Office in each of the Himalayan & NE State to expedite E&F clearances. Thus, in the case of the North Eastern States the regional office is at Shillong and the logistical arrangement of interaction and clearance in consultation with the respective State Governments become cumbrous and time consuming.

viii) In any case a time bound system for receiving, processing and granting of clearances has to be strictly followed within a reasonable time frame, not exceeding one year.

ix) The Ministry of Road Transport & Highways has submitted that for **border road projects** there is a need for permitting right-of-way up to 100 metres and up to 60 metres for widening, against 24 metres prevalent as of now. They have also recommended that cutting of trees may be permitted subject to the condition that afforestation would be done on double the area somewhere else. The Committee recommends that this is an acceptable position for border roads projects.

IMPORTANCE OF SAFER DESIGN & PRACTICES

10. The tragic events in Uttarakhand in June 2013 have highlighted the extent to which Nature's fury can be unleashed in these mountainous regions. It has underscored the importance of undertaking development work while taking full cognizance and adopting practices that mitigate the vulnerability of these regions to such extreme events. The question is how in the remote and mountainous regions of our country development activities should better take into account and work their way around the difficulties imposed by the terrain and the vulnerability of these areas to inclement and particularly extreme weather and geological events.

11. In making the designs of development activities, be it roads, railways, airports, helicopter-pads, hydropower projects, there exist a base of scientific knowledge upon which decisions have been and continue to be taken. However, it should be emphasized that the by-products of development work, be it the disposal of excavated earth, or the cutting of hillsides, should be designed and undertaken in a manner which minimizes, if not eliminates and counteracts, any increase in the vulnerability of the area to natural events of an extreme kind. These measures will if anything adds to the cost of building much needed infrastructure, which underscores the recommendations made by the Committee in regard of fiscal assistance.

12. The experience of development in the mountainous regions in the rest of the world clearly suggests that it is possible to undertake such activities in a manner that meshes in with the containment of natural vulnerabilities. While there are material differences in circumstances the development of infrastructure in the European Alpine region does

demonstrate the need and the ability to build in difficult mountainous areas in an environmentally safe manner.

13. The Committee is of the view that Government should take immediate steps to set up a platform for close interaction between the agencies enjoined with this task in the European Alpine nations, particularly Switzerland and Austria, such that the best practices and technical framework can enrich safe developmental work in our own Himalayan region.

14. The Committee had requested the Institute of Remote Sensing (ISRO), Dehra Dun, to examine the issues of the challenges to planning development and rehabilitation programmes in the region in a fashion that is sustainable from the environmental and geological perspective. The Institute has submitted a report which is annexed. A summary of the findings and recommendations are incorporated in the body of this report.

15. In the course of the discussion on this subject, it was felt that the enquiry on the landslide, identification of and eventual construction of a safe path following upon the Malpa tragedy should also be drawn upon. Accordingly ISRO had submitted a note on "Landslide Hazard Zonation (LHZ) Mapping along the Pilgrimage Route Corridors of Utarakhand and Himachal Himalaya" which is enclosed as Annex-3. It is an abbreviated version of the report on Malpa tragedy that was submitted by ISRO to Cabinet Secretary in 2000-01. It includes recommendations in the context of the recent disasters that include Okhimath Landslides in 2012 and Uttarakhand Landslides associated with June 2013 extreme rainfall.

16. ISRO has also submitted to the Committee a concept paper on "Creating a facility for Disaster Risk Reduction and Sustainable Development in the Indian Himalayan Region", which is enclosed as Annex-4 of this Report. This concept paper is a broad outline of the framework on which such an institution can be created. It also suggests three options with pros and cons for the different options. It is recommended that a separate committee with members from ISRO, Stakeholders, Ministry of Environment & Forests as well as National Disaster Management Authority may be set up to work out a full-fledged proposal based on this concept paper.

17. A scheme for developing an institutional mechanism for accessing the most suited technology and knowledge databases for adoption of environmentally safer practices for developmental work should be an intrinsic part of the recommendations of this Committee. In this existing institutions must be networked and one or two anchor institutions must be supported along with the network and this should be linked to agencies working in similar geographical regions in the European Alps and elsewhere. An outline is included later in the body of this report. The Committee underscores the importance of individual State governments to be stakeholders in this institutional arrangement.

18. In order to follow this trajectory a clear programmatic evaluation of additional safe practices that need to accompany development work in these regions needs to be done. This can be carried out within the framework of co-operation between the departments of the

Central and State governments in the field of science & environment and universities, institutes and others who are engaged in this discipline.

RECOMMENDATIONS – FISCAL COMPENSATION

19. The Committee has examined the plea for special compensation to the Himalayan & North Eastern States considering their special burdens that they carry on account of (a) historically weak infrastructure and economy and (b) the constraints of having to care and protect for a disproportionate share of the nation's forests, mountains, water sources, bio diversity and general environmental heritage. While the Finance Commission has recognised this problem and given some awards, these appear to be insufficient in light of the difficulties and disadvantages that these regions face.

20. It has to be recognised that even if some of the simplifications and rationalization that has been recommended above are indeed carried out, a large part of the natural resources that these regions have will have to continue to remain not harnessed on account of the environmental benefit of the entire nation. Accordingly, the Committee recommends that:

A. A substantial sum of fiscal transfer to be earmarked as compensation for the Himalayan States on account of the special burden that they carry for the rest of the Nation. These transfers must be linked to the development of economic & social infrastructure, namely:
    - Roads, railways, airport & helicopter landing pads;
    - Drinking water, minor irrigation;
    - Horticulture & animal husbandry;
    - Schools, skill training centres, professional colleges;
    - Health care centres & dispensaries & hospitals;

B. First, this will ensure that the fiscal transfer results in creating valuable economic and social assets on the ground and second, it will relieve the stress on the general finances of the State government.

21. The fiscal transfer has to be substantial so as to be meaningful when divided between the 3 North Western States (J&K, Himachal and Uttarakhand) and 8 North Eastern States (Arunachal, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim), that is a total of 11 (eleven) States.

22. It has been the experience in the Annual Plan discussions that each year there is an acute shortfall in fiscal resources when it comes to making transfers to these States, primarily because of the resource constraints that these States face and much of it is on account of the precise reasons at paragraph 5.5.1 above.

23. The Committee has tried to look at what the appropriate level of transfer/ compensation on this count ought to be. First, one way is to look at what the traditional

forest related revenues might have been were these governments not constrained in the matter of traditional exploitation of forest resources. Secondly, one could examine what the aggregate revenues may have been from unrestricted utilization of natural resources that are found in these areas – be it in the form of mineral or hydro resources. Third, an effort may be made to quantify what the economic and revenue opportunities may have been for these States, if the starting level of infrastructure and economic development has been comparable to the more developed part of the country. However, after considering these various approaches, the Committee felt that the quantification was likely to result in widely varying estimates, the basis of all of which may not be possible to clearly establish. Further, the order of magnitude of the compensation had also to bear some relation to the fiscal capacities of the Central government.

24. The total land area of these 11 States account for 18.1 per cent of the geographical area of the country. If appropriate adjustments are made for the topography the total surface area would be a higher proportion. As much as 34 per cent of the country's total forest cover and 36 per cent of the dense forest cover of the country is located n these eleven States. As much as 76 per cent of the geographical area of hill districts is located in these eleven States.

25. Bearing all these factors in mind, the Committee has come to the conclusion that the compensation to these eleven States on account of their contribution of environmental services (public goods) to the rest of the nation and in recognition of their special disabilities on account of these and related factors, should be at least 2 (two) per cent of the Gross Budgetary Support (GBS) to the Plan each year. At the current level of GBS this would come to about Rs 10,000 crore in 2013-14.

26. Accordingly, the Committee recommends that an annual transfer amounting to 2 per cent of annual GBS be earmarked for this purpose for the balance period of the Twelfth Plan.

27. The manner of the allocation of this sum @2 per cent of annual GBS per year should broadly adopt the form of the project-linked Special Project Plan (SPP). Accordingly, the Committee recommends that an annual transfer of 2 per cent of the Gross Budgetary Support, which at current levels would work out to about Rs.10,000 crore, be earmarked for this purpose for the balance period of the Twelfth Plan.

28. However, the Committee strongly recommends that a shelf of projects be created such that:

a. The concerned State governments are aware of the releases in the forthcoming year before the beginning of the financial year and

b. The releases can take place in a timely manner. This is particularly important as the working season in these States is short on account of difficult weather conditions, rains, floods, snow and seasonal closing of high passes.

29. The details of the allocations as between the recipient States and the selection and design of the projects that will qualify under this window of fiscal transfers should be worked out by the Planning Commission's Fiscal Resources (FR) division in consultation with State Plan (SP) division for the concerned Himalayan States.

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Chapter-1

INTRODUCTION

1.1 CONSTITUTION OF THE COMMITTEE

1.1.1 The hilly States of India, particularly those in the Himalayan region stretching from Jammu & Kashmir to the North East, have been facing various problems on account of very difficult terrain, severe weather conditions, extensive forest cover constraining availability of land, dispersed habitations, small and under-developed markets and long international borders. These States suffer from poor connectivity both with the rest of India and within their respective States as also inadequate general infrastructure which constrain their development. The cost of delivery of public services in these States is much higher compared to other States due to topography, distances and the remoteness involved.

1.1.2 In terms of generation of resources and their utilization, these States face multiple problems. First, these States have weak infrastructure on the ground and economies that have limited avenues of generating livelihood for their people. They lack in industrial development and connectivity to begin with. Second, the procedures which are in place for environmental clearances for various projects in the country are generally identical for all States. As a result, the States which have large forest cover have invariably to seek Environment & Forest (E&F) clearances and face difficulty in getting these clearances including for infrastructural projects, which hamper their developmental initiatives. Third, there is no free or open land to take up compensatory afforestation, which by definition means converting open land into a forest by planting trees/seeds. Hence the funds available under Compensatory Afforestation Fund Management and Planning Authority (CAMPA) are also not available to these States, even though it is they who have put the money on NPV basis. Fourth, these States are unable to use forest resources for raising revenue and at the same time have to incur significant expenditure for maintenance of these forests.

1.1.3 Many of these States have represented to Government of India that their efforts to develop their States and improve the living conditions of their people are being hampered by the extant manner in which the E&F guidelines and processes operate. They have stated that it is not appropriate to apply the same yardstick for statutory requirements vis-à-vis the rest of the country which have little forest cover and better initial endowments of infrastructure and modern economy, while considering providing central assistance or clearing infrastructure /development projects in States that have a large forest cover. They have argued that such States are supplying “public goods” by having the burden of protecting & preserving forests and water sources, in disproportionate measure. Hence, they should be given some kind of compensation in form of a “Green Bonus” for having more forests and other valuable eco-systems, the benefits of which are shared with the country at large. It has been suggested that this can be done by explicitly changing the Gadgil–Mukherjee Formula or by having some alternate compensation mechanism. Besides, States like Jammu & Kashmir, Himachal Pradesh and Uttarakhand have raised these issues with the Hon’ble Prime Minister indicating that they should be treated at par with North Eastern States and be

allowed to contribute only 10 per cent as their share in the Centrally Sponsored Schemes. The matter has also repeatedly come up in the Planning Commission during State Plan discussions with these States for quite some time.

1.1.4 Keeping these factors in view and with the approval of the Hon'ble Prime Minister, a Committee has been constituted by the Planning Commission on 25th November 2011 to study the development in the Himalayan Hill States arising from Management of Forest Lands with special focus on creation of infrastructure, livelihood and human development. The Committee is chaired by Shri B.K. Chaturvedi, Member, Planning Commission. A copy of the notification constituting the Committee is given in **Annexure-1**. The composition of the Committee is as under:-

i)	**Shri B.K. Chaturvedi** Member, Planning Commission	Chairperson – (In charge of North Eastern States, Jammu & Kashmir and Energy Division)
ii)	**Shri Saumitra Chaudhuri** Member Planning Commission.	In charge of Himachal Pradesh and Uttarakhand (till end-2012)
iii)	**Dr. K. Kasturirangan** Member, Planning Commission.	In charge of Environment & Forests
iv)	**Dr. Mihir Shah** Member, Planning Commission.	In charge of Rural Development
v)	**Prof. Abhijit Sen** Member, Planning Commission	In charge of Financial Resources
vi)	**Smt. Sindhushree Khullar** Secretary, Planning Commission	
vii)	**Dr. M. Govind Rao**, Director, National Institute of Public Finance & Policy (up to January 7, 2013), now Member, 14th Finance Commission	
viii)	**Prof. Atul Sarma,** Former Member, 13th Finance Commission & Former Vice Chancellor, Rajiv Gandhi University, Itanagar.	
ix)	**Shri R.S. Tolia,** Former Chief Secretary of Uttarakhand	
x)	**Smt. Anjali Goyal**, Adviser, PAMD/RTI, Planning Commission	Convener

1.1.5 The **Terms of Reference (TOR)** of the Committee are as under:-

i) To review forest cover/area during the last two decades in the Himalayan/Hill States.

ii) Identify infrastructure projects that have not been taken up for want of Environmental and forest clearances in the last 10 years.

iii) Assess loss of revenue and other investments to a State in view of projects not being cleared on account of forest clearances.

iv) To review implementation of Forest & Environmental Policy for these States and suggest speedy clearance mechanism for environment and forest clearances.

v) To identify state-wise gaps in infrastructure development, particularly, roads, rail, air connectivity and rural electrification.

vi) Access requirement of funds for infrastructure, livelihoods and human development in hilly states. Estimate funds flowing to these states for development of Infrastructure and other sectors and make recommendations for augmentation of resources and a framework for utilization of such resources to bridge the infrastructure and other gaps.

vii) To identify suitable areas/degraded forests in Hill States and an integrated action plan for afforestation and intensification of canopy cover by pooling financial resources from various sources including developmental projects for sustainable Development.

viii) To undertake a holistic review of factors adversely affecting development of infrastructure in the hilly states to harness development potential;

ix) Suggest mechanisms for strengthening capacities for project formulation, implementation and monitoring in the Hill States.

1.2 The Committee has held **six meetings** (on 8th Dec. 2011, 10th Feb 2012, 7th May 2012, 16th July 2012, 12th Mar 2013 and 10th October 2013) and has deliberated on various issues as per the TOR with the representatives of the State Governments of Hill States and the concerned Ministries. The scope of this study has been confined to the Himalayan Hill States of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and seven North Eastern States (viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura). These states have also been perceived to be worse off in terms of Developmental Disability Index, which has been discussed later in this Report. The necessary information on the TOR has also been collected from the Governments of the Hill States and the concerned Ministries such as Power, Railways, Civil Aviation, Road & Highways, and Environment & Forests.

1.3 In the first meeting of the Committee, the *National Institute of Public Finance and Policy* (NIPFP) was requested to prepare a base paper for the Committee. The base paper was prepared by the NIPFP which was deliberated at the third meeting of the Committee. The contents of the base paper have been suitably incorporated in this Report. Subsequently, as per the decision taken in the fourth meeting of the Committee, a study was assigned to NIPFP to work out a suitable methodology

for estimation of compensation to be extended to the Hill States for maintaining the forest cover. Accordingly, NIPFP prepared a study on the **Developmental Disability Index** for Hill States in India. The methodology of the index was deliberated at length within the Planning Commission and NIPFP was requested to make certain modifications. Accordingly, NIPFP made certain modifications and submitted its final report in May 2013.

1.4 Subsequently, the Planning Commission carried out extensive in-house computation to independently arrive at infrastructure and related Disability Indices. These are similar to that computed by NIPFP and is also discussed later in this Report.

1.5 The tragic events in Uttarakhand in June 2013, where thousands of people lost their lives on account of catastrophic rains, floods and landslides, including pilgrims and tourists from out of State, has highlighted the extent to which Nature's fury can be unleashed in these mountainous regions. It has underscored the importance of development work taking full cognizance and adopting practices that mitigate the vulnerability of these regions to such extreme events. The question is how in the remote and mountainous regions of our country development activities should better take into account and work their way around the difficulties imposed by the terrain and the vulnerability of these areas to inclement and particularly extreme weather and geological events.

1.6 An exercise was carried out by the Institute of Remote Sensing (ISRO), Dehra Dun, to develop an approach for environmentally safer design to infrastructure and development programmes in general which is incorporated in the body of the report. It is vitally important for all agencies – Central and State – to work together for ensuring better practices in regard of safety and sustainability from the physiographical and environmental point of view. Some suggestions are incorporated in the report. It is also necessary to build an institutional network to house and incubate superior technology and practices to back these developmental approaches. An outline for this is also included in the body of the report.

1.7 The recommendations of this Committee in regard to the process of giving clearances to development work are to make it simpler and quicker to take and implement decisions. In making the designs of development activities, be it roads, railways, airports, helicopter-pads, hydropower projects, there exist a base of scientific knowledge upon which decisions have been and continue to be taken. However, it should be emphasized that the by-products of development work, be it the disposal of excavated earth, or the cutting of hillsides, should be designed and undertaken in a manner which minimizes, if not eliminates and counteracts, any increase in the vulnerability of the area to natural events of an extreme kind. These measures will if anything adds to the cost of building much needed infrastructure, which underscores the recommendations made by the Committee in regard of fiscal assistance.

1.8 The experience of development in the mountainous regions in the rest of the world clearly suggests that it is possible to undertake such activities in a manner that meshes in with the containment of natural vulnerabilities. While there are material differences in circumstances the

development of infrastructure in the European Alpine region does demonstrate the need and the ability to build in difficult mountainous areas in an environmentally safe manner.

1.9 The Committee is of the view that Government should take immediate steps to set up a platform for close interaction between the agencies enjoined with this task in the European Alpine nations, particularly Switzerland and Austria, such that the best practices and technical framework can enrich safe developmental work in our own Himalayan region.

1.10 The institutional network for technology and best practices, with the respective State governments as stakeholders, should be the platform around which this absorption from global experience and learning from the experience on ground should be best carried forward.

1.11 Based on the deliberations of the Committee and inputs received from various quarters, a draft report was prepared by the Planning Commission and was discussed at the final meeting of the Committee, wherein it was decided that with some incorporation of some more detail – which has since been done – to adopt the report and submit to the Government for consideration.

Chapter-2

BACKGROUND

2.1 TWELFTH FIVE YEAR PLAN – APPROACH TOWARDS ENVIRONMENTAL GOVERNANCE

2.1.1 The theme for the Twelfth Five Year Plan (2012-17) is "Faster, More Inclusive and Sustainable Growth". While targeting an annual growth of 8 per cent, the Twelfth Plan recognises that the economic development would be sustainable only if it is pursued in a manner which also protects the environment. The Plan document observes that challenges of arresting the pace of degradation of environment in India are formidable due to the imperatives of maintaining high economic growth, increasing trends of urbanisation, population growth, industrialisation, unmet basic needs, life style changes and biotic pressures. While these challenges are formidable, there are also positive factors such as the country's strong base in science and technology and the institutional infrastructure that can drive the new paradigms and holistic approach demanded by the environmental governance. In this context, the vision towards environmental governance system, as spelt out in the Twelfth Plan, is given in **Box-1.** Achieving this goal requires concerted efforts by all stakeholders be it Government, industries or citizens themselves.

Box-1: 12th Plan Approach towards Environmental Governance System

Vision

Managing Environment, Forests, Wildlife and challenges due to Climate Change for faster and equitable growth, where ecological security for sustainability and inclusiveness is restored, equity in access to all environmental goods and ecosystem services is assured through institutionalisation of people's participation;

AND

A future in which the nation takes pride in the quality of its environment, forests, richness of its biodiversity, and efforts by the State and its people to protect, expand and enrich it, for intra and inter-generational equity and welfare of the local and global community.

2.1.2 The Twelfth Plan document has identified 13 monitorable targets towards environment, forests, wildlife and climate change. In so far as forests and livelihood is concerned, the Plan aims for greening 5 million hectare under Green India mission including 1.5 million hectare of degraded lands, afforestation and eco-restoration of 0.9 million hectare of ecologically sensitive areas. Technology based monitoring of forest cover, biodiversity & growing stock including change monitoring through dedicated satellite by 2017 and establishment of an open web-based National Forestry and Environment Information research has also been emphasised upon. The Plan also aims at restoring 0.1 million hectare of wetlands/ inland lakes/ water bodies by 2017.

2.2 MOUNTAIN ECOSYSTEMS

2.2.1 Mountain ecosystems are important for economic growth and human well-being. Mountains provide numerous public goods and services including fresh water, food, lifesaving medicinal products, energy, Bio-diversity & associated traditional knowledge, as well as cultural diversity. However, their services have received less recognition in national economic decision-making, including development planning and resource allocation. Since the value of mountain ecosystem services is not captured directly in any physical index, their contribution to national economies and to peoples' livelihoods is less visible. People of hill states bear a large part of the opportunity cost of providing essential ecosystem services to society at large. Yet they receive inadequate incentives for their conservation efforts and are often asked to bear additional burdens. The difficult terrain and inadequate infrastructure especially connectivity, sharply increases the cost of service delivery in these areas. This is reflected in below par economic and social indicators of development in the hill states.

TABLE 1

Land area under Hilly terrain within States in India

State	Geographical Area(km²) [GA](2009)	Geographical Area in Hill Districts (km²) (2009)	Proportion of land under Hilly terrain [HT] (2009)
Andhra Pradesh	275,069.00	0	0
Arunachal Pradesh	83,743.00	83,743.00	1.00
Assam	78,438.00	19,153.00	0.24
Bihar	94,163.00	0	0.00
Chhattisgarh	135,191.00	0	0.00
Delhi	1,483.00	0	0.00
Goa	3,702.00	0	0.00
Gujarat	196,022.00	0	0.00
Haryana	44,212.00	0	0.00
Himachal Pradesh	55,673.00	55,673.00	1.00
Jammu & Kashmir†	222,236.00	222,236.00	1.00
Jharkhand	79,714.00	0	0.00
Karnataka	191,791.00	48,046.00	0.25
Kerala	38,863.00	29,572.00	0.76
Madhya Pradesh	308,245.00	0	0.00
Maharashtra	307,713.00	69,905.00	0.23
Manipur	22,327.00	22,327.00	1.00
Meghalaya	22,429.00	22,429.00	1.00
Mizoram	21,081.00	21,081.00	1.00
Nagaland	16,579.00	16,579.00	1.00
Orissa	155,707.00	0	0.00
Punjab	50,362.00	0	0.00
Rajasthan	342,239.00	0	0.00
Sikkim	7,096.00	7,096.00	1.00
Tamil Nadu	130,058.00	22,789.00	0.18
Tripura	10,486.00	10,486.00	1.00
Uttar Pradesh	240,928.00	0	0.00
Uttarakhand	53,483.00	53,483.00	1.00
West Bengal	88,752.00	3,149.00	0.04
All States	**3,277,785.00**	**707,747.00**	**0.22**

Note: † Area outside LOC that is under illegal occupation of Pakistan and China has also been added in latest SFR report i.e. 2011

2.2.2 Mountains are among the most fragile environments in the world; they are also among the ecosystems most vulnerable to catastrophic events. The recent unfortunate developments in the State of Uttarakhand have been testimony to these facts. If mountains become degraded, or fail to generate services, the costs can be severe. Chapter 13 of UN Agenda 21[1] recognizes the value of mountain systems; these are not yet sufficiently reflected in national, regional, and international policies and priorities. Sustainable development of hill areas has remained on the margin of the international development agenda and

[1]Agenda 21 is the action plan of the United Nations related to sustainable development and was outcome of the United Nations Conference on Environment and Development, also known as Earth Summit, held at Rio De Janeiro, Brazil, in 1992. Chapter 13 of Agenda 21 focuses on Sustainable Mountain Development.

in national and sectoral policies such as those for land, water, forest, and the environment. Twenty years after the Rio Earth Summit, many of the challenges remain. To sustain the services provided by the mountain ecosystems, it is essential to promote positive conditions to motivate hill states to continue and enhance their efforts in conserving the ecosystems required to address the local developmental needs as well as the current national and global challenges.

2.2.3 As per the India State of Forest Report (SFR) 2011, out of the geographical area of 32.78 lakh sq km, a total of 7.08 lakh sq km area corresponds to hill districts (defined as districts where more than 50 per cent geographical area that are in hill *talukas*). The state-wise hilly terrain area is given in the **Table 1**. It can be seen that States like Arunachal Pradesh, Himachal Pradesh, J&K, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and Uttarakhand is entirely under the hilly terrain. Amongst the reference States for the purposes of this Report, only Assam has lower hill cover at 24 per cent. However, a large part of the State is under seasonal or permanent water bodies, swamps and marshes.

2.2.4 The development and growth in these hill states of India both in terms of income levels, creation of social and economic infrastructure, and human development indicators has been below potential and compares unfavourably with many non-hill states **(Table 2)**. The gap between the hill states as a region and the rest of the country in terms of various developmental outcomes, productivity and capacity of people and institutions is large. Even within the region, there are vast differences, particularly between the population living in the hills and in the plains and between those living in the towns and villages. This is largely due to resource and environmental constraints, connectivity problems, deficiency in human capital and skill development, and developmental policy & governance deficits faced by the hill states. To a large extent these are a result of lack of efficiency in resource use policies (including land) and ownership rights of resources; and the lack of technical and other support for improvement in traditional practices of mining, logging and shifting cultivation, and identification and creation of new opportunities for livelihood.

2.2.5 It is well recognized that the Himalayan & NE states must adopt a development path that ought not to unduly disturb the ecological balance of the region. People of hill states have the right to a dignified life and equal opportunities to develop and grow. Thus it is important to ensure that the strategy for their development takes into account their special features (geographical, topographical and socio-political characteristics) such that these do not constrain their development in any way. Also, the constant pressure on hill states for conservation of resources (with benefits spilling over beyond their boundaries) which besides involving direct public expenditure affects the ability to develop productive activities and generate revenues for welfare of people, underline the need for a different development model for the hill states.

Table-2: Comparative Economic Indicators Across States

SL.NO.	States	Population (2011) ('000)	Per Capita Income (Current Prices) 2011-12	Infant Mortality Rate (2011)	Gross Enrolment Ratio (I-VIII)	Literacy Rate (2011 p)	Life Expectancy at Birth (06-10)	Acces to Safe Drinking Water (2011)	Per Capita Electricity Consumption (Kwh)	Highway Length Per 100 Sq Km (2011)
	Himalayan/ Hill States									
1	Assam	31,169	33,633	55	84	73.18	61.9	69.9	223	3.74
2	Arunachal Pradesh	1,383	62,213	32	152	66.95	NA	78.6	582	2.42
3	Himachal Pradesh	6,857	74,899	38	111	83.78	NA	93.7	1251	2.71
4	Jammu & Kashmir	12,549	42,220	41	104.2	68.74	NA	76.8	988	0.56
5	Manipur	2,722	32,284	11	155	79.85	NA	45.4	242	5.9
6	Meghalaya	2,964	52,971	52	153.6	75.48	NA	44.7	654	5.22
7	Mizoram	1,091	NA	34	150.7	91.58	NA	60.4	462	4.87
8	Nagaland	1,980	56,638	21	85.4	80.11	NA	53.8	265	2.98
9	Sikkim	608	121,440	26	123.8	82.2	NA	85.3	880	2.1
10	Tripura	3,671	50,750	29	115.4	87.75	NA	67.5	222	3.81
11	Uttarakhand	10,117	82,193	36	107.8	79.63	NA	92.2	1144	3.82
	Other States/UTs									
12	Andaman & Nicobar	380	93,075	23	86.9	86.27	NA	85.5	499	NA
13	Andhra Pradesh	84,666	71,480	43	92	67.66	65.8	90.5	1065	1.65
14	Bihar	103,805	23,435	44	102.9	63.82	65.8	94	127	4.36
15	Chandigarh	1,055	140,073	20	79.3	86.43	NA	99.3	1283	NA
16	Chhatisgarh	25,540	46,573	48	109.4	71.04	NA	86.3	1118	1.68
17	Dadra & Nagar Haveli	343	NA	35	103.9	77.65	NA	91.6	13367	NA
18	Daman & Diu	243	NA	22	78.2	87.07	NA	98.7	7810	NA
19	Delhi	16,753	175,812	28	120.1	86.34	NA	95	1530	NA
20	Goa	1,458	192,652	11	101	87.4	NA	85.7	2061	7.27
21	Gujarat	60,384	NA	41	107.2	79.31	66.8	90.3	1508	2.06
22	Haryana	25,353	108,859	44	90.5	76.64	67	93.8	1485	3.69
23	Jharkhand	32,966	35,652	39	121	67.63	NA	60.1	749	2.72
24	Karnataka	61,131	68,374	35	99.3	75.6	67.2	87.5	925	2.29
25	Kerala	33,387	83,725	12	96.2	93.91	74.2	33.5	551	3.75
26	Lakshadweep	64	NA	24	81.9	92.28	NA	22.8	532	NA
27	Madhya Pradesh	72,597	38,669	59	122.6	70.63	62.4	78	674	1.64
28	Maharashtra	112,373	101,314	25	100	82.91	69.9	83.4	1096	1.38
29	Odisha	41,947	46,150	57	104.8	73.45	63	75.3	1070	2.38
30	Puducherry	1,244	95,759	19	103.4	86.55	NA	97.8	1850	NA
31	Punjab	27,704	74,606	30	103.1	76.68	69.3	97.6	1736	3.09
32	Rajasthan	68,621	47,506	52	99.3	67.06	66.5	78.1	844	2.08
33	Tamil Nadu	72,139	84,496	22	112	80.33	68.9	92.5	1233	3.8
34	Uttar Pradesh	199,581	30,052	57	109.5	69.72	62.7	95.1	412	3.25
35	West Bengal	91,348	54,830	32	90.1	77.08	69	92.2	538	3.02
	ALL INDIA	**1,210,193**	**60,603**	**44**	**104.3**	**74.04**	**66.1**	**85.5**	**819**	**2.42**

Source: Economic Survey 2012-13, Government of India; NIPFP

2.3. STATUS OF FORESTS

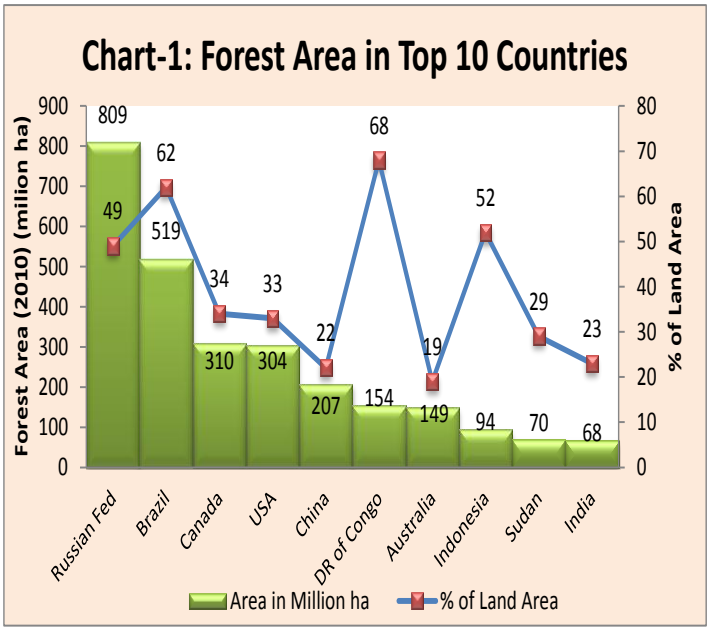
Global Scenario

2.3.1 As per the Global Forest Resources Assessment (GFRA) 2010, Report of the Food and Agricultural Organisation (FAO) of the United Nations, world's total forest area is 4.03 billion hectare, which covers 31 per cent of the total land area. The average per capita of world forest works out to 0.6 ha. Russian federation tops the list with 809 million ha of forest area (49 per cent of land area), while Brazil (62 per cent), Canada (34 per cent), USA (33 per cent) and China (22 per cent) come next with 519, 310, 304 and 206 million hectares of forest area, respectively. India, which is one of the

most densely populated large countries, stands 10th in the world with forest area of around 68 million hectares covering 23% of the land area of the country **(Chart-1)**.

Forests Scenario in India

2.3.2 Between 1991 and 2011, the total forest cover of India has increased from 6.41 lakh sq km to 6.92 lakh sq km. Of the 51,333 sq km increase in forest area, the increase in forest cover by Himalayan/ NE States is of the order of 6,748 sq km (excluding Uttarakhand, which was not in existence in 1991). However, between 2001 and 2011, the increase in forest area of the country stood at 16,489 sq km (2.4 per cent), of which 6,032 sq km (2.6 per cent) growth was contributed by Himalayan/ NE States (including Uttarakhand). In terms of forest cover to geographical area, Himalayan/ NE States have increased their forest cover from 38.6 per cent in 2001 to 39.6 per cent in 2011 while other states have increased forest cover from 16.6 per cent in 2001 to 17.0 per cent in 2011.



2.3.3 The contribution of Himalayan/NE States in total forests in India has increased from 31.8 per cent in 1991 to 34.0 per cent in 2011 **(Table-3)**. Within Himalayan/ North Eastern States, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura have forest cover in excess of 75%.

Table-3: Forest Cover Area in Last 2 Decades

Year--->	1991			2001			2011		
	Forest Cover (km²)	% of Geographical Area	% of Total Forests in India	Forest Cover	% of Geographical Area	% of Total Forests in India	Forest Cover	% of Geographical Area	% of Total Forests in India
Himalayan/ NE States	**203,689**	**34.32**	**31.79**	**228,901**	**38.56**	**33.88**	**234,933**	**39.58**	**33.95**
of which									
Arunachal Pradesh	68,518	81.82	10.69	68,045	81.25	10.07	67,410	80.50	9.74
Assam	25,977	33.12	4.05	27,714	35.33	4.10	27,673	35.28	4.00
Himachal Pradesh	13,377	24.03	2.09	14,360	25.79	2.13	14,679	26.37	2.12
Jammu & Kashmir	20,424	9.19	3.19	21,237	9.56	3.14	22,539	10.14	3.26
Manipur	17,885	80.10	2.79	16,926	75.81	2.51	17,090	76.54	2.47
Meghalaya	15,920	70.98	2.48	15,584	69.48	2.31	17,275	77.02	2.50
Mizoram	18,861	89.47	2.94	17,494	82.98	2.59	19,117	90.68	2.76
Nagaland	14,278	86.12	2.23	13,345	80.49	1.98	13,318	80.33	1.92
Sikkim	3,124	44.02	0.49	3,193	45.00	0.47	3,359	47.34	0.49
Tripura	5,325	50.78	0.83	7,065	67.38	1.05	7,977	76.07	1.15
Uttarakhand	N/A	N/A	N/A	23,938	44.76	3.54	24,496	45.80	3.54
Other States	**437,005**	**16.22**	**68.21**	**446,637**	**16.58**	**66.12**	**457,094**	**16.97**	**66.05**
Total	**640,694**	**19.49**	**100.00**	**675,538**	**20.55**	**100.00**	**692,027**	**21.05**	**100.00**

Source: State of the Forest Report (various editions)

2.3.4 Forest cover of India can been classified into three groups viz., Very Dense Forest (VDF) with more than 70 per cent canopy density, Moderately Dense Forest (MDF) with canopy density between 40 per cent and 70 per cent and Open Forest (OF) with canopy density between 10 and 40 per cent. Scrub and water bodies are also delineated. The non-forest cover includes scrub. The area under VDF, MDF and OF also includes mangrove cover of the corresponding density class. The total forest cover of India is currently 692,027 sq km (SFR 2011), which works out to 21.05 per cent of the geographical area of the country. In terms of density classes, area covered by very dense forests is 83,471 sq km (2.54 per cent), that with moderate dense forests is 320,736 sq km (9.76 per cent) and Open Forest is 287,820 sq km (8.75 per cent) **(Table 4)**.

TABLE-4: Forest and Tree Cover of India (2011)

Class	Area (km^2)	% of Geographical Area
Forest Cover		
a) Very Dense Forest	83,471	2.54
b) Moderately Dense Forest	320,736	9.76
c) Open Forest	287,820	8.76
Total Forest Cover*	**692,027**	**21.05**
Tree Cover	**90,844**	**2.76**
Total Forest and Tree Cover	**782,871**	**23.82**
Scrub	42,177	1.28
Non-Forest	2,553,059	77.67
Total Geographical Area	**3,287,263**	**100.00**

* includes 4662 sq km under mangroves

Source: SFR, 2011

TABLE-5: Forest cover in States/ Union Territories of India

State	Geographical Area (km²)	Total Forest Cover Area(km²)(2009)	Total Forest Cover Area(km²)(2011)	Ratio of Forest Cover to Total Area (%) (2011)	Change(2011-2009) (km²)
Andhra Pradesh	275,069	46,670	46,389	16.86	-281
Arunachal Pradesh	83,743	67,484	67,410	80.50	-74
Assam	78,438	27,692	27,673	35.28	-19
Bihar	94,163	6,804	6,845	7.27	41
Chhattisgarh	135,191	55,678	55,674	41.18	-4
Delhi	1,483	177	176	11.88	0
Goa	3,702	2,212	2,219	59.94	7
Gujarat	196,022	14,620	14,619	7.46	-1
Haryana	44,212	1,594	1,608	3.64	14
Himachal Pradesh	55,673	14,668	14,679	26.37	11
Jammu & Kashmir	222,236	22,537	22,539	10.14	2
Jharkhand	79,714	22,894	22,977	28.82	83
Karnataka	191,791	36,190	36,194	18.87	4
Kerala	38,863	17,324	17,300	44.52	-24
Madhya Pradesh	308,245	77,700	77,700	25.21	0
Maharashtra	307,713	50,650	50,646	16.46	-4
Manipur	22,327	17,280	17,090	76.54	-190
Meghalaya	22,429	17,321	17,275	77.02	-46
Mizoram	21,081	19,183	19,117	90.68	-66
Nagaland	16,579	13,464	13,318	80.33	-146
Orissa	155,707	48,855	48,903	31.41	48
Punjab	50,362	1,664	1,764	3.50	100
Rajasthan	342,239	16,036	16,087	4.70	51
Sikkim	7,096	3,359	3,359	47.34	0
Tamil Nadu	130,058	23,551	23,625	18.16	74
Tripura	10,486	7,985	7,977	76.07	-8
Uttar Pradesh	240,928	14,341	14,338	5.95	-3
Uttarakhand	53,483	24,495	24,496	45.80	1
West Bengal	88,752	12,994	12,995	14.64	1
UNION TERRITORIES					
Andaman & Nicobar Islands	8,249	6,662	6,724	81.51	62
Chandigarh	114	17	17	14.72	0
Dadra & Nagar Haveli	491	211	211	42.97	0
Daman & Diu	112	6	6	5.49	0
Lakshadweep	32	26	27	84.56	1
Puducherry	480	50	50	10.43	0
All States/ UTs	**3,287,263**	**692,394**	**692,027**	**21.05**	**-367**
Of which					
Hill States	**593,571**	**235468**	**234933**	**39.58**	**-535**
Other States/UTs	**2,693,692**	**456926**	**457094**	**16.97**	**168**

Source: India State of Forest Report, 2011

2.3.5 It may be mentioned that vegetation cover is commonly observed below an altitude level usually defined by a boundary called “tree line” though there is no fixed altitudinal height for the existence of this line. A sizeable part of country’s area lies in high altitude mountainous region under permanent snow/ glaciers, steep slopes and rocks which are inhospitable for tree growth. Considering areas of above 4,000 m altitude as incapable of supporting forest growth and removing this area from rest of geographical area, the proportion of forest cover in hill States expressed in terms of this effective area go up. By this approach, higher cover can be estimated for Arunachal Pradesh (87.9 per cent), Himachal Pradesh (44.3 per cent), J&K (36.1 per cent), Sikkim (85.9 per cent)

and Uttarakhand (59.2 per cent). Excluding these high altitude areas, the forest & tree cover for the whole country would go up from 23.82 per cent to 25.22 per cent.

2.3.6 State-wise distribution of forest cover in India is given in **Table 5**. As per 2011 estimates of SFR, the total forest cover in the hill states is 234,933 sq km. This amounts to 39.58 per cent of the geographical area as against the national average of 21.05 per cent. With only 18 per cent geographical area of the country, hill states account for 34 per cent of the total forest cover. In fact, within the hill states, NE States (excluding Assam) have more than 75 per cent area under forest cover. However, these are also the States which have witnessed sharp decline in forest area between 2009 and 2011. The hill districts (124 districts in 2011) constitute 21.5 per cent geographical area in the country, but cover 39.8 per cent of the total forest cover in the country **(Table 6)**. However, all these districts have reported decline of 548 sq km area under forest cover between 2009 and 2011.

Table-6: Forest Cover Area in Hill Districts of India (2011)

State	No. Of Hill Districts(2011)	Geographical Area(km²) [GA](2011) under Hilly Terrain	Total Forest Cover Area(km²)(in Hill Districts)(2011)(TFCA)	(TFCA)% of [GA]	Change (2011-2009)
Arunachal Pradesh	13	83,743	67,410	80.5	-74
Assam	3	19,153	12,985	67.8	-18
Himachal Pradesh	12	55,673	14,679	26.37	11
Jammu & Kashmir	14	222,236	22,539	10.14	2
Karnataka	6	48,046	23,200	48.29	0
Kerala	10	29,572	13,687	46.28	-13
Maharashtra	7	69,905	15,502	22.18	-6
Manipur	9	22,327	17,090	76.54	-190
Meghalaya	7	22,429	17,275	77.02	-46
Mizoram	8	21,081	19,117	90.68	-66
Nagaland	8	16,579	13,318	80.33	-146
Sikkim	4	7,096	3,359	47.34	0
Tamil Nadu	5	22,789	6,372	27.96	5
Tripura	4	10,486	7,977	76.07	-8
Uttarakhand	13	53,483	24,496	45.8	1
West Bengal	1	3,149	2,289	72.69	0
All States	**124**	**707,747**	**281,295**	**39.75**	-548

Source: SFR 2011

2.4 ESTIMATES OF WASTELAND IN INDIA AND HILL STATES

2.4.1 There are several estimates of the extent of degraded lands reported by various agencies in the country. These estimates vary largely due to variation in approaches and methodologies of estimation. According to an atlas (Wasteland Atlas of India, 2010) developed by the National Remote Sensing Agency (NRSA) of the Department of Space on the wastelands of the country, there are 13 categories of wastelands covering 19.4 per cent of the country's geographical area; while in the IHR, wastelands cover significantly higher (about one third) proportion of the total area of the region **(Table-7)**. More than one fifth (22.4 per cent) land in the Indian Himalayan Region (IHR) is either under snow or barren and does not support any biological growth. However, for most of the states in the north-eastern Himalaya, reliable revenue records are yet to be prepared or updated. Land

ownership and obtaining right-of-way are major issues for executing developmental projects in areas where government owns no or small area of land (e.g., Nagaland and Meghalaya). This has implications on the time taken for project execution and cost of the project.

Table-7: Wastelands and Non-usable lands in the IHR (km2)

Region	Wastelands		Non-usable Area		
	Total Area	% to Total Area	Snow/ Glacier	Barren/ Rock	Steep Slopes
Indian Himalayan Region	180432.9	33.5	55788	38415	4198
India	638518.3	19.4	55788	64585	7656

Source: GoI,2010

2.5 ESTIMATES AS PER LAND USE STATISTICS

Under the Land Use Statistics (LUS) of the Department of Agriculture & Cooperation, the total reporting area has been estimated at 300.8 million ha. Of these, 65.6 million ha (21.8 per cent) is in form of forests while 43.1 million ha (14.3 per cent) is not available for cultivation (being either barren or under non-agricultural uses); 26.1 million ha (8.7 per cent) belongs to other uncultivated land (excluding fallow land). Total cropped area is about 197.8 million ha which is around 65.8 per cent of the total reported area under LUS. On 55.6 million ha (18.5 per cent) of land, crops are grown more than once.

2.6. FOREST MANAGEMENT POLICIES AND LAWS

2.6.1 There are a number of laws and policies which impact forestry sector and forest management in India. The different laws related to the forests and biodiversity include Indian Forest Act (IFA), 1927; Forest (Conservation) Act (FCA), 1980; Wildlife (Protection) Act, 1972; and Biological Diversity Act, 2002. However, the key policies and laws which have brought paradigm shift in forest management include National Forest Policy (NFP), 1988; Joint Forest Management Resolution (JFMR), 1990; National Environment Policy (NEP), 2006; Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 along with the recently adopted National Action Plan on Climate Change (NAPCC).

2.6.2 The present legislative framework for environmental protection is broadly contained in the umbrella NEP 2006, Environment Protection Act 1986, the Water (Prevention and Control of Pollution) Act, 1974, the Water Cess Act 1977 and the Air (Prevention and Control of Pollution) Act, 1981. The environmental clearance process is required for 39 types of projects and covers aspects like screening, scoping and evaluation of the upcoming project. The main purpose is to assess impact of the planned project on the environment and people and to try to abate/minimize the same.

2.6.3 The IFA 1927, was the first comprehensive Act governing the forest sector. It allowed the state control of all forests and prioritized commercial objectives. The basic tenets of the Act were based on commercial exploitation and state custodianship and management. The Act does not address contemporary issues such as people's participation in forestry management. This resulted in forest degradation and the alienation of forest-dependent communities.

2.6.4 The FCA 1980 was enacted to control the diversion of forest land for non-forestry purpose and to slow down deforestation. Under this legislation, the approval of the Central Government is required for diversion of forest land above 1 ha for non-forestry purposes. The user agency has to pay for compensatory afforestation as well as an amount equal to the Net Present Value of the forests diverted. While this Act has helped in keeping a check on diversion of forests for non-forestry purposes, it has also posed serious challenges for setting up developmental infrastructure in states, especially the hill states which have limited non-forest land resources.

2.6.5 The NFP 1988 marked a paradigm shift in forest management from regulatory to participatory. It laid the foundation of involvement of local communities in management of forests as well as implied a shift from the earlier revenue-oriented forest management to the current conservation-oriented management. It puts emphasis on meeting peoples' needs and involving them in management of forests. Meeting the subsistence needs of the local communities, maintenance of environmental stability and restoration of ecological balance have been identified as the major objectives of forest management under the NFP.

2.6.6 JFM 1990 facilitated involvement of local communities in the management of forests. Joint participation was the most well-known system of forest management globally based on sharing of responsibilities and benefits between the state and local communities. The Forest Policy (1998) clearly supports participation in forestry by calling for the creation of a massive people's movement to achieve its objectives. JFM differs in form from state to state and while it has created opportunities for communities to participate in and benefit from the formal system of forest management, it is troubled by a number of shortcomings. Although JFM is reported to have had positive impacts in terms of improvement in vegetation cover and income of communities in many areas across the country, several issues such as distribution of powers of Forest Protection Committees (FPCs) vis-à-vis those of the forest department, gender equity, security of tenure, financial sustainability remain.

2.6.7 The NEP 2006 recognized that forest laws and formal institutions have undermined traditional community rights and disempowered communities, and such disempowerment has led to the forests becoming open access in nature, leading to their gradual degradation. The Policy advocates recognition of traditional rights of communities.

2.6.8 The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA) recognizes the rights of forest dwelling STs and other forest dwellers (in occupation for at least 3 generations or 75 years). The rights include habitation, self-cultivation for livelihood, ownership, access to minor forest produce, other community and customary rights. The Act commands upon them the responsibility of protection of forests. The procedure for determining the rights of dwellers is initiated at the level of *Gram Sabha*.

2.6.9 The Green India Mission under the NAPCC, 2008, advocates bringing one-third of the geographic area of the country under forest cover, through afforestation of wastelands and

degraded forest areas. A key program to facilitate this is the Greening India Program, under which 6 million ha of degraded forest area would be afforested with the participation of FPCs. The mission also recognizes the need for effective conservation of biodiversity both within and outside Protected Areas (PAs). While this is an important policy statement, the guidelines for its implementation are being formulated. As of now, the money collected under NPV and compensatory afforestation has been reallocated for the afforestation activities under the NAPCC.

2.6.10 The National Forest Policy (1998) advocated that two-thirds of the area in hills should be maintained under forest cover. Following the Planning Commission's practice, a hill *taluka* can be defined as one where the altitude is above 500 m above sea level, based on which 124 districts (SFR 2011) in the country can be classified as hill districts in India.

2.6.11 In addition, Wild Life (Protection) Act,1972 (amended in 2001 and 2002) and Biological Diversity Act, 2002 provides for protection of wild animals, birds, plants and their habitats, and setting up of protected areas.

2.7 FOREST MANAGEMENT IN SPECIAL AREAS

2.7.1 This can operate at two levels – tenure rights and right to decision making. The decentralized governance framework is not uniform and varies in states, scheduled areas and special category regions. While most States are governed by the provisions of *nagarpalikas* in urban areas and *panchayats* in rural areas, certain areas have a different version of it or are exempt from these institutional arrangements. Further, Schedule VI areas bar application of Acts of Central and State Governments in the subject matter where Autonomous Council is authorized to make laws. This would imply that the IFA 1927; and the FCA 1980 would be applicable only to the reserve forests in Schedule VI areas whereas these Acts would apply in non-Schedule VI areas. Certain national laws, the IFA 1927 and the FCA 1980 are not applicable to Jammu and Kashmir, but the State has its own Forest Act and Forest Conservation Act, both of which must be complied with when undertaking works that encroach on forest areas. However, since the Forest Act and the Forest Conservation Act of the Government of India are not applicable to the state of Jammu and Kashmir, any project activity that encroaches on forest areas needs to obtain clearance from the State Forest Department, as per the Jammu and Kashmir Forest (Conservation) Act, 1997.

2.8 CROSS-SECTORAL LINKAGES

2.8.1 In the absence of an integrated land-use policy and development planning, the policies and programs at various levels may sometimes have inadvertent impacts (based on that both positive & negative) on the forestry sector. For instance, afforestation activities have been part of watershed development in the country since the beginning of the program. Its implementation may be improved by strengthening the coordination between the watershed development agencies and the state forest department. Permissible works under the NREGS include land development, afforestation and horticulture activities. Under agriculture, some of the national level activities like National Horticulture Mission and National Bamboo Mission are being undertaken to improve the

livelihoods of the farmers and simultaneously increase the vegetative cover of the country. Likewise, the energy program has direct impact on the forest management in the country. As per NSS report No. 541 on household consumption of various goods and services (2009-10), 87 per cent of rural and 25 per cent of urban population has reported use of firewood and chips, which puts immense pressure on forests and is one of the reasons for degradation of forests. The Ministry of New and Renewable Energy (MNRE), Government of India, has been promoting improved cook stoves (IC) which could significantly save fuel wood and thus could reduce pressure on the forests. Therefore, there exists cross-sectoral linkages and a synergy in these programs and the forestry sector programs can be used gainfully in addressing conflicts in forest conservation and infrastructure development; strengthening of institutions; and improving the forest resources.

2.9 COMPENSATORY AFFORESTATION FUND MANAGEMENT & PLANNING AUTHORITY (CAMPA)

2.9.1 The "Compensatory Afforestation Fund" has been constituted pursuant to the Hon'ble Supreme Court's order dated 30.10.2002 in IA No. 566 in Writ Petition (Civil) No. 202/1995 and wherein, all monies received by the States/UTs from the user agencies towards compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, Net Present Value (NPV) of the forest land diverted, Catchment Area Treatment Plan Funds and use of forest land lying within protected areas, etc. are to be deposited. However, the funds available under CAMPA have not been utilized effectively for various reasons.

2.10 INFRASTRUCTURE IN HILL STATES

North Eastern Region (NER) States

2.10.1 The biggest constraint in the NER has been the poor state of infrastructure, in particular, roads, railways and power. At 66 km/100 sq. km area, the road length in the region is lower than that the average in the country (75 km/sq. km) and the quality of roads in the region is poorer. The total railway track length in the entire region is 2,592 km, with broad-gauge track only confined to Assam. Even in Assam, broad gauge is only a small proportion of the tracks. The inland waterways in the Brahmaputra and smaller rivers, such as the Kolodyne in Mizoram and Barak in Assam, have become non-functional after the partition of the country. Air connectivity to the region is poor: three of the state capitals do not have airports, and feeder services from Delhi/Kolkata/Guwahati to the state capitals where airports exist are poor. Even where there are airports, there are no regular civilian flights. Most intra-regional connection is routed through Kolkata, which is expensive in terms of both time and money (Rao et al, 2007).

2.10.2 The only connection of the North East Region to the rest of India is by way of a narrow corridor of West Bengal commonly referred to as "chicken's neck" which is 40 km wide, with several fast flowing rivers running through it. This corridor provides the only connectivity for roads, railways, telecom cables and oil pipelines. In Nagaland, the railway network is till Dimapur. The length of the National Highway is only 365.38 km whereas that of state roads is 1094 km. The state's only airport is located at Dimapur (70 km away from the State Capital) though another is being planned at Kohima. Tripura is connected with the rest of the country (takes about 36 hours) by a meter gauge railway

line extending to Lumding and Silchar in Assam. National Highway-44 also connects it to Assam and the rest of India. Agartala airport, the main airport in Tripura provides flights to Kolkata, Guwahati, Bangalore, Chennai, Delhi and then Calicut. Meghalaya is a land locked state with a large number of small settlements in remote areas. Roads are the only means of transport within the state. While the capital city Shillong is relatively well connected by road and air[2] (the state has an airport at Umroi, about 40 km from Shillong on the Guwahati–Shillong highway but operation is limited to only 50-seater aircraft, and the flights are often irregular due to erratic weather conditions). There is also a helicopter service between Guwahati and Shillong.

2.10.3 The lack of connectivity has virtually segregated and isolated the region not only from the rest of the country and the world, but also within itself. Poor density of road and rail transportation within the region has not only hampered mobility but also hindered the development of markets. Trade barriers with the neighbouring countries have equally contributed to this. The blocking of access to the Chittagong port and the land route through Bangladesh, has closed the sea transportation routes for the region altogether. Inland waterways, which were an important means of transportation, have all but vanished due to the complexities in the political and economic relationship with Bangladesh. The region has tremendous potential for generating hydroelectric power, but actual generation is less than 8 per cent of the potential.

2.10.4 Improving connectivity is an important precondition for social and economic mobility and market integration. With various insurgency groups operating in different parts of the region, land transportation within the region has become hazardous. Critical to improving connectivity are diplomacy and an improvement in border infrastructure and trade facilitation with neighbouring countries, namely Bangladesh and Myanmar and then on to the rest of South East and East Asia.

2.10.5 Faster movement of goods and people at lower costs is essential to provide an impetus to economic activity. It helps the development of markets, reduces exploitation by middlemen, and in the process improves livelihoods of people in remote areas by enabling them to market their products at higher prices. By increasing social interaction among people of different states in the region, it promotes awareness and harmony. Opening up remote areas can also help improve the law and order situation, especially in areas affected by insurgency, and help protect people's property rights. All these are important preconditions for attracting the private investment needed for development in the region. In the human development context, better roads mean easier access to health centres for people and to schools for children, which, apart from being desirable outcomes in themselves, will promote a more productive and better skilled workforce.

2.10.6 Telecommunications infrastructure in the NER lags far behind the rest of the country. This infrastructure is particularly important given the difficulty of physical communication in the hill areas. Apart from allowing greater national and international integration for people of the region, most of the earlier studies have pointed to the need for the NER states (particularly in the hilly areas) to promote their IT sectors. As the IT industry moves from the metros of the country to outlying areas,

[2] No civilian aircraft presently operates here.

NER states are considered the next most likely destination, given the high rates of literacy, and large pool of educated people in the region.

Western Region Himalayan States

2.10.7 Water is one of the most precious products of the Himalayan ranges. Himalayan glaciers are important in maintaining ecosystem stability and as buffers regulating runoff of water supply. In the context of climate change these dynamics may be adversely impacted. Therefore, planning and investment priority must be accorded to the conservation, protection and maintaining the productivity of these resources. Formulation of an efficient and practical river valley and watershed management strategy within enforceable, water governance framework is imperative. Initiatives for conservation and revival of springs, lakes, aquifers, underground channels etc. need a comprehensive policy.

2.10.8 Many areas are facing water and moisture scarcity. Access to tap water, water quality and quantity are serious issues. Rain fed re-charge in the springs is decreasing as evident by its drying up or decreased discharge observed in some springs. Ground water potential of different states should also be considered while planning for water security for the region. In a wider context, the possible impact on operational efficiency of hydropower and irrigation projects would also need to be assessed.

2.10.9 The region is power deficient and at the same time has untapped hydro power potential. Further, the revenue that can be raised by selling hydro-power to other states in the future offers the most lasting solution to their situation of fiscal stress. Domestic energy needs in the mountains are primarily for cooking, lighting, and space heating. Firewood remains the primary source of cooking for a majority of households in Himalayan & NE States (ranging from 45 per cent of households in Mizoram to 81 per cent households in Tripura as per Census 2011; compared to 49 per cent at all-India level). Likewise households using LPG as primary source of fuel for cooking is relatively low ranging from 12 per cent in Meghalaya to 53 per cent in Mizoram. There is a general lack of access to clean energy sources. Solar energy is used only in a very limited scale in different states; Uttarakhand (1.9 per cent households), and Jammu & Kashmir (0.7 per cent).

2.10.10 The local economy of most hill states of India, is still dependant on agriculture & horticulture. Yet, surplus production of agriculture or horticulture makes no sense unless these can be evacuated on time, conveniently and cheaply to the main markets in the plains especially cities. Connectivity is the key to transporting produce from production centres to the markets. This region is characterized with inadequate road network, communication and marketing infrastructure. The general health, emergency medical care, education and cultural welfare of the people are also affected adversely due to poor connectivity to service centres.

2.10.11 Construction of road, rail and air transport network is crucial. Himachal Pradesh has a road network of 28,208 km, including eight national highways. Railway tracks exist, connecting Punjab with a few towns – Shimla (narrow gauge, ineffective for goods), Solan and Una. There are three domestic airports in the state—Shimla, Bhuntar (Kullu), and Gaggal serving Kangra and Dharamsala.

While most of the major cities of Uttarakhand, located in the plains, are accessible throughout the year by road and rail, most towns and villages in the higher altitudes remain cut off for large periods in a year due to landslides and snowfall. Uttarakhand disaster underscores the problems. At present there are only two airports in the state viz., Jolly Grant (Dehradun) and Pantnagar (Udham Singh Nagar District). In spite of steady progress there is huge deficit especially in terms of quality of roads.

2.10.12 Telecommunications infrastructure in the region lags far behind the rest of the country. This infrastructure is particularly important given the difficulty of physical communication in the hill areas. Deficiency in infrastructure in terms of telecommunications and satellite supported connectivity is a serious constraint in development and growth in the region. This is partly due to the challenges posed in laying optical fibre cables along hill terrains. The SATCOM division of National Informatics Centre has VSATs connecting the Districts/States. This service needs to be augmented (Report of the Task Force on Indian Himalayan Region, GoI, 2010).

2.11 PROJECTS HELD UP ON ENVIRONMENTAL ISSUES[3]

2.11.1 Ministry of Power has indicated that out of 145,320 MW hydro-electric potential (above 25 MW) in the country, hill States account for 112,685 MW (78%) of the hydro power potential. During the 12th Plan, 27 hydro projects with capacity of 8,744 MW have been identified for commissioning in the hill States against 31 projects of 9,204 MW on all-India basis. Though 16 hydro power projects of 14,557 MW capacity in the hill States have been cleared by the CEA but they are awaiting environment and/or forest clearance. Of these, 10 projects have been awaiting environment and forest clearances for more than 3 years. Environment clearance for Dibang hydro project (3,000 MW) in Arunachal Pradesh is pending for about 6 years and Teesta Stage IV (520 MW) in Sikkim for the last 2 years.

2.11.2 The Ministry has indicated that there is a need to expedite environmental clearances with a time bound approach. However, a more productive approach would be in the direction of densification of existing forests, in many of which the canopy cover is poor. There is also a need to identify non-forest/ degraded forest land for compensatory afforestation. Such land banks may be identified by the States on the lines of Arunachal Pradesh. CEA has pointed out that hydro projects also suffer due to various problems such as inaccessible sites, law & order, rehabilitation of affected families, longer gestation period and geological surprises.

2.11.3 As regards roads, the Ministry of Road Transport and Highways has indicated that under National Highways Development Project, construction of 20 road packages of Assam Rifles and 270 projects of BRO had started but implementation has been affected due to environment/ forest clearances. Ministry has suggested that the right-of-way may be permitted up to 100 meter for border roads and 60 meters for widening against 24 meters prevalent as of now. It has also been suggested that cutting of trees may be permitted subject to the condition that afforestation would be done on double the area somewhere else.

[3] Figures are that for 2012.

2.11.4 Ministry of Civil Aviation has apprised the Committee that there is a large requirement of funds for development of infrastructure in civil aviation sector in the NER. The Airports Authority of India (AAI) has informed that projects being developed in NER are being funded with Govt/NEC grant while projects in Uttarakhand are getting no such financial support. It has been suggested that a similar funding pattern may be evolved for hill States in the North West for infrastructure works. Most of the airports being developed in NER would not be making any profit, but are being developed for providing connectivity in the NER and other regions. As regards forest clearance, civil aviation projects were not facing any major problems in the region. Further, Guwahati needs to be designated as a regional hub for improving air connectivity in the region, with maintenance facilities and staff located there.

2.11.5 In so far as railways is concerned, the Ministry has informed that there were 36 on-going Railway projects (23 for new lines, 7 gauge conversion, 4 doubling and 2 electrification projects) with total length of 5,183 kms and of investments of the order of Rs.54,512 crore in the Himalayan Region. Plans for development of Railway infrastructure in the North East Region to provide connectivity to all State capitals, access to international borders and expansion of network to unconnected areas of the region are on the anvil. There were four strategic lines in hill States under different stages of development. Sivok–Rangpo new line project (52.70 km) in Sikkim still awaited approval of State Wild Life board for a forest stretch of 0 to 5 km since July 2010. It has been suggested that the norms for environment & forest clearances would need to be relaxed to cut-short time lag of 1 to 2 years in obtaining such clearances, especially exemption of hearing in *Gram Sabhas*.

2.11.6 The Ministry of Environment and Forests (MOE&F) have informed that the grant of forest clearance is governed by statutory framework stipulated in the Forest (Conservation) Act 1980, Forest (Conservation) Rules 2003 and guidelines issued by MOE&F. The guidelines provide for special provision for creation of compensatory afforestation in hill States. General provision is that compensatory afforestation will be done over equivalent area of non-forest land. As an exception to this general provision, guidelines provide that for construction of link road, small water works, minor irrigation works, school buildings, dispensaries, hospitals, tiny rural industrial sheds, of the government or any other similar works excluding mining and encroachment cases, in hill districts and in other districts having forest area exceeding 50 per cent of the total geographical area, compensatory afforestation may be raised over degraded forest land of twice the extent of forest area being diverted, provided diversion of forest area does not exceed 20 hectares. The guidelines further provide that where non-forest lands are not available or non-forest area is less that forest lands being diverted, compensatory afforestation may be carried out over double the degraded forest area or to the difference between forest land being diverted and available non-forest land as the case may be.

2.11.7 Keeping in view all these factors, the Committee feels that there is a merit in the concern of the States for not being able to undertake developmental activities, including infrastructural projects, on a large scale due to environmental concerns. While due emphasis on environment needs to be continued, some relaxation in norms may be considered for the Himalayan hill & NE States. In the

process, special focus may be given on the infrastructure projects with some relaxed provisions at least for projects involving diversion of small extent of forest land of say 5 to 10 ha. There is also a need to streamline the policy and procedures by cutting multiple stages in processing the forest/ environment clearance projects. Finally, a methodology could be developed to compensate Hill States for maintaining large forest covers through some analytical and transparent methodology.

2.12 THE UTTARAKHAND TRAGEDY OF JUNE 2013: RECONSTRUCTION AND REHABILITATION

2.12.1 In the light of the unprecedented rainfall, landslips, disaster and the tragedy of large human casualties, the Committee had sought the views from the Department of Science and Indian Institute of Remote Sensing, Dehra Dun, who had been previously involved in the Enquiry following the Malpa tragedy which had cost many lives. The Committee's enquiry was in the framework of what the approach towards sustainable development in the region should be, particularly in the area of infrastructure and what the learning is from the ground experience in the region. The Institute has submitted to the Committee as detailed report which is placed at Annex-2 to this report. A summary is provided in the subsequent paragraphs.

2.12.2 In the course of the discussion on this subject, it was felt that the enquiry on the landslide, identification of and eventual construction of a safe path following upon the Malpa tragedy[4] should also be drawn upon. Accordingly ISRO had submitted a note on "Landslide Hazard Zonation (LHZ) Mapping along the Pilgrimage Route Corridors of Utarakhand and Himachal Himalaya" which is enclosed as Annex-3. It is an abbreviated version of the report on Malpa tragedy that was submitted by ISRO to Cabinet Secretary in 2000-01. It includes recommendations in the context of the recent disasters that include Okhimath Landslides in 2012 and Uttarakhand Landslides associated with June 2013 extreme rainfall.

2.12.3 ISRO has also submitted to the Committee a concept paper on "Creating a facility for Disaster Risk Reduction and Sustainable Development in the Indian Himalayan Region", which is enclosed as Annex-4 of this Report. This concept paper is a broad outline of the framework on which such an institution can be created. It also suggests three options with pros and cons for the different options. It is recommended that a separate committee with members from ISRO, Stakeholders, Ministry of Environment & Forests as well as National Disaster Management Authority may be set up to work out a full-fledged proposal based on this concept paper.

2.12.4 The Uttarakhand disaster in June 2013 was one of the worst disasters of recent times in the Himalayan region. A large part of the state was affected by floods due to widespread and excessive rain in the upper reaches of the Himalaya which were then accompanied by landslides, glacial lake outburst flood (GLOF) and also probably high snowmelt runoff. The tragedy killed thousands of people, both local residents and tourists, and caused extensive damage to infrastructure, property, agriculture and other natural resources of this Himalayan state.

[4] NRSA (2001): Landslide Hazards to Nation, Atlas of Uttaranchal.

2.12.5 Relief in terms of foodgrain, financial and other assistance was provided to meet immediate needs. However, Reconstruction & Rehabilitation (R&R) and restoration of normal life have become major challenge before the State government. R&R activities in the State calls for sound scientific planning so that the vulnerabilities of the communities to natural hazards are minimized and developmental activities are sustainable in longer run.

2.12.6 Uttarakhand State was created in 2000, by bifurcating erstwhile Uttar Pradesh State. Undoubtedly, one of the main objectives for the formation of the State was the aim of enhancing the quality of life of the mountain people, by adopting mountain-specific developmental strategies. The State is endowed with a unique ecosystem, large forest cover, rich floral and faunal biodiversity and abundant water resources. However, its physical geography or physiography, harsh climate, risk prone nature in respect of natural hazards, prevalence of subsistence farming, poor accessibility and infrastructure, places severe constraints on development in the State. Floods, landslides, forest fires, earthquakes and high soil erosion rates are common natural hazards, often resulting in heavy loss of life, property and resources.

2.12.7 The following is a broad guideline for scientific planning in taking up R&R activities in Uttarakhand state from a long term perspective, based on the experience gained by ISRO in carrying out national (mapping) mission projects, pilot projects, limited field experience, and literature:

a. The Himalayan region has a very fragile geomorphology and provides valuable ecosystem services to the nation in general and to the people living in Indo-Gangetic Plain in particular. Therefore, “sustainable development” ought to be central to developmental activities in this region. This is essential to maintain a balance between environment and economic development while striving for faster and inclusive growth, as also emphasised in Twelfth Plan document.

b. Damage assessment in disaster-affected areas, especially Char-Dham and Pindar valley areas, is the first step to take up the R&R activities in Uttarakhand. This can be done in three stages:

    i. Analysis of post-disaster high resolution satellite images taking the pre-disaster images as reference for first-cut damage assessment;

    ii. Ground truthing in the damaged areas mapped through satellite imagery; and (3) collating the satellite imagery and field data to assess the extent and spatial pattern of damage. Ground truthing for detailed assessment of extent of damage is a time and labour-intensive task. Collaborative mapping/ crowd-sourcing by involving local people is therefore is the viable option. A multi-institutional initiative on “Map the Neighbourhood in Uttarakhand” (MANU) has been initiated by Department of Science and Technology (DST), Govt. of India, wherein field data are being collected using geospatial technologies by the students and teacher/scientific community (~150) of the state who were trained by Indian Institute of Remote Sensing (IIRS) in association with National Remote Sensing Centre (NRSC) and Survey of India (SOI). A mechanism to involve local people/community will further help in this endeavour.

c. Conservation of natural resources and environment along with measures to enhance the productivity for improved livelihood and human development is vital in the long-term perspective. This can be achieved by adopting scientifically and technically appropriate, economically viable and environmentally sustainable methods and approaches that are acceptable to local people. The sectors which need the attention include: (1) forest and biodiversity; (2) soil and agriculture; and (3) water, including hydropower. The spatial databases on forest types, biodiversity and biological richness, geomorphology, soil (some parts), groundwater, glaciers, land degradation, land use/ land cover, etc. prepared by Indian Space Research Organisation (ISRO) in association with State Remote Sensing Centres and other institutions under National Natural Resources Management System (NNRMS) using satellite imagery with limited field checks can be used for this purpose. There is a strong need to promote participatory approach for sustainable management of natural resources.

2.12.8 Community based land & water resource development plan and governance, using indigenous knowledge requires formulation and this ought to be implemented to sustain the developmental programmes and schemes of government. The concept of inventorying the assets and other baseline information including natural resources using the latest tools and technologies by crowd-sourcing (i.e. by involving local community including school/college level students) should be promoted. While specific measures for conserving the natural resources and environment are detailed in the note, some of the important ones are highlighted here sector-wise.

2.12.8.1 Forest and biodiversity: (1) conservation of high and very high biological richness areas by bringing in suitable legislation; (2) promoting re-vegetation/ densification of forest cover in degraded forest areas; (3) strengthening the participation of local people/ Van Panchayats (village level forest councils) for afforestation and forest management; (4) plantation of environmentally and economically suitable indigenous species (oak, species of hill bamboo, Seabuckthorn, etc.); (5) enhancing silk cultivation in oak forests or in other suitable areas; (6) promoting social forestry with tree species of indigenous/ natural vegetation types for carbon credits and soil conservation; (7) regulation of grazing in alpine meadows; (8) creating facilities/ infrastructure and know-how to harness forest produce (major and minor); (9) strengthening the capacity for forest fire mitigation.

2.12.8.2 Soil and agriculture: (1) adopting appropriate soil and water conservation measures for protecting the lands from soil erosion and deterioration in soil health; (2) plantation of fruit trees, bamboos and allied species, and adopting agro-horticulture practices in steep sloping areas prone to soil erosion and mass movements along with necessary infrastructure for transport and processing of fruit crops; (3) bringing abandoned agriculture terraces under fruit or fodder trees with shrubs/ grasses along the bunds; (4) developing infrastructure for proper storage and processing of agricultural produce; (5) agro-climatic suitability analysis for tea plantation and sericulture; (6) cultivation of suitable medicinal and aromatic crop, plant and culinary herb species with necessary market infrastructure; (7) enhancing the plantation of fodder crops; (8) promoting indigenous agro forestry system; (9) strengthening of Agriculture Extension Centres and Van Panchayats to spread awareness of latest technologies and innovations to increase food, fodder and livestock productivity, thus enhancing the livelihood and quality of life.

2.12.8.3 Water: (1) monitoring of glaciers, flow in rivers/ streams and springs, and river morphology; (2) taking up large-scale water conservation and groundwater augmentation (wherever feasible) measures along with afforestation activities through public participation within the framework of ongoing integrated watershed management programmes (IWMP) in the state for solving the water availability problem for use by human and livestock, maintaining the flow in the streams and springs and rejuvenation of dried springs; (3) involving R&D institutions for delineation of recharge areas of the springs; (4) putting up infiltration wells, shallow tube wells in the alluvial deposits adjacent to the perennial streams, lakes and in wide valleys of the misfit streams, and also deep wells in the fractured zones after necessary investigations and exploratory drilling; (5) estimating the rates of glacier recession and understanding its impact on river discharge and flora and fauna; (6) mapping of glacial lakes and studying the associated GLOF risks, especially in the context of climate change.

2.12.8.4 Hydropower: (1) assessing the carrying capacity of rivers/streams to sustain the number and size of hydropower projects and also assessing the optimal distance between hydropower sites in the context of cascaded hydropower schemes; (2) regional assessment of environmental flows in different river systems; (3) judicious mix of small and large schemes to sustain uninterrupted power generation; (4) potential assessment and environmental impact assessment of identified hydropower schemes while utilising the site-specific datasets; (5) assessment of the likely impact of the glacial recession upon the projected hydropower potential.

2.12.9 The state being prone to multi-hazards, Disaster Risk Reduction (DRR) strategy should be central to R&R and developmental planning process so that vulnerabilities of the society to disaster risks are minimised.

2.12.10 A two-pronged process/strategy is suggested for this: (1) spatial zoning based on multi-hazards risks using the scientific data and methods; and (2) integrate the hazard mitigation processes with sustainable practices along with developing strong early warning systems and preparedness strategies.

2.12.11 Multi-hazard risk zoning is an immediate requirement for delineating safer areas for construction activities so that the exposure of society to natural hazards can be reduced. It is suggested that such zoning can be carried out at 1:50,000/1:25,000 scale to know the hot spots of natural hazards and their possible impact on human settlements or major infrastructure using satellite images and other available datasets. The detailed risk assessment can be carried out subsequently at the required places considering first the element of risk and then assessing the risk from all possible hazards, some of which can be triggered at distant location. Geographical Information System (GIS), rainfall-runoff and flash flood modelling, debris flow modelling, etc. are some of the approaches that could be used for comprehensive risk assessment.

2.12.12 Landslide inventory and characterisation is needed using post-disaster satellite data and field investigations as many new landslides have taken place and many of the old landslides have

been reactivated during the recent disaster. NRSC has initiated landslide mapping from satellite images using a semi-automated method.

2.12.13 The work is in progress; however, ground truthing of these landslides is required for detailed characterisation. The MANU initiative and field investigations by the Geological Survey of India (GSI) will help in this. At this juncture, it is also appropriate that landslide hazard zonation (LHZ) maps be prepared for the entire state at appropriate scales using a multi-tier approach. The LHZ maps prepared along the pilgrim routes by ISRO/DOS in association with different partner institutions in 2001 can also be revisited.

2.12.14 Detailed geo-morphological mapping along major river valleys needs to be carried out using latest satellite data to understand the post-disaster morphological changes, viz. shifting of active channel, bank erosion, toe cutting, changes in river width, channel bars, etc. Further, identification and mapping of the highest flood levels of various rivers in the recent past vis-à-vis location of settlements will also be vital to mark unsafe settlements and infrastructure.

2.12.15 Planning and regulating construction activities based on scientific approach is essential to prevent/ reduce recurrence of disaster losses in future. Identifying safer and environmentally sustainable places for R&R and developmental activities is, therefore, a prime requirement.

2.12.16 For this, multi-hazard risk zones (see above) can be integrated with environmentally sensitive places (like reserve forests/ national parks, high biological richness areas, wildlife corridors and other protected areas) and the suitable zones for R&R and future development can be delineated. Initial zoning to mark high-risk and environmentally sensitive zones can be carried out based on existing scientific datasets through a multi-institutional effort, which can be subject to revision subsequently with the availability of additional scientific data and knowledge.

2.12.17 Construction activities in high-risk and environmentally sensitive zones can generally be avoided through government legislation. However, construction will have to be undertaken in such zones for critical infrastructure needed for public services (e.g. roads, telecommunication, power etc.), national security, etc. Therefore a body of best practices drawing on all technological expertise and experience needs to be deployed.

2.12.18 Best practices should be followed while constructing houses, roads and communication infrastructure so that they are disaster resilient and also that the by-products of construction activities are not detrimental to environment and do not increase the vulnerability to hazards. The practices followed in other countries in similar geomorphology should be adopted here.

2.12.19 The tourist sites and supporting infrastructure, including camping sites, need to be evaluated for multi-hazard risks and wherever needed/feasible, these may be relocated at safer places. Further, the tourist influx to famous places (e.g. Char-Dham) needs to be regulated based on the carrying capacity.

2.12.20 Strengthening emergency communication systems for early warning and emergency response is needed for reducing disaster losses as terrestrial links often fail during disaster. A strong network of SatCom-based systems like portable satellite phones (MSS Type-D terminals), DTH-based system, BGAN (broadband global area network), etc. developed by ISRO/DOS can be established across the state, particularly in critical areas, to make satellite communication an integral part of the disaster management.

2.12.21 Enhancing livelihood opportunities for rural population deserves immediate attention to prevent migration of people from rural areas to towns/ cities in search of employment. Capacity building to improve agricultural and livestock productivity, generating necessary infrastructure to market their produce, promoting small-scale industries and self-employment generating schemes, besides imaginatively using and converging with other government schemes is vitally necessary.

2.12.22 Strengthening institutional capacity and linkage of State government departments is urgently needed to effectively analyse and utilise scientific inputs coming from central government and other knowledge institutions. Trained inter-disciplinary scientific staff, well-versed in cross-cutting technologies, such as remote sensing, GIS, communication and information technologies should be employed in an appropriate state government department. A holistic outlook towards developmental planning cognizant of the limitations imposed by the topography.

2.12.23 Mainstreaming remote sensing & GIS in developmental planning and hazard mitigation is needed to be used as a decision-making tool. Towards this, creating a state spatial data infrastructure and a policy framework for appropriate utilisation of remote sensing and GIS data in all the developmental planning process is required.

2.12.24 EIA (Environmental Impact Assessment) based on scientifically sound data and methods. However, care needs to be paid to the effective implementation of EMP which should be closed monitored and enforced. Since the Himalayan States are in a disadvantageous situation due to lack of availability of land for developmental purposes, the mechanism and provisions for granting environmental clearances for infrastructure projects must be eased out and streamlined in the interest of providing public services and enhancing the quality of life of the mountain people.

2.12.25 Strengthening scientific observational network is required to improve the quality and availability of scientific data on land, water and air, essentially for two purposes: (1) early warning for natural hazards, and (2) monitoring and evaluating (before, during and after) the developmental activities, projects and programmes and even the disasters.

2.12.26 Monitoring and evaluation of developmental activities taken up at the institution and community level ought to be carried out to assess the impact periodically with reference to project objectives. Environmental monitoring and protection of biologically rich areas should be one of the top priorities. While satellite imagery can play a vital role in monitoring and evaluating the developmental activities and in post-disaster damage assessment, a strong network of instrumented scientific measurement observatories is also necessary for not only validating the satellite-based

observations but also for making the measurements on certain parameters which are not yet operationally retrievable from space data.

2.12.27 Capacity building of community and local bodies of governance (Panchayati Raj Institutions) are of vital importance for sustainable management of natural resources, enhancing opportunities for livelihood and preparing a disaster resilient community.

2.12.28 Implementation strategy towards R&R and developmental activities needs to be prioritised as short-term, medium-term and long-term activities. Damage assessment; identifying safer and environmentally sustainable places for R&R and developmental activities including detailed geo-morphological mapping along major river valleys and landslide inventory, characterisation and hazard-zonation; and reconstruction of damaged houses, roads and communication infrastructure can be the part of short-term strategy.

2.12.29 Strengthening communication systems for early warning and emergency response; enhancing livelihood opportunities for rural people; strengthening institutional capacity and linkage, mainstreaming remote sensing and GIS in developmental planning; and streamlining the implementation of EMP commitments of infrastructure projects ought to be part of the medium-term strategy. Strengthening scientific observational network; monitoring and evaluation of developmental activities; and capacity building for sustainable management of natural resources, improving livelihood opportunities and preparing disaster resilient community can form part of long-term strategy.

CHAPTER-3

SPECIAL SCHEMES AND PROGRAMS FOR HILL STATES

3.1 WEAK FINANCIAL BASE OF NORTH EASTERN STATES

3.1.1 Due to small size, remoteness, hilly terrain and internal fund raising constraints, North Eastern Region (NER) States have a weak financial base and limited scope to raise additional resources. Recognizing their special requirements and the need for significant levels of Government investment, emphasis has been accorded to the economic development of the region particularly from the Eighth Plan period. In October 1996, the Central Government's announcement of 'New Initiatives for the North Eastern Region' included a number of measures for the development of the NER which covered policy changes, special area development and development projects in key sectors. These states have been categorized as Special Category states and some of the policy preferences for them include the following:-

- ✓ Provision of Central Plan assistance to these states on liberal terms with States' contribution at 10 per cent generally compared to 20-50 per cent by other States in respect of most Centrally Sponsored Schemes. These states are also allowed to divert 20 per cent of the Normal Central Assistance (NCA) under the Plan to meet non-plan expenditure
- ✓ Earmarking of at least 10 per cent of the Plan Budget(s) of the Central Ministries/Departments for development of the North Eastern states (except for exempted categories).
- ✓ Liberal repayment terms and conditions in respect of Externally Aided Projects (EAPs). Being special category states (also applies to J&K, H.P. and Uttarakhand in addition to Sikkim and NE States) the loan burden is shared by GOI and Special Category States in the ratio of 90:10. In other words, the amount disbursed by External Donor Agency will be released as 90 per cent Grant and 10 per cent loan (Block Loan) in Indian rupees to the Special Category States. The maturity period is also liberal at 20 years and repayments are made in 20 annual equal instalments. The States are also protected from the exchange rate fluctuation risks.
- ✓ Creation of a Non-Lapsable Central Pool of Resources (NLCPR) (operationalised since 1998–99) through accrual of the unspent balance of the mandatory 10 per cent budgetary allocation of the Ministries/Departments. The broad objectives of the NLCPR Scheme is to ensure speedy development of infrastructure by way of filling the existing infrastructural gaps (economic and social) in the region by making funds available from the pool.
- ✓ Setting up of the Department of Development of North Eastern Region (DoNER) in 2001 to coordinate and give impetus to the Centre's development efforts pertaining to socio-economic development of the region. It was converted into a full-fledged Ministry in 2004 and is the only Ministry with a territorial jurisdiction. The North Eastern Council, Shillong set up in 1971 has also been brought under the administrative control of the Ministry of DONER

- ✓ Special incentives to units/ assesses in NER and other hilly States in terms of concessions in income tax/ excise duties, etc.
- ✓ Announcing special packages for socio-economic development of the NER by the Central Government. Priority funding (both in the Central Plan and State Plan) are being arranged from time to time for expeditious implementation of these packages. The schemes/ programmes cut across various Ministries/ Departments in Government of India. Some of these are the following:-
  - o FM's Rs.500 crore package for NER from Social Infrastructure Development Fund.
  - o Bodoland Territorial Council (BTC) Package, Assam.
  - o Packages announced by Hon'ble Prime Minister during his visits to NER.
  - o Special Accelerated Road Development Programme for North East (SARDP-NE).
  - o Non-Lapsable North East Railway Development Fund.
  - o NER Biotechnology Programme Management Cell (NER-BPMC).
  - o Horticulture Mission for North East and Himalayan States.
  - o Special packages by Planning Commission for Majuli Island (District Jorhat, Assam) and Tirap/ Changlang Districts of Arunachal Pradesh.
  - o Central Sector Scheme for Inland Water Transport Sector for the North Eastern States including Sikkim.
  - o Extending green revolution to Eastern India (only for Assam in NER).
  - o Special Central Assistance from Planning Commission under the Hill Areas Development Programme (for Designated Hill Areas).
  - o Special Central assistance (100 per cent grant) under Border Area Development Programme.
  - o Lumpsum provision for projects/ schemes of NER/ Sikkim.
  - o Programmes for Training/ capacity building in information and communication technology.
  - o Promotion and application of Geo-textiles in NER.
  - o Special economic package for Karbi Anglong Autonomous District Council, Assam.
  - o Enhancing Skill Development Infrastructure in NE States and Sikkim.
  - o Access to Justice – NE and J&K.
  - o Integrated Scheme for Women's Development for North Eastern.

Table 8

Plan Outlays and Expenditure for States/ UTs (Amount in Rs. Crore)

State	9th Plan (1997-2002)		10th Plan (2002-07)		11th Plan (2007-12)		Percent Increase Between 9th and 11th Plans	
	Outlay	Actual	Outlay	Actual	Outlay	Actual	Outlay	Actual
HIMALAYAN & NE STATES								
Arunachal Pradesh	3,191	2,487	4,150	3,460	11,385	10,878	256.8%	337.4%
Assam	8,140	7,091	12,503	9,673	31,457	25,596	286.4%	261.0%
Himachal Pradesh	7,150	7,900	7,975	8,412	13,500	14,057	88.8%	77.9%
Jammu & Kashmir	9,005	7,543	16,321	12,715	28,463	25,189	216.1%	233.9%
Manipur	2,281	1,663	4,073	2,712	10,844	7,246	375.4%	335.7%
Meghalaya	2,214	1,825	3,516	2,924	9,677	8,420	337.1%	361.5%
Mizoram	1,794	1,720	2,970	2,917	6,300	5,208	251.1%	202.8%
Nagaland	1,637	1,502	2,843	2,652	6,910	6,238	322.1%	315.3%
Sikkim	1,257	1,108	2,296	2,097	5,163	4,834	310.7%	336.4%
Tripura	2,400	2,254	3,729	3,383	8,160	7,474	240.0%	231.6%
Uttarakhand$	1,050	2,550	11,619	11,320	29,554	20,788	2714.7%	715.3%
Total - Hill States (A)	**40,119**	**37,642**	**71,995**	**62,266**	**161,413**	**135,929**	**302.3%**	**261.1%**
OTHER STATES								
Andhra Pradesh	29,825	28,432	69,512	62,177	187,797	158,021	529.7%	455.8%
Bihar	15,411	9,921	23,864	21,045	83,700	76,037	443.1%	666.4%
Chhattisgarh$	1,312	1,831	17,068	15,576	57,901	51,406	4313.2%	2707.6%
Goa	1,595	1,390	4,344	3,786	11,438	8,881	617.1%	539.1%
Gujarat	31,377	24,658	47,482	45,976	128,500	125,362	309.5%	408.4%
Haryana	10,206	7,987	12,708	12,980	60,568	51,030	493.5%	538.9%
Jharkhand$	2,650	2,024	20,708	15,522	47,454	37,649	1690.7%	1760.6%
Karnataka	31,498	31,126	60,275	59,512	142,591	136,352	352.7%	338.1%
Kerala	15,533	14,521	24,887	19,543	45,605	42,648	193.6%	193.7%
Madhya Pradesh	18,348	16,658	33,725	34,003	84,368	62,132	359.8%	273.0%
Maharashtra	54,490	44,656	58,888	56,100	161,075	138,528	195.6%	210.2%
Orissa	14,588	12,115	15,300	14,099	48,305	44,290	231.1%	265.6%
Punjab	12,721	9,816	16,645	14,885	40,591	32,705	219.1%	233.2%
Rajasthan	21,741	19,532	33,067	33,735	94,461	93,951	334.5%	381.0%
Tamil Nadu	25,495	25,036	42,351	42,676	91,103	92,655	257.3%	270.1%
Uttar Pradesh	46,332	30,510	57,140	54,797	188,000	179,492	305.8%	488.3%
West Bengal	25,502	20,453	29,721	22,396	75,101	76,037	194.5%	271.8%
A & N Islands	1,768	1,748	3,002	2,211	4,504	4,321	154.8%	147.3%
Chandigarh	709	710	939	966	2,004	2,352	182.6%	231.5%
D & N Haveli	223	220	308	306	917	991	310.4%	350.1%
Daman & Diu	181	176	268	266	870	849	380.7%	381.9%
Delhi	14,873	13,465	25,026	22,646	55,533	53,479	273.4%	297.2%
Lakshadweep	327	344	517	500	1,493	1,518	356.3%	342.0%
Puducherry	1,440	1,448	3,688	3,447	10,705	6,763	643.5%	367.1%
TOTAL - OTHER STATES (B)	**378,146**	**318,775**	**601,431**	**559,147**	**1,624,585**	**1,477,448**	**329.6%**	**363.5%**
GRAND TOTAL (A+B)	**418,265**	**356,417**	**673,426**	**621,412**	**1,785,998**	**1,613,377**	**327.0%**	**352.7%**

$ Ninth Plan data for Uttarakhand, Chattisgarh and Jharkhand pertains to only one year 2001-02

3.2 PLAN ASSISTANCE FOR HILL STATES

3.2.1 An attempt has been made to examine the total Plan outlays in respect of the Himalayan hill and NE states vis-à-vis other States over the last few Plans. The State-wise break-up of Plan outlay and expenditure is given in the following **Table 8**.

3.2.2 It can be seen that between Ninth and Eleventh Plans, the Plan outlay of Himalayan & NE States has increased by 302 per cent whereas actual expenditure has increased by 261 per cent. In contrast, Plan outlay of Non-Himalayan/ NE States has increased by 330 per cent while actual expenditure has increased by 363 per cent. Likewise, utilisation of Plan assistance by Non-Himalayan/ NE States has been more than 90 per cent during 10^{th} and 11^{th} Plans, whereas, the utilisation of Plan assistance by Himalayan & NE States is lower at around 85 per cent.

3.2.3 This indicates that the Budgeted Plan for Himalayan/ NE States has increased by less than that of the Other States of the Union. Secondly, actual Plan expenditure in the Himalayan/ NE states has lagged by even more compared to the other States of the Union. One reason for the same could be that the resources during and at the end of the year fall short of the requirements; and secondly, the projects get delayed mostly on account of delay in obtaining clearances.

3.3 FLOW OF FUNDS TO NE REGION

3.3.1 It is important to flag that for North Eastern Region, the flow of funds can be channelized through various ways. Firstly, it is directly provided by Planning Commission in terms of assistance for State Plans. Secondly, it is through the North East Council and the Ministry of DONER (through non-lapsable central pool of resources). Besides, under each Ministry/ Department's Plan assistance, there is a 10 per cent component compulsorily earmarked for NER, unless specifically exempted. In fact, the flow of funds from the Budget of Central Ministries/ Departments constitutes nearly half of the total funds flowing to the NE States.

CHAPTER-4

ANALYTICAL METHODOLOGY FOR COMPENSATING HILL STATES

4.1 CONSTRUCTING A DEVELOPMENTAL DISABILITY INDEX

4.1.1 In order to arrive at an empirical methodology to assess the developmental disability of Himalayan and North Eastern States, the Committee had requested National Institute of Public Finance and Policy to construct such an index, which was suitably revised based on the deliberations within the Planning Commission. The construction of the Developmental Disability Index is discussed in the subsequent paragraphs.

4.2 CONCEPTUAL FRAMEWORK

4.2.1 The starting premise of the study is that States which have large areas designated as forest land tend to face certain developmental disadvantages. In economic terms, these can be conceptualized as opportunity costs - for not being able to use the land in alternative use that would yield the highest marginal economic value for the land. The economic rationale for this lies in the fact that forest ecosystems provide a range of services, many of which are either "intangibles" or "non-marketed" and thereby the values of these are not captured through normal market processes. Thus, they remained under-valued with complete total economic value (TEV) not being estimated in practice due to methodology and data limitations, and NPV being an inadequate reflection of the true opportunity cost. Thus, States in India which have large tracts of land under forests provide services which are un-priced or underpriced, leading to a notion of "disadvantage" in economic or financial terms. This disadvantage can be characterized in alternative ways. On one hand this notion is formalized in terms of opportunity costs of (forgone) alternative paths of primary, secondary or tertiary sector development (e.g. more extensive agriculture, development of special economic zones, industrial development) which yields benefits in the form of greater income generation and employment creation. On the other hand, the lack of these economic benefits as well as the under-pricing of ecosystem services from forests, water and mountains, lead to a reduction in the taxable base and revenue raising capacity or a "revenue loss" for the States concerned in financial terms.

4.2.2 At the same time, it is equally important to recognize that the immensely valuable forest ecosystem services that are found here have to be preserved. These services accrue at different scales – international, national, regional, and local. For instance, carbon storage value is a global value and typically from an efficiency argument this value will tend to dominate other values such as livelihood values, leading to trade-offs in decision-making regarding devolution of funds. For instance, the XIII Finance Commission formula has in-built in it greater weightage to global values than livelihood values, which by itself is justified in terms of a TEV approach, but does not do much in terms of incorporating distributional considerations. As well recognized in economics,

distributional considerations require add-ons since market principles cannot take care of these adequately.

4.2.3 The Himalayan and NE States in India are uniquely situated in terms of the large amount of land area designated as forest lands. Given that a full accounting of the value of the services provided by forest ecosystems in national GDP or SDP is not achievable within the foreseeable time frame, it becomes important to evolve mechanisms that can achieve the twin objectives of incentivizing conservation alongside meeting developmental objectives of the hill states.

4.2.4 A case for compensation is thus built on economic principles, for those Himalayan and NE States that have substantial areas under forests, mountain and riverine cover. Opportunity costs when expressed in terms of forgone developmental alternatives, restrictions on livelihood options, and mark ups on costs of developmental projects (both due to unique local geo-physical conditions, technology and material requirements, and federal and other regulatory requirements/restrictions) are likely to be higher for forested areas of these states than their corresponding costs in non-forested areas of such states and non-forested states. The operationalization of such concepts can be achieved through developing a Developmental Disability Index that forms a basis for compensation.

4.3 COMPONENTS OF THE INDEX

4.3.1 In constructing an index that captures the developmental or opportunity cost of maintaining forestlands for hill states in India several aspects need to be recognized.

- Accounting for the flows of Ecosystem Services from these forests at various levels:
  - *global level*: e.g. Carbon sequestration, biodiversity[5].
  - *national, regional and local level:* e.g. watershed services, timber, tourism.
  - *local level:* e.g. fuel wood, fodder, NTFPs, micro climatic stabilization, cultural.
- Provision for Cost escalation factor on developmental projects in forested areas due to:
  - *unique geo-physical conditions*
  - *higher transaction cost, mostly emanating from difficult terrain, poor connectivity and remoteness.*
- Criteria for Inclusive development and equity for states *linked to* forested and mountainous land in such difficult terrain states

4.3.2 While there has been some progress on incorporating the first factor in the existing devolution mechanisms, the last two are yet to receive full attention in the existing institutional mechanisms partly perhaps due to the fact that these pose problems both conceptually and empirically. The formula for distribution of a fund of Rs.5,000 crore as recommended by the XIII Finance Commission, and the NPV for use or diversion of forestland for non-forestry purposes currently being charged by state forest departments, both seek to address the requirements for the

[5] Note that by definition and depending on the specific empirical context, these classifications of services may change or overlap. The important point to note here is that these exist and need to be accounted for.

first criteria listed above. The primary purpose behind the formulae is to incentivize conservation while recognizing the economic loss that this may involve.

4.3.3 However, existing mechanisms for compensating states fall short of expectations with regard to criteria two and three. While in theory one can argue against the parallel incorporation of all three criteria, the fact is that current knowledge on both ecosystem services and valuation methodologies does not permit complete valuation and accounting for ecosystem services, which could have by itself been an adequate basis (at least theoretically) for distributing resources among states. When devising formula for distribution and compensation among states, one has to also keep in mind the severe limitations posed by data availability and its accuracy.

4.3.4 Considering costs, the compensation can potentially incorporate distinct cost aspects. These can alternatively be considered as transaction costs which manifest themselves in various ways. They include a range of factors that lead to both directly higher cost and also cost escalations such as increased time and institutional costs due to legal requirements and federal restrictions. These include the laws and rules that govern the states, such as clearances from MoEF for non-forest activities and Supreme Court rulings on diversion of forestland for non-forest purposes that impose specific ranges for charging NPV. Cost mark-ups due to technological and material requirements for meeting specific rules and regulations occur due to the difficult terrain in forested areas of such states (e.g. variant technology for developing infrastructure such as roads, maintaining wildlife corridors, minimizing damage to forest ecosystems and environment)

4.3.5 Mostly, the formula proposed and used for devolution of funds among states has used the percentage share of forest lands in a specific state to address distributional considerations. However, the emphasis has been on using this as a proxy for approximating the extent of forest ecosystem service benefits, rather than to advance the notion of achieving equity in developmental status of population residing in forested areas with those in non- forested areas. The former approximates more to an efficiency criterion while the latter calls for a focus on equity based criterion in defining human welfare. This gains importance in view of the Eleventh and Twelfth Plan's focus on inclusive development. The Planning Commission (2003) had proposed a forest disability index which sought to incorporate disadvantage faced by hill states in terms of agricultural productivity. Thus, the value for forest land was evaluated in terms of farming as a primary alternative activity and the potential loss in revenue projected accordingly. Alternative criteria which helps incorporate disparities such as those in per capita state GDP may however be considered as more appropriate since in most hill regions, farming may not be the most economically viable alternative at par with plains for instance. This is especially true of those areas (in terms of both feasibility and incentive effects unless one is assuming availability of latest technology, various other material inputs and human skills) which suffer from poor connectivity. As a general point low connectivity is an important issue for hill areas and impedes development of economic activity in most sectors. Although farming has traditionally been practiced in most areas, meeting some self-consumption needs of the poor, it is an inadequate vehicle for poverty

alleviation as data on poverty among Scheduled Tribes and other forest dwelling communities has shown. This would lead to a more comprehensive measure for judging the economic losses involved and the disparity that requires to be addressed through a distributional formula which can be used to devolve funds across states with this specific objective of achieving development with equity in mind.

4.4 ARRIVING AT DEVELOPMENTAL DISABILITY INDEX (DDI)

4.4.1 As stated earlier, in order to arrive at an empirical methodology to assess the developmental disability of Himalayan and NE States, the Committee had requested the NIPFP to construct such an index. Accordingly, NIPFP prepared a study on the Developmental Disability Index for Hill States, which was revised by them based on suggestions of the Planning Commission. Subsequently, the Planning Commission has carried out extensive in-house computation to independently arrive at infrastructure and related Disability Indices.

4.4.2 The revised index developed by Planning Commission has two broad components. The first component is the endowment effect which is based on the Geographical Area Disadvantage Index (GADI). This index has been developed based on two sub-components, viz. (i) Forest Cover Index (FCI) i.e. the proportion of Forest Cover Area (FCA) to Geographical Area (GA), and (ii) Barren & Unculturable Land Index (BULI) i.e. the proportion of Barren & Unculturable Land to GA. The composite index of this component is based on the combined index of Forest Cover Index (BCI) and BULI in the ratio 60:40. For the purposes of FCI as well as BULI, the Land Use Statistics (LUS) data has been used.

4.4.3 The second component is the Infrastructure Deficit Index (IDI) which takes into account deficits in major infrastructural sectors viz. power, road, telecommunication, aviation, ports and railways. First, an index has been developed for each of these infrastructural sectors. Then the consolidated infrastructure index has been constructed by combining the indices of these infrastructural sectors with equal weights. Thereafter the State-wise deficit has been worked out as the deviation from the maximum level of index for any State. Further, the infrastructure deficit index has been multiplied by combined indicator of area of the hilly districts and flood prone area to arrive at a comprehensive Infrastructure Deficit Index. Various indicators/ indices used to arrive at individual infrastructural sector index are as under:-

- ✓ **Roads**: Habitation Coverage, Highways per sq km, State Highways per sq km
- ✓ **Power**: Per Capita Consumption of Electricity, Households electrified
- ✓ **Railways**: Route Broad-gauge in proportion to total area and electrification of rail route in proportion of 67:33.
- ✓ **Aviation and Ports**: No. of civilian airports per sq km and no. of ocean ports per sq km.
- ✓ **Telecom**: Rural tele-density index and urban tele-density index in proportion of 67:33.

4.4.4 The Developmental Disability Index (DDI) has been calculated as an average of Component-1 i.e. Geographical Area Disadvantage Index and Component-2 i.e. Infrastructure Deficit Index.

Thereafter the States have been ranked in terms of DDI. As an alternate mechanism, this DDI has been further superimposed with the connectivity disadvantage factor to arrive at another DDI (called DDI-2) and the States have again been ranked in terms of DDI-2.

4.5 RESULTS AND ANALYSIS

4.5.1 **Table 9** provides the rankings of the states based on Component-1 (Geographical Area Disadvantage Index), Component-2 (Infrastructure Deficit Index including Hilly Terrain and Flood Prone Area component), Developmental Disability Index-1 [combination of Components-1&2] and Developmental Disability Index-2 (DDI-1 with factor such as connectivity disadvantage). It can be seen that while there has been minor variations in terms of relative rankings, broadly the seven North Eastern States, Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand have been ranked at the top with respect to DDI. This demonstrates the robustness of the formula across weighting categories. Individual data components and calculations of DDI are given in the **Table 10**.

TABLE 9
Ranking of States according
to Components 1 & 2 and Developmental Disability Index values 1 & 2

Rank	Comp-1	State	Comp_2	State	DDI-1	State	DDI-2	State
1	2.55	Arunachal Pradesh	4.09	Arunachal Pradesh	3.32	Arunachal Pradesh	3.01	Arunachal Pradesh
2	2.53	Manipur	4.06	Jammu & Kashmir	3.18	Manipur	2.89	Manipur
3	2.1	Mizoram	4.05	Nagaland	3.06	Mizoram	2.76	Mizoram
4	2.08	Tripura	4.01	Mizoram	2.92	Uttarakhand	2.58	Tripura
5	1.97	Uttarakhand	4.01	Sikkim	2.87	Sikkim	2.57	Sikkim
6	1.93	Assam	4.00	Meghalaya	2.85	Tripura	2.53	Uttarakhand
7	1.73	Sikkim	3.86	Uttarakhand	2.81	J&K	2.5	Meghalaya
8	1.69	Himachal Pradesh	3.82	Manipur	2.8	Meghalaya	2.46	J&K
9	1.59	Meghalaya	3.79	Himachal Pradesh	2.76	Nagaland	2.46	Nagaland
10	1.57	Jammu & Kashmir	3.62	Tripura	2.74	Himachal Pradesh	2.36	Himachal Pradesh
11	1.47	Nagaland	2.01	Kerala	1.48	Assam	1.48	Assam
12	1.42	Chhattisgarh	1.03	Assam	1.41	Kerala	1.21	Kerala
13	1.41	Odisha	0.9	Karnataka	0.82	Karnataka	0.74	Maharashtra
14	1.28	Jharkhand	0.76	Maharashtra	0.81	Maharashtra	0.73	Karnataka
15	1.25	Goa	0.57	Tamil Nadu	0.73	Odisha	0.72	Odisha
16	1.23	Gujarat	0.2	Uttar Pradesh	0.71	Chhattisgarh	0.71	Chhattisgarh
17	1.15	Andhra Pradesh	0.19	West Bengal	0.65	Tamil Nadu	0.64	Jharkhand
18	1.09	Madhya Pradesh	0.12	Bihar	0.64	Jharkhand	0.63	Gujarat
19	0.87	Maharashtra	0.09	Rajasthan	0.63	Gujarat	0.63	Goa
20	0.81	Kerala	0.09	Punjab	0.63	Goa	0.59	Andhra Pradesh
21	0.74	Karnataka	0.06	Haryana	0.59	Andhra Pradesh	0.59	Tamil Nadu
22	0.72	Tamil Nadu	0.04	Odisha	0.55	Madhya Pradesh	0.55	Madhya Pradesh
23	0.72	Rajasthan	0.04	Andhra Pradesh	0.41	Rajasthan	0.4	Rajasthan
24	0.51	Bihar	0.03	Gujarat	0.32	Bihar	0.3	Bihar
25	0.39	West Bengal	0.01	Madhya Pradesh	0.29	West Bengal	0.27	West Bengal
26	0.34	Uttar Pradesh	0	Chhattisgarh	0.27	Uttar Pradesh	0.25	Uttar Pradesh
27	0.2	Punjab	0	Jharkhand	0.14	Punjab	0.13	Punjab
28	0.19	Haryana	0	Goa	0.13	Haryana	0.12	Haryana

Tabale-10: Calculations of Development Disability Index

S.No.	States	Forest cover Index (LUS)	Barren and unculturable land (LUS)	Geographical area disadvantage Index	Infrastructure Deficit Index (ID)	proportion of Hilly terrain HT)	Proportion of Flood Prone area (FPA)	Combination of Hill terrain & flood prone area	[HT & FPA]* [ID-Index]	Development Disability Index (1)	Development Disability Index-Rank (1)	Connectivity Disadvant.	Combined index of Infra deficit and connectivity disadv.	Development Disability Index (2)	Development Disability Index-Rank (2)
						0.8	0.2		0.8			0.2			
1	Arunachal Pradesh	4.18	0.12	2.55	5.11	1.00	0.00	0.80	4.09	3.32	1	1.0	3.47	3.01	1
2	Manipur	3.51	1.06	2.53	4.77	1.00	0.00	0.80	3.82	3.18	2	1.0	3.26	2.89	2
3	Mizoram	3.46	0.07	2.10	5.01	1.00	0.00	0.80	4.01	3.06	3	1.0	3.41	2.76	3
4	Uttarakhand	2.82	0.71	1.97	4.83	1.00	0.00	0.80	3.86	2.92	4	0.0	3.09	2.53	6
5	Sikkim	2.17	1.06	1.73	5.01	1.00	0.00	0.80	4.01	2.87	5	1.0	3.41	2.57	5
6	Tripura	2.75	1.06	2.08	4.51	1.00	0.01	0.80	3.62	2.85	6	1.0	3.09	2.58	4
7	Jammu & Kashmir	1.25	2.05	1.57	5.07	1.00	0.00	0.80	4.06	2.81	7	0.5	3.35	2.46	8
8	Meghalaya	1.95	1.06	1.59	5.00	1.00	0.00	0.80	4.00	2.80	8	1.0	3.40	2.50	7
9	Nagaland	2.44	0.03	1.47	5.06	1.00	0.00	0.80	4.05	2.76	9	1.0	3.44	2.46	9
10	Himachal Pradesh	1.11	2.57	1.69	4.73	1.00	0.01	0.80	3.79	2.74	10	0.0	3.03	2.36	10
11	Assam	1.08	3.20	1.93	4.80	0.24	0.09	0.21	1.03	1.48	11	1.0	1.02	1.48	11
12	Kerala	1.28	0.10	0.81	3.27	0.76	0.03	0.61	2.01	1.41	12	0.0	1.61	1.21	12
13	Karnataka	0.74	0.74	0.74	4.49	0.25	0.00	0.20	0.90	0.82	13	0.0	0.72	0.73	14
14	Maharashtra	0.78	1.00	0.87	4.17	0.23	0.01	0.18	0.76	0.81	14	0.0	0.61	0.74	13
15	Odisha	1.71	0.96	1.41	4.75	0.00	0.04	0.01	0.04	0.73	15	0.0	0.03	0.72	15
16	Chhattisgarh	2.11	0.40	1.42	4.85	0.00	0.00	0.00	0.00	0.71	16	0.0	0.00	0.71	16
17	Tamil Nadu	0.75	0.67	0.72	4.02	0.18	0.01	0.14	0.57	0.65	17	0.0	0.46	0.59	21
18	Jharkhand	1.29	1.27	1.28	4.63	0.00	0.00	0.00	0.00	0.64	18	0.0	0.00	0.64	17
19	Gujarat	0.45	2.41	1.23	3.93	0.00	0.04	0.01	0.03	0.63	19	0.0	0.03	0.63	18
20	Goa	1.59	0.74	1.25	0.00	0.00	0.00	0.00	0.00	0.63	20	0.0	0.00	0.63	19
21	Andhra Pradesh	1.04	1.32	1.15	4.51	0.00	0.04	0.01	0.04	0.59	21	0.0	0.03	0.59	20
22	Madhya Pradesh	1.30	0.77	1.09	4.88	0.00	0.01	0.00	0.01	0.55	22	0.0	0.01	0.55	22
23	Rajasthan	0.37	1.24	0.72	4.86	0.00	0.10	0.02	0.09	0.41	23	0.0	0.08	0.40	23
24	Bihar	0.30	0.82	0.51	4.67	0.00	0.13	0.03	0.12	0.32	24	0.0	0.09	0.30	24
25	West Bengal	0.62	0.04	0.39	4.36	0.04	0.08	0.04	0.19	0.29	25	0.0	0.15	0.27	25
26	Uttar Pradesh	0.32	0.37	0.34	4.68	0.00	0.22	0.04	0.20	0.27	26	0.0	0.16	0.25	26
27	Punjab	0.27	0.09	0.20	4.18	0.00	0.11	0.02	0.09	0.14	27	0.0	0.07	0.13	27
28	Haryana	0.04	0.42	0.19	4.44	0.00	0.07	0.01	0.06	0.13	28	0.0	0.05	0.12	28

LUS-Land Use Statistics, Ministry of Agriculture

4.5.2 The results indicate that in terms of Component-1 (geographical disabilities), the States of Arunachal Pradesh, Manipur, Mizoram and Tripura top in the ranking as these are also the States which have a high forest cover in excess of 75%. Assam ranks relatively higher in this component due to highest proportion of barren and unculturable land. In terms of Component-2 (infrastructure disabilities), Arunachal Pradesh, J&K, Nagaland, Mizoram, Sikkim and Meghalaya are at the top. These are also the States which are less industrialised. Though J&K has been relatively better placed in terms of Component-1, it ranks much higher due to substantial disadvantage in terms of infrastructure deficit, alongside higher transaction costs due to hilly terrain, although it has much lower percentage area under forest cover. Kerala is the only non-Himalayan Hill State which figures in top 11 in terms of infrastructure deficit index, which is predominantly due to the fact that it has a higher proportion of land under hill districts (76 per cent) compared to Assam (24 per cent).

4.5.3 Among the states which have 30-60 per cent forest cover, and can be differentiated in terms of hilly and non-hilly terrain, Sikkim and Uttarakhand are also at relatively a greater disadvantage in terms of the infrastructure deficit component. Assam, in spite of having lower forest cover ranks lower due a pattern of distribution of hill areas across districts. In Assam some districts have very large hill areas whereas some have large plain areas.[6] Although Himachal Pradesh has relatively less forest cover than some other states such as Kerala, Chhattisgarh or Jharkhand, its overall rank in terms of disability is higher due to disadvantage in terms of the infrastructure deficit when interacted with the proportion of hilly terrain.

4.5.4 It can, therefore, be established that the eleven States including J&K, H.P., Uttarakhand, Sikkim and 7 North Eastern States rank high in terms of Developmental Disability Index (both in terms of DDI-1 and DDI-2). Accordingly, a special view could be taken to compensate these States through some alternate mechanism or a “Green Bonus”. This separate window for financial assistance can act as an incentive to these States to preserve their forests and other valuable eco-systems, the benefits of which are shared with the country at large

[6] A hill district is a district with more than 50 per cent of its geographical area under 'hill talukas” based on criteria adopted by the planning Commission for hill area and Western Ghats development programs.

Chapter-5

CONCLUSIONS AND RECOMMENDATIONS

5.1 THE ISSUES INVOLVED

5.1.1 The Twelfth Five Year Plan, while striving for faster and more inclusive growth, lays significant emphasis on the issue of sustainability. The Plan document recognizes that the development process cannot afford to neglect the environmental consequences of economic activity, or allow unsustainable depletion and deterioration of natural resources. The Twelfth Plan must, therefore, have a strategy of development which effectively reconciles the objective of development with the objective of protecting the environment.

5.1.2 All States in India have State-specific requirements to meet their developmental aspirations and targets of which poverty alleviation and the creation of infrastructure command high priority. However, certain States are at disadvantageous situation in terms of difficult terrain, severe weather conditions, large forest land, dispersed habitations, small and under-developed markets, long international borders, poor connectivity and inadequate general infrastructure. The cost of delivery of public services in these States is higher compared to other States due to their typical topography. These acts as constraints in terms of development compared to other States. In order to address the specific needs of these States, certain mechanisms are already in place such as through the tax devolution formulae used by the Finance Commissions; budgetary support provided by the Planning Commission; special schemes, packages and policy measures; fiscal incentives in terms of income tax/ excise duty concessions, and so on. However, these may still be inadequate and may need to be expanded keeping in view the emerging requirements.

5.1.3 The forests of India constitute the first line of defence against pollution resulting from the economic activities, whether of agricultural or industrial origin. Forests provide a wide variety of services which encompass carbon sequestration; sediment control and soil conservation; ground water recharge; protection from extreme weather events and preservation of bio-diversity. These services, by their very nature, accrue beyond the boundaries of the state in which the forest lies. Although there are benefits that do accrue exclusively to the state, from forest produce and recreational services yielded by standing forests, there are national restrictions on timber felling which impose the costs of having land under forests exclusively on the state in whose jurisdiction it lies. For instance, the Forest (Conservation) Act, 1980 restricts the diversion of forest lands for non-forestry purposes without prior approval from Government of India. Likewise, Hon'ble Supreme Court has, in its order of 12th December 1996, restricted irregular felling of forests and mandated management of forests according to a scientifically prepared working plan, approved by the Government of India.

5.1.4 As a consequence of the FCA, 1980 and following a Supreme Court judgement in 2002, there is already in place a national provision for compensatory afforestation and Net Present Value

(NPV) payments when land under forests is diverted to non-forest uses for industrial or other purposes. These payments are to flow into a Compensatory Afforestation Fund Management and Planning Authority (CAMPA). There is, presently in place, an *ad hoc* CAMPA with which the funds deposited by way of compensatory afforestation and NPV now lie. This body has been authorised to release about Rs. 100 crore annually to the respective states' CAMPA for the next five years. The principle of allocation to states of the funds so collected is in accordance with the jurisdiction in which the diversion of forest land takes place.

5.2 TWELFTH & THIRTEENTH FINANCE COMMISSION AWARDS

5.2.1 In order to compensate the States for maintaining high forest cover, the Twelfth Finance Commission had provided a grant of Rs. 1,000 crore to States, to be disbursed in accordance with the share of State in the total forested acreage in the country. The Thirteenth Finance Commission has also recognized the need for incentivizing forest conservation and compensating states for economic disadvantages arising from the maintenance of forest cover. The Commission has recommended a forest formula designed to take into consideration three factors. The first is the share of total forest area in the country falling in any particular state. This is further enhanced for those states where the share of forested area in the total area of the state is greater than the national average. The enhancement serves to add a further compensation for the economic disability posed by forest cover. The entitlement of each state, so obtained, is further weighted by the third factor, which is the quality of the forest in each state, as measured by density. The weights are progressively higher for area under moderately dense and dense forest cover. Keeping in view these factors, a specific formula has been proposed by the Thirteenth Finance Commission and a sum of Rs. 5,000 crore has been allocated for compensating States for these purposes.

5.2.2 However, it is seen that apart from Arunachal Pradesh which has been given an allocation of Rs. 728 crore over the 5 year period, the allocation to other States is much lower with Sikkim getting Rs. 40.56 crore and Uttarakhand Rs. 205.44 crore. Though the Finance Commission grant is in addition to Compensatory Afforestation and Fund Management Authority (CAMPA) funds, the releases under CAMPA funds have been through an ad hoc arrangement with the amount released at Rs. 100 crore. Thus, both Finance Commission grants as well as CAMPA funds taken together appear insufficient to provide resources on a scale which would enable these State Governments to take up major infrastructure projects.

5.3 PLANNING COMMISSION & OTHER TRANSFERS

5.3.1 At present, Government is providing large amount of funds for the Special Category States. In addition to funds transferred by Planning Commission, 10 per cent of the Plan outlay of the non-exempted Ministries is to be spent in the NE States. The non-lapsable pool for certain Plan resources are also made available to Department of NER to make investments in infrastructure, the allocation of which ranges between Rs. 650 to 800 crore per annum in the recent years. The accrual in NLCPR at present would be close to Rs. 8,000 crore. A window has already been opened under NLCPR which has become operational since April 2012 under which central ministries dealing with infrastructure

projects can get access to these funds from NLCPR (Central) for projects in the North East Region (NER). However, making available resources is not enough to meet the desired objectives. There are equally important issues such as those pertaining to land acquisition, forest clearances, disturbed law & order conditions and inadequate capability of the institutions to implement major projects in the region.

5.3.2 The present study seeks to address another dimension – that of specific disadvantages arising from increased costs arising from a combination of bio-physical features such as terrain and increased transaction costs due to legal and public good aspects of maintaining forest ecosystems. This differs from the earlier forest disability index of the Planning Commission (2004) which computed the replacement value of forests in terms of (agricultural) farming. It may be noted that if a complete valuation of ecosystem services applying state-of-the art techniques to sufficiently disaggregated and reliable data is possible, then that would constitute the most comprehensive valuation replacing all these sub components of values. In the interim, a Developmental Disability Index has been constructed, thereby generating a principle and basis for compensating hill states for a part of the values that their ecosystems provide based on the rationale of opportunity cost in economics. It may be mentioned that this is a partial value, which captures only certain aspects, and is not the full opportunity cost.

5.3.3 The Developmental Disability Index discussed in the previous Chapter demonstrates that there is a case for devolving funds to states based on the higher transaction costs that they face due to bio-geographical reasons such as forest land in hilly terrain. Since the notion of disability stems from the motivation of inclusiveness and sustainable development, it is desirable that such devolution is closely monitored and linked to outputs/outcomes that address the disability and help in overcoming these.

5.4 RECOMMENDATIONS – PROCESS ISSUES

5.4.1 Keeping in view all these aspects, the Committee feels that there is a need to compensate the Himalayan and North Eastern States for maintaining valuable eco-systems, the benefits of which are shared by the country at large. The recommendations are made in two parts. The first part covers the Process Issues and the second part covers the special financial dispensation, which are as under.

5.4.2 These issues essentially comprise those initiatives which are required to speed up the development process and may not require any special financial compensation. These include the following:

i) While due emphasis on environment needs to be continued, relaxation in norms should be made for Himalayan & North Eastern States. The Committee has observed that the procedures which are in place for environmental clearances of various projects in the country are generally identical for all States. This is a constraint for States which have large forest lands or hilly terrains. There is a need to take a view on the relaxation of forest clearance norms for

Himalayan States in line with Left Wing Extremism (LWE) affected districts in order to ensure fast tracking of clearance for infrastructure projects.

ii) The MoE&F should scrutinize specific proposals in this regard in consultation with the respective States. Besides, it is essential to fast track the proposals for environmental approvals/forest clearance to impart efficiency and transparency to the entire system. There must be a time bound approach for providing clearances, within a time frame of 3 to 6 months. A co-ordination committee could be formed with representatives of both Central and State Governments at least for large projects, which could sort out issues, if any.

iii) The decision to permit the use of CAMPA funds for densification of forests with low canopy cover has already been given in some cases and this provision should be made applicable generally.

iv) For developmental projects the extant provisions must be relaxed, allowing for automatic diversion of forest land up to 10 ha from the current limits of 1 ha.

v) In the case of infrastructure projects, a large number of such projects are held up due to non-availability of forest clearances. The Committee feels that the respective States should be provided greater flexibility to accord approval for projects involving diversion of forest land up to an area of 10 ha from the present limit of 5 ha.

vi) There is also a need to streamline the policy and procedures by cutting down on the multiple stages in processing the forest/ environment clearance projects.

vii) There should be at least one office of the Ministry of Environment and Office in each of the Himalayan & NE State to expedite E&F clearances. Thus, in the case of the North Eastern States the regional office is at Shillong and the logistical arrangement of interaction and clearance in consultation with the respective State Governments become cumbrous and time consuming.

viii) In any case a time bound system for receiving, processing and granting of clearances has to be strictly followed within a reasonable time frame, not exceeding one year.

ix) The Ministry of Road Transport & Highways has submitted that for **border road projects** there is a need for permitting right-of-way up to 100 metres and up to 60 metres for widening, against 24 metres prevalent as of now. They have also recommended that cutting of trees may be permitted subject to the condition that afforestation would be done on double the area somewhere else. The Committee recommends that this is an acceptable position for border roads projects.

5.4.3 The tragic events in Uttarakhand in June 2013 have highlighted the extent to which Nature's fury can be unleashed in these mountainous regions. It has underscored the importance of undertaking development work while taking full cognizance and adopting practices that mitigate the vulnerability of these regions to such extreme events. The question is how in the remote and mountainous regions of our country development activities should better take into account and work their way around the difficulties imposed by the terrain and the vulnerability of these areas to inclement and particularly extreme weather and geological events.

5.4.4 In making the designs of development activities, be it roads, railways, airports, helicopter-pads, hydropower projects, there exist a base of scientific knowledge upon which decisions have been and continue to be taken. However, it should be emphasized that the by-products of development work, be it the disposal of excavated earth, or the cutting of hillsides, should be designed and undertaken in a manner which minimizes, if not eliminates and counteracts, any increase in the vulnerability of the area to natural events of an extreme kind. These measures will if anything adds to the cost of building much needed infrastructure, which underscores the recommendations made by the Committee in regard of fiscal assistance.

5.4.5 The experience of development in the mountainous regions in the rest of the world clearly suggests that it is possible to undertake such activities in a manner that meshes in with the containment of natural vulnerabilities. While there are material differences in circumstances the development of infrastructure in the European Alpine region does demonstrate the need and the ability to build in difficult mountainous areas in an environmentally safe manner

5.4.6 The Committee is of the view that Government should take immediate steps to set up a platform for close interaction between the agencies enjoined with this task in the European Alpine nations, particularly Switzerland and Austria, such that the best practices and technical framework can enrich safe developmental work in our own Himalayan region.

5.4.7 In order to follow this trajectory a clear programmatic evaluation of additional safe practices that need to accompany development work in these regions needs to be done. This can be carried out within the framework of co-operation between the departments of the Central and State governments in the field of science & environment and universities, institutes and others who are engaged in this discipline.

5.4.8 ISRO has submitted to the Committee a concept paper on "Creating a facility for Disaster Risk Reduction and Sustainable Development in the Indian Himalayan Region", which is enclosed as Annex-4 of this Report. This concept paper is a broad outline of the framework on which such an institution can be created. It also suggests three options with pros and cons for the different options. It is recommended that a separate committee with members from ISRO, Stakeholders, Ministry of Environment & Forests as well as National Disaster Management Authority may be set up to work out a full-fledged proposal based on this concept paper.

5.5 RECOMMENDATIONS – FISCAL COMPENSATION

5.5.1 The Committee has examined the plea for special compensation to the Himalayan & North Eastern States considering their special burdens that they carry on account of (a) historically weak infrastructure and economy and (b) the constraints of having to care and protect for a disproportionate share of the nation's forests, mountains, water sources, bio diversity and general environmental heritage. While the Finance Commission has recognised this problem and given some awards, these appear to be insufficient in light of the difficulties and disadvantages that these regions face.

5.5.2 It has to be recognised that even if some of the simplifications and rationalization that has been recommended above are indeed carried out, a large part of the natural resources that these regions have will have to continue to remain not harnessed on account of the environmental benefit of the entire nation. Accordingly, the Committee recommends that:

A. A substantial sum of fiscal transfer to be earmarked as compensation for the Himalayan States on account of the special burden that they carry for the rest of the Nation. These transfers must be linked to the development of economic & social infrastructure, namely:
    - Roads, railways, airport & helicopter landing pads;
    - Drinking water, minor irrigation;
    - Horticulture & animal husbandry;
    - Schools, skill training centres, professional colleges;
    - Health care centres & dispensaries & hospitals;
B. First, this will ensure that the fiscal transfer results in creating valuable economic and social assets on the ground and second, it will relieve the stress on the general finances of the State government.

5.5.3 The fiscal transfer has to be substantial so as to be meaningful when divided between the 3 North Western States (J&K, Himachal and Uttarakhand) and 8 North Eastern States (Arunachal, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim), that is a total of 11 (eleven) States.

5.5.4 It has been the experience in the Annual Plan discussions that each year there is an acute shortfall in fiscal resources when it comes to making transfers to these States, primarily because of the resource constraints that these States face and much of it is on account of the precise reasons at paragraph 5.5.1 above.

5.5.5 The Committee has tried to look at what the appropriate level of transfer/compensation on this count ought to be. First, one way is to look at what the traditional forest related revenues might have been were these governments not constrained in the matter of traditional exploitation of forest resources. Secondly, one could examine what the aggregate revenues may have been from unrestricted utilization of natural resources that are found in these areas – be it in the form of mineral or hydro resources. Third, an effort may be made to quantify what the economic and revenue opportunities may have been for these States, if the starting level of infrastructure and economic development has been comparable to the more developed part of the country. However, after considering these various approaches, the Committee felt that the quantification was likely to result in widely varying estimates, the basis of all of which may not be possible to clearly establish. Further, the order of magnitude of the compensation had also to bear some relation to the fiscal capacities of the Central government.

5.5.6 The total land area of these 11 States account for 18.1 per cent of the geographical area of the country. If appropriate adjustments are made for the topography the total surface area would be a higher proportion. As much as 34 per cent of the country's total forest cover and 36 per cent of the

dense forest cover of the country is located in these eleven States. As much as 76 per cent of the geographical area of hill districts is located in these eleven States.

5.5.7 Bearing all these factors in mind, the Committee has come to the conclusion that the compensation to these eleven States on account of their contribution of environmental services (public goods) to the rest of the nation and in recognition of their special disabilities on account of these and related factors, should be at least 2 (two) per cent of the Gross Budgetary Support (GBS) to the Plan each year. At the current level of GBS this would come to about Rs. 10,000 crore.

5.5.8 Accordingly, the Committee recommends that an annual transfer amounting to 2 per cent of annual GBS be earmarked for this purpose for the balance period of the Twelfth Plan.

5.5.9 The manner of the allocation of this sum @2 per cent of annual GBS per year should broadly adopt the form of the project-linked Special Project Plan (SPP).

5.5.10 However, the Committee strongly recommends that a shelf of projects be created such that:

a. The concerned State governments are aware of the releases in the forthcoming year before the beginning of the financial year and

b. The releases can take place in a timely manner. This is particularly important as the working season in these States is short on account of difficult weather conditions, rains, floods, snow and seasonal closing of high passes.

5.5.11 The details of the allocations as between the recipient States and the selection and design of the projects that will qualify under this window of fiscal transfers should be worked out by the Planning Commission's Financial Resources (FR) division in consultation with State Plan (SP) division for the concerned Himalayan States.

ANNEXURE-1

NOTIFICATION OF THE COMMITTEE

No. 0-13021/2/2011-PAMD
Government of India
Planning Commission
(Project Appraisal & Management Division)
******

Yojana Bhawan, Sansad Marg,
New Delhi-110001.
Dated 25th November 2011.

NOTIFICATION

Subject: Committee to Study Development in Hill States arising from management of forest lands with special focus on creation of Infrastructure, Livelihood and Human Development.

1. It is decided to constitute a Committee to Study Development needs in Hill States arising from management of forest lands. The members of the Committee would be:

i)	**Shri B.K. Chaturvedi**, Member, Planning Commission.	Chairperson – (In charge of North Eastern States, Jammu & Kashmir and Energy Division)
ii)	**Dr. Saumitra Chaudhuri**, Member, Planning Commission.	In charge of Himachal & Uttarakhand
iii)	**Dr. K.Kasturirangan**,Member, Planning Commission.	In charge of Environment & Forests
iv)	**Dr. Mihir Shah**, Member, Planning Commission.	In charge of Rural Development
v)	**Prof. Abhijit Sen**, Member, Planning Commission.	In charge of Financial Resources
vi)	**Ms. Sudha Pillai**, Member Secretary, Planning Commission.	
vii)	**Dr. M. Govind Rao**, Director, National Institute of Public Finance & Policy, 18/2 Satsang Vihar Marg, Special Institutional Area, Delhi-110067.	
viii)	**Prof. Atul Sarma,** Former Member, Thirteenth Finance Commission & Former Vice Chancellor, Rajiv Gandhi University, Itanagar.	
ix)	**Shri R.S. Tolia,** Former Chief Secretary of Uttarakhand, 17, Usha Colony, Post Office Kulhan, Sahastradhara Road, Dehradun,Uttarakhand.	
x)	**Dr.Nagesh Singh**, Adviser (PAMD/RTI), Planning Commission.	Convenor

2. **The Terms of Reference of the Committee would be as under**:

i) To review forest cover/area during the last two decades in Hilly States.

ii) Identify infrastructure projects that have not been taken up for want of Environmental and forest clearances in the last 10 years.

iii) Assess loss of revenue and other investments to a State in view of projects not being cleared on account of forest clearances.

iv) To review implementation of Forest and Environmental Policy for these States and suggest speedy clearance mechanism for environment and forest clearances.

v) To identify state-wise gaps in infrastructure development, particularly, roads, rail, air connectivity and rural electrification.

vi) Access requirement of funds for infrastructure, livelihoods and human development in hilly states. Estimate funds flowing to these states for development of Infrastructure and other sectors and make recommendations for augmentation of resources and a framework for utilization of such resources to bridge the infrastructure and other gaps.

vii) To identify suitable areas/degraded forests in Hilly States and an integrated action plan for afforestation and intensification of canopy cover by pooling financial resources from various sources including developmental projects for sustainable Development.

viii) To undertake a holistic review of factors adversely affecting development of infrastructure in the hilly states to harness development potential;

ix) Suggest mechanisms for strengthening capacities for project formulation, implementation and monitoring in the Hill States.

3. The expenditure towards TA/DA for non-official members would be met by the Planning Commission as admissible to the Class-I officers of the Government of India.

4. The Committee will submit its report by 28th February 2012.

s/d
(Dr. Nagesh Singh)
Adviser(PAMD)
Tel: 23096707

Copy to:

1. Members of Planning Commission.
2. Secretary, Department of North Eastern Region.
3. Secretary, Ministry of Environment and Forest.
4. Secretary, Department of Secondary & Higher Education.
5. Secretary, Ministry of Health & Family Welfare.
6. Secretary, Ministry of Power.
7. Secretary, Ministry of Road Transport and Highways.
8. PS to Deputy Chairman, Planning Commission.
9. Joint Secretary, Prime Minister's Office

ANNEXURE-2

Uttarakhand Disaster 2013: A Concept Note for Reconstruction And Rehabilitation Activities

Indian Institute of Remote Sensing
Indian Space Research Organisation
Dehradun

1. Preamble

Uttarakhand disaster 2013 has been one of the worst disasters of the recent times in the region. A large part of the state was affected by floods due to widespread and excessive rain in the upper reaches of the Himalaya which coincided with occurrence of landslides, glacial lake outburst flood (GLOF) and probably high snowmelt runoff. The event killed thousands of people, both local and tourists, and has caused extensive damage to the infrastructure and property of this hill state. According to a draft report by Disaster Mitigation and Management Centre (DMMC) of Uttarakhand published in September 2013 (available in public domain), "580 human lives were lost; over 5,400 people are still reported as missing; 4,200 villages were affected; 9,200 cattle/livestock lost; and 3,220 houses were fully damaged." In addition, many of the public buildings, roads, power and telecommunication infrastructure, and other installations along with agriculture and natural resources were severely damaged. While the relief in terms of food grain and financial assistance were meant for most immediate requirement, Reconstruction and Rehabilitation (R&R) and restoration of normal life have become major challenge before the state government. This not only requires help and collaborative efforts from various national and international agencies, but more importantly it calls for scientifically sound planning so that the vulnerabilities to natural hazards are reduced to minimum and developmental activities are sustainable in long-term.

This note, while analysing the strengths and opportunities vis-à-vis constraints and threats in the region, provides a broad guideline for scientific planning in taking up R&R activities in the disaster-ravaged Uttarakhand state in the long-term perspective.

2. Brief State Profile

Uttarakhand state was formed in the year 2000 by bifurcating the erstwhile Uttar Pradesh (U. P.) state with a primary aim to evolve and implement development strategies suited to mountain region, thereby enhancing the quality of life of the people. Physiographically, the state consists of five distinct regions from south to north (Gopendra Kumar, 2005): (1) Indo-Gangetic Plain; (2) Sub-Himalaya (or Outer Himalaya); (3) Lesser Himalaya (or Lower Himalaya); (4) Greater Himalaya (or Himadri) and (5) Tethyan Himalaya. Over 86% of the geographical area of the state is characterized by steeply sloping, rugged hills and mountains which makes it unique in terms of physiography, climate, ecosystem and natural resources. On the other hand, owing to its relief, geologic setting and climate along with anthropogenic interference with natural landscape, it is vulnerable to a number of natural hazards. Further, the accessibility, infrastructure and socio-economic development of the people in rural areas are poor as in other mountain regions in the world.

The state is divided into two administrative divisions (Garhwal in the west and Kumaun in the east), 13 districts (7 districts in Garhwal and 6 districts in Kumaun divisions), 78 *tehsils* and 95 development blocks. It has 7,555 *gram panchayats* having 16,793 villages as per 2011 census; 03 municipal corporations and 121 other town/ urban agglomerations. There are 6,069 Van Panchayats (Forest Councils), managing over 13% of total forest area (DMMC, 2013). The total population as per 2011 census is 10.1 million; rural population constitutes about 70%; and population density is 189 per km^2 against the national figure of 364 per km^2. The economy of the state is growing fast and is mainly driven by tourism and agriculture. The per capita income is Rs. 82,193 (FY 2012); both the Gross State Domestic Product (GSDP) and per capita income of Uttarakhand is higher than the national average (Wikipedia).

The areas starting from nearly 400m elevation in the Outer Himalaya to 2,800m in the Lesser and Higher Himalaya, experience increase in monsoonal precipitation up to 1,600–1,800mm and thereafter decrease in monsoonal precipitation to almost negligible amount of precipitation in the Tethyan Himalaya and Tibet region.

Geologically, the Himalayan region is one of the most active regions of the world with three major fault systems (HFT-Himalayan Frontal Thrust, MBT-Main Boundary Thrust, and MCT-Main Central Thrust) running parallel to the Himalayan trend. The areas starting from the foothills of Siwaliks to Lesser Himalaya and further up to Higher Himalaya and beyond are characterised by suite of sedimentary, metasedimentary and crystalline rocks covering almost the entire geological time scale. The effect of active tectonics, paleo-climatic variations, and paleo-seismicity has largely influenced the hill forming processes and present topography. Apart from tectonic causes, the hill slopes are also shaped by surficial processes such as sheet, gully and head ward erosion. River banks are exposed to toe cutting and bank erosion at many places.

The entire State of Uttarakhand falls within Zone-IV and Zone-V (Zone-V represents the highest level of seismicity) of the Earthquake Zoning Map of India. Seismic Zone-V covers the northern parts of the state covering the districts of Bageshwar, Chamoli, Pithoragarh, Rudraprayag and Uttarkashi, while Zone-IV covers the remaining districts lying south. In the recent past, the State has witnessed two major earthquakes (Uttarkashi 1991 and Chamoli 1999) causing death and destruction due to ground shaking and earthquake triggered landslides.

The rapid pace of developmental activities without much scientific planning in this fragile mountain belt has put a lot of pressure on the sustainability of the natural resources, ecosystem and natural landscape processes, especially in the light of changing climate.

3. Strengths and Opportunities vis-à-vis Weaknesses & Threats

An in-depth analysis of the strengths and opportunities vis-à-vis weaknesses and threats in the region, like typical SWOT analysis, is essential for planning the developmental activities. These are highlighted below (Table 1):

Table 1
Strengths and opportunities vis-à-vis weaknesses and threats in the Uttarakhand state

Strengths and opportunities	Weaknesses and threats
• Large forest resource • High floral, faunal and crop diversity • Abundant water resource • Ample opportunities for hydropower generation • Large potential to increase agricultural productivity and to develop horticulture • Harnessing rain water through watershed management practices • Setting up small-scale industries or creating alternate source of livelihood in rural areas • Strengthening tourism development sector • Developing mountain-specific technologies • Raising awareness and capacity development for adopting better practices of land and water resource management, enhancing agriculture produce, coping with natural hazards, etc.	• Rugged topography, harsh climate, poor infrastructure and connectivity • Risks to different natural hazards (floods, landslides, earthquakes, forest fires etc.) • Small and scattered land-holdings, mainly rain-dependent agriculture, low productivity and lack of post-harvest technology • Depletion/ degradation of forest and biodiversity • High soil erosion rate • Drying of springs/ perennial water sources and pollution of surface-water and groundwater resources • Migration to cities/ urban centres due to low agricultural income and lack of industrial/ economic activity and awareness of new technologies • Paucity of scientific measurement data • Climate change

Source: compiled from different sources (mainly, Rao and Saxena, 1994; WMD, undated)

4. Broad Guideline for Restoration and Development Planning

The Himalayan region is one of the most fragile regions in the world and provides extremely valuable ecosystem services to the nation in general and to the people living in Indo-Gangetic Plain in particular. Therefore, the concept of 'sustainable development' should be central to all kinds of restoration and development activities so that the needs of both present and future generations are met. The focus should be on conserving the land, water and other natural resource including the floral and faunal biodiversity by adopting the environmental friendly, non-degrading, scientifically and technically appropriate, economically viable and socially acceptable approach (FAO, 1989). Six basic components of the framework of sustainable development (Grove *et al.*, 1990; cited in Rao and Saxena, 1994) ought to be considered: (1) conservation and maintenance of natural resources and productivity; (2) economic viability; (3) reducing environmental impacts; (4) optimal production with minimum external inputs; (5) meeting the basic human needs; and (6) provision for social needs. This is essential to maintain a balance between environment and economic development while striving for faster and inclusive growth as also emphasised in Twelfth Plan document.

Indian Space Research Organisation (ISRO) with partner institutions (different state and central government departments) has contributed in different national mapping mission projects of different ministries of the Govt. of India or as an initiative of National Natural Resources Management System (NNRMS). Satellite imagery with supporting field checks are used in these projects to prepare spatial databases on different themes, *viz.* land use/ land cover, land degradation, geomorphology, ground water prospects and biodiversity characterization. It has also participated in Integrated Mission for Sustainable Development (IMSD) project in which action plan maps for land and water resource development were prepared for certain parts of the state. Apart from national mapping missions, a few pilot studies have also been undertaken as a part of training & education and research

programmes. The following broad guidelines are suggested for restoration and development planning in the state based on the experience gained in the national mission projects, pilot projects, limited field experience and literature (Rao and Saxena, 1994; Kumar *et al.*, 2001; Tiwari *et al.*, 2001; Tiwari and Kumar, 2003; MoEF, 2010; van Westen *et al.*, 2011; UCOST and USERC, 2012; GoU, 2012, 2013; Roy *et al.*, 2012; GBPIHED, undated; WMD, undated).

4.1 Damage Assessment

Damage assessment in disaster-affected areas, especially Char-Dham and Pindar valley areas, is the first step to take up the R&R activities in Uttarakhand. This can be done in three stages: (1) analysis of post-disaster high resolution satellite images taking the pre-disaster images as reference for first-cut damage assessment; (2) ground truthing in the damaged areas mapped through satellite imagery; and (3) collating the satellite imagery and field data to assess the extent and spatial pattern of damage. National Remote Sensing Centre (NRSC) has carried out damage assessment in and around Kedarnath and in upper reaches of Mandakini and Alaknanda valleys using satellite images and the results are available in ISRO's Bhuvan geoportal. The complete disaster-affected area could not be covered due to non-availability of cloud-free high resolution satellite data. Therefore, it is suggested that as and when the cloud-free images are available, the same can be analysed immediately for first-cut damage assessment. Ground truthing for detailed assessment of extent of damage is a time and labour-intensive task. Collaborative mapping/ crowdsourcing by involving local people is therefore is the viable option. Towards this, a multi-institutional initiative on “Map the Neighbourhood in Uttarakhand” (MANU) has been initiated by Department of Science and Technology (DST), Govt. of India. In this initiative, field data are being collected through crowdsourcing by involving the students and teacher community of the universities/ institutes located in the state. Indian Institute of Remote Sensing (IIRS) in association with NRSC and Survey of India (SOI) has trained 149 students and teachers/ scientists from HNB Garhwal University, Kumaun University, and Wadia Institute of Himalayan Geology (WIHG), on using the latest geospatial tools and technologies for field data collection and uploading the same on ISRO's Bhuvan geoportal in near real-time using GPS-enabled mobile application, GAGAN SBAS receiver and other field instruments. The field data collection has already started and is envisaged to be completed in about two-months time (October and November 2013). A mechanism to involve local people/community will further help in this endeavour. After the field data collection process is over, the information from satellite image, field data along with ancillary data can be collated to assess the extent of damage and also to understand the spatial pattern of damage. This assessment and understanding will be vital in carrying out risk zonation to natural hazards in the area.

4.2 Conservation of Natural Resources and Environment

Much of the natural resource and environmental degradation is governed by mountain specificities, *viz.*, inaccessibility, fragility, marginality, diversity (heterogeneity), niche (natural suitability) and adaptability (human adaptation). Over 10% area of the state is constituted by culturable wasteland, permanent fallow and barren/un-culturable wasteland, of which the former two categories constitute 6.6% of total area. About 11.6% area of the state comes under degraded land, most part of this constituted by the wastelands and permanent fallow lands. Although about 61% of the geographical area is under forest but a considerable portion of it is under degraded forest cover. Similarly, although there is a large potential of water resources but water crisis prevails across the hilly region. These facts point out that there is a lot of scope for conservation of the natural resources and enhance the productivity by adopting scientific, technically viable and environmentally sustainable methods and approaches that are also acceptable to local people.

4.2.1 Forest and biodiversity

The wide variation in the topography and climate has given rise to diverse ecosystems, supporting large taxonomic variability in flora and fauna. Uttarakhand is among the few states in India that has more than 60% of its geographical area under natural vegetation cover (FSI, 2011) with a rich and diverse array of forest types from tropical to alpine types. With 12 National Parks and Wildlife Sanctuaries covering almost 14% of the total area, the Biological Richness (BR) in the region is quite high. There are about 4700 species of flowering plants and about 146 species of fodder plants. The rich forest cover is not only intricately associated with the hydrological balance but also forms the life support system for the local inhabitants. Despite apparent remoteness and inaccessibility, the region has not been spared from human-induced activities, *e.g.* habitat and biodiversity loss. Nearly thirty species have been listed under various threat categories. In the temperate and alpine forests, habitat loss is severe, with over 70% of the natural vegetation reported to have lost. All the gentle and accessible meadows in the alpine and sub-alpine region have undergone extensive habitat degradation due to overgrazing, trampling and commercial harvest for medicinal and aromatic plants. Lopping of trees for fodder, fuelwood, collection of timber, removal of forest floor biomass, edible fruits, fibre and extensively exploited medicinal plants from these forests not only influence the soil, hydrology and ecosystem health but also climatic conditions.

A few measures are suggested to conserve the rich forest resource and biodiversity:

- Areas having high and very high biological richness need to be conserved by bringing in suitable legislation. The biological richness map of Uttarakhand, prepared by IIRS using the satellite imagery and ground sampling under the joint project of the Dept. of Space (DOS) and Dept. of Biotechnology (DBT) of the Govt. of India (Roy *et al.*, 2012), can provide an extremely useful input in this.

- Afforestation has a positive impact on environment and in early 70s through people's participation, Dasoli Gram Swaraj Mandal, Gopeswar and many other organisations had taken up afforestation drive and created forest cover in different parts of the state. Examples can be cited from Gopeswar, where oak forest cover was created with local participation. As oak trees improve water retention capability of the root zone, it has potential to improve the ground water recharge and rejuvenate the natural springs. Therefore, at many places where land has been degraded in the recent disaster, it can be used for plantation with suitable indigenous species that are environmentally and economically viable.

- The area harbours several multi-purpose species, however, four species of hill bamboo, *viz.*, *Sinarundinaria falcata, Chimnobambusa jaunsarensis, Thamnocalamus falconeri* and *Thamnocalamus spathiflora* are of high ecological and conservation significance. They help in retaining the stream banks and steep slopes besides serving important habitat for wildlife and also serve as important Non-timber forest produce (NTFP) for the local people.

- Trees like *Alnus nepalensis* grow very well in unstable areas in sub-tropical and lower temperate climate and therefore should be planted in areas affected with mass movement/landslides. This is a very good shade plant and below this shade-loving crops like 'Badi Elaichi' can be tried. Soil-binding plants, *e.g.* bamboo (a multipurpose plants) found locally should also be planted in these areas. Similarly, Kharsu oak may be planted in the higher temperate zone.

- The key phytoresources including *Abies pindrow, Acer caesium, Aesculus indica, Prunus cerasoides, Pyrus pashia, Fraxinus micrantha* etc, used for fulfilling fodder and fuel requirement,. need to be managed scientifically.

- Oak forests are good for silk cultivation, fooder, timber, fuelwood and for soil conservation. State Silk Department offices exist in upper reaches. There is a need to enhance the silk cultivation in Oak forests which will improve economic condition of the locals.

- Social forestry in form of mixed plantation should also be encouraged for carbon credits which may benefit the local population and also ensure conservation. The tree species to be planted can be the ones which constitute the indigenous/natural vegetation types of the region (*e.g.* Himalayan moist temperate: *Abies pindrow, Cedrus deodara, Quercus floribunda, Quercus lucotrichophora, Rhododendron arboreum*; Temperate coniferous: Abies *pindrow, Cedrus deodara, Quercus lucotrichophora* etc.). Along with the proposed species, the traditional knowledge base also needs to the considered for finalizing the species for revegetation. Cultivation of 'Seabuck thorn' may be promoted in the alpine zone as it is a multi-purpose plant and also has good economic value. It can also be grown along the bunds of agricultural fields.

- Alpine areas where the impact of the devastation during the recent disaster is maximum need to be regulated for excessive grazing (*grazing is necessary as otherwise it will lead to changes in the species composition*). Proper scientific methodology need to be developed towards this. Significant work has been carried out by GBPIHED in estimating the impact of grazing regimes in the alpine meadows.

- The forests of Uttarakhand store huge amount of carbon (C). Revegetation of the degraded forest areas will not only increase the C stock but also help improve the ecosystem goods and services. Community forest need to be promoted for carbon sequestration in land. It can be used as additional source of income by claiming the payment for carbon credits. *Van panchayats*, village level forest councils, can play a great role in this and should therefore be strengthened.

- Food processing units for preparing different products from *Rhododendron arboreum* forest need to be developed and know-how needs to be transferred to the local people to help improve their economy.

- Forest fires are frequent in UK particularly in Sal and Chir Pine Forests. Fire fighting teams need to be strengthened to make use of the latest tools and technologies for fire mitigation planning. There is also need for establishing centers for forest fire warning using space-based, metrological and ground based parameters.

4.2.2 Soil and Agriculture

About 70% population of the state primarily depends on agriculture for livelihood. The cultivated area is about 7.41 lakh ha (14%) of which about 55% is rainfed. The land-holdings are small and scattered; the average land-holding in hills is only around 0.68 ha. The subsistence nature of agriculture leads to low and unstable income, leading to migration of people from rural areas in search of employment. Three hill districts, *i.e.*, Chamoli, Tehri Garhwal and Uttarkashi of Garhwal Division have more than 45% of their population below poverty line. The state is also under constant threat of water erosion. Nearly 65% of the area is affected with soil erosion hazard (more than the tolerance limit of 10 t/ha/yr); nearly 11% area is affected with sheet erosion. Natural calamities compound the problem further.

The following suggestions are made to conserve the soil resource and sustain the agricultural productivity. Many of these suggestions can be implemented under the Integrated Watershed Management Programme (IWMP).

- Uttarakhand hills suffer due to severe soil erosion of more than 20 t/ha/year. Chamoli, Pithoragarh and Uttarkashi districts have >40% and Bageshwar and Rudraprayag districts have nearly 20% area under wasteland category, severely affected by soil erosion. Other districts have <10 % area under this category. Due to high erosion rate, a lot of carbon (C) stored in the soil is also lost, affecting the soil health. Soil erosion starts as sheet erosion and minor gully erosion, later it develops deep gullies and bad land topography and finally it leads to landslides in the upper reaches. The adoption of appropriate soil and water conservation measures is essential for protecting the lands from soil erosion and deterioration in soil health. A number of mechanical and cultural management practices like land leveling, gabion structure, check dam, stone patching at riser of terraces, gully plugging, geo-jute, contour bunding, contour trenching, bench terracing, contour farming, intercropping, strip cropping, mixed cropping, mulching, crop geometry and vegetative barriers etc. are recommended for checking soil and water loss from the sloping lands. Fruit trees and agro-horticulture are recommended in such areas. Bamboos and allied species have good soil binding capability that can resist soil erosion and protect slopes. It can also promote economic activity as demonstrated by a NGO in Pipalkoti which manufactures various bamboo products and markets in the neighbourhood as well as outside State. Bamboos and Fibre Development Board of the state can play a major role in this direction which will contribute in slope stability, reduction in soil erosion and generate income for local population.

- Although cultivation of food grain crops is recommended up to 30% slope, in Uttarakhand it is practiced on steep and very steep slopes as well. Areas having >30% slope should be allocated for agro-horticulture and fruit trees only.

- Watershed health concept needs to be adopted wherein there should be a balance in terms of areal extent of crop land and forest cover. It is estimated that to sustain the productivity of each hectare of cropland, there is a need for 2-15 ha of forest area. It will support re-generation of natural springs as well as availability of water in the area.

- Terraced croplands in the region are often left uncultivated for long time either due to low productivity/ income or farmers have migrated to plains in search of employment. These abandoned terraces, which are currently facing severe erosion, should be kept under fruit or fodder trees. Steeply sloping terraces need to be protected by planting shrubs/ grasses along the bunds.

- The region has high potential for vegetable crops, such as tuber crops (ginger, turmeric and potato), beans and legumes. There is a need to develop infrastructure for proper storage of produce and small processing units.

- Agro-climatic suitability analysis needs to be carried out to identify potential areas for tea plantation and sericulture in the region.

- Rich biodiversity prevails in the state, both in forest and in agriculture areas. There is a high prospect for medicinal plants and herbs farming in the region. The species selection needs to be done properly considering the microclimatic variations influenced by altitude, aspect, degree of slope, soil condition. These plants and herbs also have soil conservation potential. There is also a need to train the manpower and provide market infrastructure. Annex-A provides a list of medicinal and aromatic crop, plant and culinary herb species growing at different elevations (WMD, 2007).

- Livestock plays a vital role in the rural economy. Garhwal and Kumaun divisions have large deficit (45% and 43% respectively) of fodder requirement for livestock. Thus, there is high demand for

fodder trees plantation in the region. The three principal types of oak forests, **banj, moru** and **kharsu**, serve as best source of fodder. Banj forests are ordinarily found at 1,800-2,150 m elevation, moru forest at 1,980-2,750 m and kharsu forests above 2,750 m and 2,150 m above sea level.

- An indigenous agro-forestry system needs to be promoted. It not only supports the livelihood through production of food, fodder and firewood but also mitigates the impact of climate change through carbon sequestration. Annex-B provides the status of tree species in the agro-forestry system of selected villages of Tehri Garhwal (Kala, 2010).

- There is a need to promote local fruits, fruit juices and fruit processed items. This will help generating income particularly from tourists. Small fruit processing units also need to be established in the region.

- Agriculture extension centres and *van panchayats* need to be strengthened to spread awareness of latest technologies and innovations to increase food, fodder and livestock productivity and hence income.

4.2.3 Water

Uttarakhand state is considered as the "water tower" of India. The average annual rainfall is about 1600 mm spread over a period of about 100 days, which is much above the average rainfall of the country. It is the storehouse of glaciers which feed the Ganges river system, consisting of Alaknanda, Bhagirathi, Yamuna, Ramganga, Sharda and Kali rivers. About 13% of the area of state is snow covered containing over 900 glaciers. The rivers emanating from these glaciers feed millions of population residing in the Indo-Gangetic alluvial plains, yet the hilly part of the state suffers with water crisis due to heterogeneity in rainfall and very high runoff owing to rugged topography. The rugged topography is also responsible making the aquifers discontinuous. Ground water occurring in such aquifers emerges as springs, which are the primary source of drinking water supply in the hilly areas. Handpumps have been installed recently tapping the shallow aquifers. However, the discharge of springs and handpumps generally decreases during the lean period; some sources even dry up. Harnessing the water resources and its sustainable management has thus become a major area of concern. A few suggestions are provided here to address some of issues concerning the conservation and management of water resources.

- The challenges in the water resources management of Uttarakhand should broadly be viewed in the context of upstream-downstream linkages. Any imbalance or the meteorological extremes in the upstream region causes river flow to vary from its normal in the downstream region. In the upstream region, the condition of glaciers, springs and lakes should be monitored regularly to understand any changes in their behavior. In the downstream, the changes in river morphology, highest flood level and proximity of settlements and infrastructure to the river need to be studied regularly.

- As water demand is estimated to be just 3% of the precipitation, utmost priority is to be given to the water conservation and groundwater augmentation through construction of rain-water harvesting and recharge structures. Desilting of existing ponds/ lakes/ reservoirs can also be taken up. Discharges from springs need to be harvested through storage tanks and diverted to suitable places for recharging the groundwater to help sustenance of springs and maintain flow in perennial rivers. These activities should be taken up on a large scale by involving the public participation and building awareness about the advantages of such measures. Integrated watershed management approach is the key for this particular activity and thus can be

implemented effectively as a part of the ongoing watershed development programmes (IWMP) in the state.

- Rejuvenation of dried springs and increasing the discharge in the springs and perennial streams is also another area which need immediate intervention. The locations of such springs and streams need to be identified; in case of spring, it's type/ origin is to be identified; reasons for dwindling discharges are to be analysed; recharge/ catchment areas need to be delineated; and appropriate soil and water conservation and recharge measures including afforestation in the recharge/ catchment areas (particularly in degraded areas) need to be taken up. This can be done by collaborative efforts of the government, R&D and public participation. Due care should be taken on unstable slopes as it can also be counter-productive by increasing the pore water pressure leading to slope instability. Delineation of recharge areas of the springs is a specialised job and support of R&D institutions like NIH and BARC should be taken up in this endeavour to ensure that the interventions made for restoring the springs are successful. While taking up afforestation activities, native species need to be selected.

- Certain geo-morphological features, such as inter-montane/structural valleys, fluvial terraces, alluvial fans, misfit streams etc., which have a strong bearing on groundwater occurrence and movement can be identified and tapped for meeting the drinking/ domestic and even the agriculture water requirements. The alluvial deposits occurring adjacent to the perennial streams, lakes and in wide valleys of the misfit streams can particularly be used for tapping the groundwater by putting the infiltration wells and shallow tube wells. Infiltration/ river bank filtration wells put up by the Uttarakhand Water Supply Department in the foot hill areas have been highly successful. The feasibility of putting up such wells in the upper reaches also exist can be tried in suitable places after necessary ground-based investigations. "Uttarakhand Koop" developed by Uttarakhand Jal Sansthan should also be used, wherever feasible, for tapping the sub-surface flow of streams.

- Ground water mainly occurs and circulates through fractures and fissures present in the Himalayan rocks. A few exploratory wells may be drilled by Central Ground Water Board (CGWB) in the fractured zones occurring in suitable rocks and having sufficient recharge zone to evaluate the feasibility of deep wells in the hilly terrain of Himalaya.

- The status of knowledge regarding the present day glaciers and their environment hold the key to our understanding of the past, present and future environmental conditions. The impact of global warming is already visible in the Himalaya. It is estimated that the ~30 km long Gangotri Glacier is receding rapidly, the rate of retreat during the period 1962-1991 being about 20 m/yr. Human-induced climate change is believed to be one of the reasons for the enhanced rate of retreat. Monitoring glacier recession, volumetric changes in mass volume and snowline fluctuations for better understanding of the climate change. The understanding of the rates of recession with the river discharge is important as many of the hazards are directly or indirectly controlled by the fluctuating hydrological regime. Further, quantification of the magnitude of the problem arising out of glacial recession in terms of the impact on the surrounding population groups, flora, fauna, river hydrology and micro-climate is also needed.

- Identification of glacial lakes and associated Glacial Lake Outburst Flood (GLOF) risks needs to studied in the present context of climate change.

- Study of river morphology using latest EO data after the disaster is needed to understand its changed fluvial regime. Further, understanding of the highest flood level of various rivers and

proximity of settlements is also required to find the safer places for habitations along the river valleys.

4.2.4 Hydropower

Most of the rivers which originate in Uttarakhand have their upper catchments in snow and glaciated areas and traverse through deep gorges. These perennial rivers are important sources for hydropower generation and also supply water to some of the largest irrigation networks of the world. There are ambitious plans to exploit more hydropower through several micro- and mini- hydel projects including run-of-the-river power plants. Current estimates suggest that 194 hydropower plants are proposed in Uttarakhand with a planned power generation capacity of about 18,700 MW. This is in contrast to the existing operational capacity of 2,050 MW of power. The state power sector has installed capacity of 2,455 MW, constituting 1.4% of the total installed capacity in the country. About 81% of the generation capacity is based on hydropower while thermal power and renewal energy sources account for 13% and 6%, respectively. The anticipated power supply position of Uttarakhand during 2011-12 show energy deficits of 20.2% while the peak demand deficit has shot to 10.6%. It reflects the need for more power generation in the state with growing population, industrial base and for self-reliance in energy sector.

As power plants located in Uttarakhand are largely run-off the river based hydro power plants, changes in climate and increase in temperature across Himalayan region will have a direct impact on energy generation. Any changes in river discharge patterns can have profound impacts on the hydropower potential of this region. Changes in the water regime as a consequence of climate change may lead to concerns about energy security due to investment in hydropower development across the state as the hydropower generation at a site faces three challenges *i.e.*, geological (earthquake, landslides, etc.), hydrological (uninterrupted inflow, flash flood, etc.) and very high silt loads during flash floods. During winters the problem is aggravated as the discharge in the rivers fall due to frozen ice, leads generation dropping to one-third in comparison to summer months and increase in demand due to heating loads. It has been found that reduction in snow cover in the Himalayan glacial systems from where perennial rivers such as Ganga, Yamuna & Kali originate shall result in decreased discharge in the rivers and hence lower generation, which will widen the power supply-demand deficit in Uttarakhand. Extreme weather events are also likely to pose some threat to physical infrastructure assets. During the recent disaster in Uttarakhand state, the infrastructure facilities at many sites have been severely affected. Thus, the energy generation from hydropower sources is a viable alternative but needs preventive action for sustained production and also environmental conservation. The following suggestions are made to harness the hydropower in sustainable manner:

- Assessing the carrying capacity of any river to sustain the number and dimensions of hydropower projects and also assessing the optimal distance between hydropower sites in the context of cascaded hydropower schemes.
- Regional assessment of environmental flows in various river systems of Uttarakhand region to sustain the demands of local populace and aquatic life.
- Judicious mix of small and large schemes to sustain uninterrupted power generation.
- Potential assessment and environmental impact assessment of identified hydropower schemes while utilising the site-specific datasets.
- Assessment of the likely impact of the glacial recession upon the projected hydropower potential of the state.

4.2.5 Participatory approach for sustainable management of natural resources

There is a strong need to involve the local people and use indigenous knowledge in protection and conservation of natural resources. Community based land and water resource development plan and governance need to be formulated and implemented to sustain the developmental programmes and schemes of the government. The concept of generating the assets inventory and other baseline information through community including school/ college level students should also be promoted using the latest tools and technologies. Subsequent to Uttarakhand disaster 2013, an initiative on 'Map the Neighbourhood in Uttarakhand' (MANU) has been taken wherein students from different universities in the region will be contributing in collecting field data for damage assessment in Uttarakhand, which will form an important input in R&R activities in the state.

4.3 Mainstreaming Disaster Risk Reduction Strategy in Development Planning Process

This region is prone to frequent natural and man-made/induced hazards which have the potential to cause extensive damage to life, property, infrastructure and natural resources. The common and potential hazards of immediate concern to human kind living in this region are flash-floods, landslides, forest fires, earthquakes, glacial lake outburst flood (GLOF) and avalanche. Land degradation processes, particularly soil erosion, are other major concern as they have adverse impact on the productivity and environment in the long-term. This is mainly attributed to its physiographic setting, social, economic and environmental conditions and unsustainable development processes. Climate change with accompanied environmental degradation poses further threat as it will potentially increase the vulnerability of the society to natural hazards in future.

Therefore, disaster risk reduction (DRR) strategy should be central to developmental planning process in this region so that vulnerabilities of the society to disaster risks are minimised. The disaster losses can be reduced if better information is available on the exposed populations, assets including natural resources, and the pattern and behaviour of particular hazard, and also if preparedness towards hazards is strengthened. Two-pronged process/ strategy is suggested for this:

- To carry out scientific assessment of disaster risks to multi-hazards in a spatial manner. This includes identification and spatial assessment of multi-hazards, elements at risk, vulnerabilities (social, physical and environmental) and potential losses. This information is critical to reduce the exposure of society to natural hazards.

- To integrate the hazard mitigation processes with sustainable practices along with developing strong early warning systems and preparedness strategies.

4.3.1 Risk assessment and mitigation

- It is a well known fact that many insurance companies like Swiss Re and Munich Re have a comprehensive spatial database for country-wise or region-wise risk assessment which is mainly used for re-insurance business. Similar approaches at a much larger scale can be adopted for state/ district level risk assessment and risk reduction measures.

- Risk assessment as envisaged can be carried out at two levels: one at macro scale say on 1:50,000 or 25,000 scale to know the hot spots of natural hazards and their possible impact on human settlements or major infrastructure using data sets mostly available or derived from remote sensing data. Data sets such as lithology, land use, geomorphology, soil, road etc. required for such study are available/generated under various projects of ISRO such as RGDWM, NGLM, NRCENSUS, wasteland mapping project, bio-diversity projects, etc.

- The second level of risk assessment is the most important as it is more of a bottom up approach, *i.e.* considering first the element of risk and then assessing the risk from all possible hazards, some of which can be triggered at distant location. For example, the Ukhimath landslide hazard of 2012 started at a far off cliff of a hill and destroyed houses almost one kilometre away. The Gohna Tal tragedy of 1970 caused landslide lake outburst flooding (LLOF) at Birahi basin which affected areas as far as Srinagar and Rishikesh. Similarly, all GLOF events such as recent Kedarnath disaster can destroy areas at far off places in the downstream direction. Temporal satellite images aided by Digital Elevation Models can be of immense help in assessing such risk and suggest remedial measures.

- Additionally debris flow modelling, flash flood modelling, rainfall-run off modelling are some of the approaches that could be used for comprehensive risk assessment.

- It is suggested that first the areas where risk assessment is required needs to be identified based on number of people living, infrastructure availability and also places of high importance (religious, tourist places, etc.). Preliminary risk assessment can be done with local neighbourhood knowledge by simple filling up a check list. For areas where stakes are high like religious places and populous villages, satellite-based and other ancillary information must be used for risk assessment.

- The results of risk assessment must be integrated in administrative measures (non-structural measures) as well as developmental planning, so that mitigations measures are automatically taken care during construction of new infrastructure.

- The risk assessment must result in suggested remedial measures, which have to be evaluated by stake holders and finally DPR must be developed for implementing structural measures.

- Set up a mechanism for communicating risk to stake holders through awareness generation, advertisement, periodic announcement at public places, and training of administrative staff.

- Recently, risk assessment of Yamunotri temple was carried out using temporal satellite images and limited field observation. It was revealed that the temple and surrounding structures that had come up recently are prone to rock slide/rock fall, debris slide from upper reaches, bank erosion due to river shifting and flash flood due to intense monsoonal rainfall as well as potential breach of snow accumulation zones in the upper catchment. Based on the risk assessment, following remedial or mitigation measures have been suggested.

    - Satellite based temporal observation to detect landslides/rock falls in the near vicinity and in the catchment.
    - Physical monitoring of overhang rocks/cliffs.
    - Scaling and trimming of overhanging rocks;
    - Wire meshing/rock curtain, shot-creting and rock bolting;
    - Heavy gauge wire mesh fence to reduce direct impact of rock fall;
    - Pressure grouting of toe cutting areas;
    - River training and channelization;
    - Satellite/ aerial survey to assess landslides/ snow-melt accumulation zones;
    - Installation of Automatic Rain Gauges (ARG)/ Automatic Weather Stations (AWS) and run off modeling;
    - Communicating risk to stake holders including pilgrims;
    - Non-structural measures include pilgrim management to minimize exposure to risk;

- In the past the temple has been devastated by natural hazards and it has been reconstructed in 1995 at a location which is very vulnerable to flash floods and rock falls. As a long-term measure keeping in view ever growing number of pilgrims and vulnerability of the temple, adequate measures need to be taken.

4.3.2 Landslide hazard mitigation

- In view of the devastating and recurring landslides in Uttarakhand, it has become a major challenge for all stake holders to develop coping mechanism to reduce the impact of such disasters through a series of disaster risk reduction (DRR) strategies incorporated in the developmental practices in the region. In this regard, the cause of the disaster must be understood in local as well as regional context and remedial measures must be thought in terms of both structural and non-structural form taking full advantage of current initiatives under R&R and development programmes of the State. In broader perspective, a comprehensive Landslide Hazard Mitigation Programme (LHMP) is envisaged with respect to following important aspects.

- **Mapping and monitoring of active landslides/ vulnerable slopes:** Mapping and monitoring of active landslides as well as vulnerable slopes and associated potential danger such as lakes formed by landslide on the river course can contribute immensely in any effort related to landslide hazard mitigation. In this regard field investigation, mainly related to early detection, and earth observation techniques can play a significant role, particularly in inaccessible areas, where physical monitoring is not possible or not very cost effective. Early detection not only averts disaster, but also requires low cost remedial measures for stabilization of the slope. Although Uttarakhand is affected by landslides year after year, there is no mechanism of slope monitoring. In most of the cases, landslide event is studied after the disastrous event. Therefore, specific effort must be made to initiate programmes for slope monitoring, which may require capacity building and developing expertise to detect landslides at early stage for taking effective remedial measures.

  With respect to extreme event of 15-17 June 2013, numerous landslides have occurred in many parts of Uttarakhand. These landslides need to be mapped and characterised with respect to cause, mechanism, activity, materials involved, and dimensions.

- **Landslide hazard zonation (LHZ):** LHZ at different scales *i.e.* starting from regional scale to site-specific scale serves various purposes as per the intended application. Recent advances in data acquisition techniques based on remote sensing as well as ground based instruments provide ample data that can be processed, modelled and analysed using statistical as well as deterministic modelling techniques in GIS and prepare the quantitative landslide hazard zonation maps. Based on application potential, it is envisaged that for all hilly regions, first level of maps must be prepared at regional scale based on most important parameters such as geology, slope, relief, land use, and rainfall. At the second stage, LHZ maps must be prepared on 1:25,000 scale for priority areas of Uttarakhand, Himachal Pradesh, Jammu & Kashmir and Northeast India. Larger scale maps can be prepared for specific vulnerable sites. Therefore, LHZ must be visualized as a multi-tier exercise with specific aim and objective at each scale or level. ISRO/DOS, in association with partner institutions including central/ state government institutions and universities, has prepared LHZ/ susceptibility zonation maps at 1:25,000 scale along the selected (pilgrim) routes (NRSA, 2001) and the maps are available in public domain (www.bhuvan.nrsc.gov.in). It has been observed in the past that many landslides have taken place in the *high* and *very high* hazard zones shown in LHZ maps. In the light of recent disaster, LHZ maps prepared earlier can be revisited.

  NRSC has initiated landslide mapping from satellite images using a semi-automated method. The work is in progress; however, ground truthing of these landslides is required for detailed

characterisation. The MANU initiative and field investigations by the Geological Survey of India (GSI) will help in this.

- **Debris flow/ rock fall modeling:** Debris flow and rock fall modelling is essential to determine the length of the flow/fall, its trajectory, velocity and thickness of the landslide material. It requires high resolution DEM and characterisation of geotechnical characteristics. At selected location, where the probability of landslide occurrences is high, this need to be applied to forewarn the local population and make advance planning. IIRS has successfully simulated the Ukhimath 2012 and Uttarkashi 2003 landslide events.

- **Seismicity induced landslides (SIL):** Earthquake in mountainous terrain trigger landslides which are known as earthquake triggered landslides or seismicity induced landslides. Such landslides cause immense damage as observed during Uttarkashi earthquake of 1991, Chamoli earthquake of 1999, Kashmir earthquake 2005 and more recently during Sikkim earthquake in 2011. During Kashmir and Sichuan earthquakes, it was observed that almost 1/3rd of the death and destruction was attributed to landslides triggered by earthquakes. Lessons must be learnt from such events that landslides burry habitats, infrastructures, and can dam a river and form a reservoir that can be a potential danger in case of breach. Therefore, steep hill slopes of Himalaya on fragile rocks must be assessed for potential landslides in the event of earthquakes. Using geotechnical properties of rock, earthquake parameters and slope from Cartosat-1/SRTM DEM, NEWMARK or equivalent spatial deterministic models can be applied.

- **Early warning systems:** As landslides are much localized phenomena and are often triggered by high intensity and prolonged precipitation, attempts can be made to develop early warning system using various types of precipitation threshold for landslide occurrence. There have been some attempts based on rainfall threshold as experimented by IIRS using data acquired through automated weather stations (AWS). Similar instruments are also used by SASE (DRDO, India) for snow and avalanche prediction. However, these studies are at very nascent stage and need to be developed further by taking advantage of numerical weather prediction (NWP) modeling using Doppler Weather Radar (DWR) data. Additionally, any technology that provides information on slope deformation such as DGPS, InSAR, Total Station based real time monitoring needs to be deployed at high risk areas.

- **Awareness generation:** Experiences have shown that high level of awareness and proper communication with local population can avert disaster due to landslides. During Uttarkashi landslide event in 2003, due to high level of awareness by the efforts of scientists and administration, no human lives were lost, although property worth crores of rupees was buried in the rubble. Therefore, it is important to take up awareness programmes in the hazard prone areas to apprise local population and all stake holders about the landslide risk in the region, possible causes of landslides, preventive measures (including bio-engineering methods), early detection and monitoring methods as well as remedial measures. It is important to generate awareness at various levels starting from school level through distance education, development and distribution of leaflets and posters in local languages, meetings, seminars, workshops on a regular basis.

- **Site-specific mitigation measures:** In view of the wide spread fatal landslide incidences in the Uttarakhand Himalaya, it is necessary to adopt suitable site specific mitigation measures to minimize the devastating effect of landslides. Various site specific remedial measures can be adopted after detailed examination of the site conditions as suggested below:

- ***Maintaining hydrological balance***. Maintenance of hydrological balance in the system is the key to slope stability as water infiltration in the overburden during heavy rains and consequent increase in pore pressure within the overburden reduces the strength of the material and causes sliding of the landmass. This can be minimized by reducing infiltration by providing adequate drainage network. In this regard dual prong strategy must be adopted such as reducing flow of water into the vulnerable slope material by constructing interceptor drain, trench drain, diverting side drains and by channelization of all drains and secondly by draining out the remaining water by horizontal to sub-horizontal drainage system (using perforated pipes) including construction of collection chamber and diverting the water to existing channel and removal of any blockade to existing drainage system. Most importantly all drainage system need regular maintenance and surveillance for detecting any change in the flow pattern or pore water pressure by installing inexpensive piezometers at selected locations.

- ***Bio-engineering/ Afforestation***. It is a well understood fact that tree cover largely increases the stability of the underlying ground by increasing root strength, intercepting direct effect of precipitation and reducing pore water pressure by evapo-transpiration. Therefore, bio-engineering methods including that of large scale afforestation and protection of existing vegetation cover needs to be adopted in the landslide prone areas. The selection of suitable plant species should be such that it can survive agro climatic and hydrological conditions.

- ***Early Detection.*** Early detection is the key to any effort towards minimizing loss and implementing remedial measures. As landslides normally occur in far flung areas, wherein local population is first to witness and face consequences, it is imperative that they should be made aware of the slope conditions and some of the natural phenomenon which precedes major landslide events. Some of the noteworthy symptoms are given below:

    - ✓ New fractures or unusual bulges in the ground, street pavements or sidewalls;
    - ✓ Soil moving away from foundations, and ancillary structures such as decks and patios tilting and/or moving relative to the house;
    - ✓ Sticking doors and windows, and visible open spaces on floors and side walls;
    - ✓ Broken water lines and other underground utilities;
    - ✓ Leaning telephone poles, trees, retaining walls or fences and houses;
    - ✓ Sunken or dropped-down road beds;
    - ✓ Increase in stream discharge, possibly accompanied by increased sediment load;
    - ✓ Sudden decrease in discharge level even though rain is still continuing or just stopped;
    - ✓ Minor rock falls or debris slides.

- ***Slope stability measures.*** In addition to all suggested measures related to proper drainage management to reduce pore water pressure, structural measures need to be adopted after detailed investigation of the site. These measures include providing soil reinforcement, surface protection, slope modification, retaining walls, gabion wall, rock shed, rock bolting, fencing, rock curtains, etc.

4.3.3 Detailed geo-morphological mapping

In the Uttarakhand disaster-2013, major river basins such as Mandakini, Alkananda, Yamuna, Bhagirathi, Pindar and Kali river basins and many minor basins have undergone significant geomorphic changes in terms of shifting of active channel, bank erosion, toe cutting, appearance of new streams, increase of river width, appearance and disappearance of channel bar and terrace deposits. Therefore, it is very important to map such new features, which would be useful in planning for reconstruction and rehabilitation as well as remedial measures. Further, identification and

mapping of the highest flood levels of various rivers in the recent past vis-à-vis location of settlements will also be vital to mark unsafe settlements and infrastructure.

4.4 Planning and Regulating Construction Activities

- Planning and regulating construction activities based on scientific approach is essential to prevent/ reduce recurrence of disaster losses in future. Identifying safer and environmentally sustainable places for R&R and developmental activities is, therefore, a prime requirement.

- The state being prone to multi-hazards, spatial zoning based on multi-hazards risks using the scientific data and methods requires immediate attention for regulating the construction activities.

- Flash-floods, landslides and forest fires being the common recurrent hazards affecting the mankind and ecosystem must be given priority for multi-hazard risk zoning. Initial zoning can be carried out based on existing scientific datasets on various aspects through a multi-institutional effort. The multi-hazard risk zones can then be integrated with environmentally sensitive zones (viz. reserve forests, national parks, high biological richness areas, wild life corridors and other protected areas) and suitable areas for R&R and future development can be delineated. These areas can be subject to revision subsequently with the availability of additional scientific data and knowledge. Construction activities in the high-risk and environmentally sensitive zones can generally be avoided through government legislation. Legislation based on such a scientific approach will bring a lot of advantage in safeguarding the people and infrastructure from exposure to natural hazards but also conserving the natural environment. However, some relaxation can be given for developing critical infrastructure needed for public services (e.g. roads, telecommunication, power etc.), national security, etc. Further, high-risk areas, if not falling in environmentally sensitive zones, can also be used for other land use practices based on suitability.

- Detailed geo-morphological mapping along with identification and mapping of highest flood levels along major river valleys need to be carried out as mentioned in previous section.

- Land use planning around the new and old settlements should be based on integration of science & technology and the local knowledge/ wisdom for optimum returns.

- Since the Uttarakhand state falls in seismic zone IV and V, the constructions should be seismic resistant as per the standard building codes so that the damage due to poor construction due to earthquake is minimised. This should be done through a regulatory mechanism.

- Best practices should be followed while constructing the houses, roads and communication infrastructure so that they are disaster resilient and also that the by-products of construction activities are not detrimental to environment and do not increase the vulnerability to hazards. The practices followed in other countries in similar landscape can be adopted here as well with suitable modifications based on local conditions.

- Environmental impact assessment (EIA) carried out by the hydropower, industrial and other infrastructure projects must be based on scientifically sound data and methods and should be subject to scrutiny before granting clearances. Further, effective implementation of environmental management plans (EMP) in developmental projects must be enforced through a monitoring and regulatory mechanism.

4.4.1 Re-building of road infrastructure

- Re-building of road infrastructure is the top-most priority as numerous landslides and toe erosion by the sediment loaded rivers caused breaching of roads/highways at many locations and washed away several bridges (steel girder bridges, beam bridges, suspension/cable bridges). Once roads are rebuilt, other economic and developmental activities will automatically catch up.

- The roads and bridges need to be designed to withstand earthquake, landslide, subsidence and flood forces.

- The present method of road construction primarily by cut and fill mechanism is not suitable as most part of the road passes through steep slopes.

- Thorough geotechnical investigations, bridges and rock sheds to avoid landslide zones, adequate drainage (trench drain, dewatering of slope, and interceptor drain at the crest of the slope), slope protection measures with high retention walls are some of the methods which need to be adopted.

- At select locations, although tunnelling must be explored, it must be evaluated against all negative impacts such as accidentally puncturing of water table or passing through a structurally disturbed zone.

- Green road concept as well as alternate mode of connectivity such as provision of suspension/cable bridges and gravity rope-ways must be explored.

- As per the current practice of road construction generates enormous amount of debris consisting of angular to sub-angular boulders, cobbles and pebbles. These debris are largely dumped into rivers, which are carried during peak discharge adding to the erosive power of the river. Secondly, the depth of the river valley also reduces, leading to higher water level during peak discharge.

- Presently bridges are constructed by narrowing the bridge span by extending the abutments into the active flood plain, thus exposing them to flood hazard during peak discharge. Therefore, flood plain, active and old, mapping (which is part of an applied geo-morphological mapping) must be carried out to decide about the appropriate length of the bridge to ensure long-term sustainability.

- Uttarakhand disaster 2013 should be used as a strategy to enhance road connectivity to border areas. Roads such as Badrinath-Mana-Ghostoli and beyond and Joshimath-Maneri and beyond up to Tibet border should be taken on priority.

- Road construction activity must be linked to employment generation schemes, such as PMGSY (Pradhan Mantri Gram Sadak Yojana). Although in Uttarakhand most of the road construction activity is carried out by migrant labours, local labour force must be encouraged to participate.

- Remotely sensed high resolution data need to be used to map and monitor the early signs of slope instability, erosion activity, geomorphological features, faults/lineaments, spring heads/moisture accumulation zones, road alignment, progress of road construction, and impact on the surrounding land use/ land cover.

- Landslide hazard zonation should be carried out along the road corridor to find out potential hazardous areas as similar work has been carried out for the major roads (pilgrim routes) in Uttarakhand by ISRO/DOS in association with other institutions in 2002. Risk assessment must be

carried out for different sections of the road, with respect to number of vehicles, time of the day and period of the year. A study on this aspect has been carried out by IIRS for part of the Uttarkashi-Gangotri road.

4.4.2 Reconstruction of Houses

- Reconstruction of damaged houses and public buildings is one of the top-priorities where the aim should be to reduce the vulnerability to different kinds of hazards (especially earthquake, flood, landslides and forest fires) and restore access to basic amenities and services of governance.

- There are four different types of requirements as far as reconstruction of damaged houses is concerned (DMMC, 2013): (1) housing in the land owned by owner, provided the land is free from hazards; (2) housing for those who have lost houses as well as land, however, land free from hazards is available within the same village area; (3) reconstruction of the complete village along with all other amenities at a new location. Damaged public buildings and infrastructure related to basic amenities are also required to be reconstructed at many places.

- All the existing and new locations for re-construction must be evaluated against multi-hazards and availability of basic amenities such as access to drinking water, road, etc. Multi-hazard risk assessment must be carried out with respect to all risk elements including dynamic occupants in the building.

- Ground subsidence due to creeping is one of the most significant hazards often overlooked due to very slow rate of subsidence/ movement. Many houses in Joshimath town have developed cracks and buildings and have been left abandoned. Remote sensing and other ground-based techniques can be used for detection of subsidence/movement before selecting such sites for any major construction.

4.4.3 Power and telecommunication infrastructure

Telecommunication towers and power transmission lines are the most crucial infrastructure for maintaining connectivity with far-flung areas as well as for transmission of power generated by hydroelectric power project sites to national grid. At many places the telecom towers as well as power transmission towers are not on solid foundation and are erected over vulnerable buildings and unstable slopes. Therefore, there should be a revisit by power companies as well as telecommunication companies to assess the vulnerability of such structures. Further, provision for enough power backup (for at least 7-days without DG/AC supply) for the telecom towers should be ensured. During Kedarnath tragedy, it was observed that communication network collapsed due to lack of power backup.

4.4.4 Strengthening Tourism Sector

- Not only the new sites need to be identified and developed but even the existing tourist sites need a lot of infrastructure improvement to cope up with the tourist influx.

- The tourist sites (new ones) and supporting infrastructure (both at new and old sites) are to be located at safe places based on scientific planning.

- The camping sites need not be at the banks of the rivers and rather should be at safer places.

- The tourist influx to famous places (particularly Char-Dham) needs to be regulated based on the carrying capacity. The concept of eco-tourism needs to be promoted.

- Early warning systems and the infrastructure to disseminate the warnings to the tourists should be strengthened.

4.5 Strengthening Emergency Communication Systems

Communication plays a vital role in early warning and emergency response. It helps in reducing losses as terrestrial links often fail during disaster. As most part of Uttarakhand is characterized with rugged and inaccessible terrain, a strong network of space-based communication system needs to be established to ensure the availability of communication link even during the disaster. ISRO/DOS has developed Satcom-based early warning and emergency communication systems, such as portable satellite phones (MSS Type-D terminals), DTH-based system, BGAN (broadband global area network), etc. which can be deployed in critical areas of the state to make satellite communication an integral part of the disaster management. During the recent disaster, ISRO has deployed satellite phones and DMS hub and user nodes using C_{Ext} 1.8m VSAT antennas in disaster-affected areas which were very useful in supporting rescue and relief operations when the terrestrial links failed.

4.6 Enhancing Livelihood Opportunities for Rural Population

Migration of people from rural areas to towns/ cities in search of employment is a serious issue in the state. The main reason for this is small and scattered land-holdings coupled with low agricultural productivity. New ways to enhance the income of farmers need to be promoted to enhance the livelihood opportunities. These could be: improvement in farming system so as to increase the productivity by adopting high-yield varieties of seed, crop diversification, change from conventional crops to high-value crops, providing marketing support, promoting the self-employment generating schemes, involving people in national schemes like MNREGS and IWMP, etc. (Report of Watershed Management Directorate, Dehradun).

4.7 Strengthening of Institutional Capacity and Linkage

- There is an urgent need to strengthen the institutional capacity of the state government departments, namely State Emergency Operation Centre (SEOC), Disaster Mitigation and Management Centre (DMMC), Uttarakhand Space Application Centre (USAC), Uttarakhand Council of Science & Technology (UCOST), Geology and Mining Unit, in terms of technical expertise (including number of staff) and facility augmentation. State needs to invest heavily in S&T to enable it effectively analyses and utilize scientific inputs coming from various agencies. Suitable inter-disciplinary scientific staff with research background (PhDs) well versed ground realities, domain expertise (landslide, earthquake, environment, meteorology etc.) and well versed with cross-cutting technologies (such as remote sensing, GIS, communication and information technologies) should be recruited. These staff shall have a holistic approach and outlook towards developmental planning taking cognizance of limitations of mountain regions. Himalayan countries like Nepal and Bhutan have come out with various policies for sustainable road development and have set up special departments for that. If necessary, in order to give focus to road construction in a sustainable manner, Department of Roads can be set up in addition to PWD to look after road construction. When the Uttarakhand state was formed, Directorate of Geology and Mining (DGM) of Uttar Pradesh was bifurcated and a Geological and Mining Unit was carved

out which even now has a limited staff. This Unit needs to be strengthened as the scope of geological investigations in the state is large.

- ***Strengthening institutional linkage***. The linkage among the state government departments must be strengthened to share the data and exchange of the technical expertise. The linkage between state and central government departments and centres of excellence also needs to be strengthened.

- ***Strengthening Emergency Response Capacity***. An efficient emergency response depends on the timeliness of many actions based on real time, simulated as well as ancillary spatial and non-spatial information. Technical expertise is prerequisite for synthesization of various spatial and non-spatial inputs which keep flowing prior to disaster to during golden hours of disaster management from various agencies and field workers/first responders.

4.8 Mainstreaming Remote Sensing and GIS in Developmental Planning and Hazard Mitigation

As hazard, vulnerability and risk assessment requires several spatial inputs, remote sensing and GIS can play a very important role. Attempt should be made to use GIS system as a decision making system, that will allow to assess all information related to disasters and also help to prioritise R&R work and manage overall implementation and progress. In this regard, it is very important to set up spatial data infrastructure for the State. State agencies like USAC, UCOST, DMMC have several relevant data sets and national agencies like NRSC, SOI and DST have also relevant data sets that can be used for R&R activities. The following baseline information will be very useful for both R&R activities and hazard mitigation measures:

- Digital topography (relief)
- Temporal satellite images (moderate to high resolution)
- Administrative boundary map (up to village level)
- Population
- Per capita income/ Human Development Index
  a) House, school, important administrative/heritage buildings
  b) Road
  c) Railway
  d) Bridges
  e) Dam
  f) Airport/helipad
  g) Places/ village locations
- Drainage map
- Water body/reservoir map
- Rainfall map
- Flood Hazard map
- Flood inundation map
- Glacier and snow cover map
- Glacial lake map
- GLOF hazard scenario map
- Biodiversity/Biological richness index map
- National parks
- Landslide hazard map
- Landslide incidence map
- Geology (Lithology) map
- Earthquake hazard map
- Seismicity map

- Tectonic map (Faults and lineaments)
- Detailed Geo-morphological map (with spring locations)
- Soil map
- Land use/ land cover map

4.9 Mechanism for EIA, EMP and Environmental Clearance of Infrastructure Projects

Scrutiny and implementation mechanism for EIA (Environmental impact assessment) and EMP (environmental management plans) of infrastructure projects and granting of environmental clearances needs due attention. As mentioned in section 4.4, while the EIA must be based on scientifically sound data and methods, effective implementation of EMP must be enforced through a monitoring and regulatory mechanism. However, since the hill/ mountainous states are at disadvantageous situation due to lack of availability of land for developmental purposes, the mechanism and provisions for granting environmental clearances for infrastructure projects can be eased out and streamlined in the interest of providing public services and enhancing the quality of life of hill/mountain people.

4.10 Strengthening Scientific Observational Network

- Himalayan region is data scarce and, therefore, a strong network of instrumented observatories is required to improve the quality and availability of scientific data on land, water and air. These data are needed essentially for two purposes: (1) early warning for natural hazards, and (2) monitoring and evaluating (before, during and after) the developmental activities, projects and programmes and even the disasters.

- Cloudburst and associated flash floods, and landslides which are generally trigged by heavy rain are recurring events in the Himalayan region due to which life and property are lost every year. Precipitation in Uttarakhand is largely controlled by interplay of summer monsoon, Westerlies and orographic effect of the rugged mountain terrain and as a result although there exists a general pattern but it is extremely variable in different topographic set up. This warrants a strong network of meteorological instruments, *viz.* automatic weather stations (AWS), rain gauges, radars including Doppler weather radar (DWR), etc. for improving the weather forecasts through numerical weather prediction (NWP) models that will be extremely useful in early warning of meteorology related hazards. Many organisations such as IMD, ISRO, dam authorities, Central Water Commission (CWC), universities, research organisations and state government departments have installed AWS, automated rain gauges (ARG), and traditional rain gauges at various locations. Attempt should be made to integrate all such systems and share the data for various purposes. Based on the inventory of such systems, additional instrumentation must be installed in gap areas as the accurate meteorological data are necessary in flood modelling/ forecasts and also early warning of landslides. As the cost of AWS/ARGs instruments are low and there is an improved GSM network in the State, attempts should be made to install such instruments and collect data at a centralised server for faster dissemination and usage related to modelling, prediction/ forecast and decision making. However, in view of paucity of instrumental precipitation data, satellite-based precipitation data available from different sources (*e.g.* TRMM, NOAA CPC) also need to be analysed in addition to ground-based measurements to assess precipitation pattern in spatio-temporal domain, extreme events, intensification of monsoon, spatial anomaly and delayed onset of monsoon, etc.

- Recently, TROPMET-2012 Symposium on "Frontiers of Meteorology with Special Reference to the Himalaya" held at Dehra Dun in November 2012 has strongly recommended strengthening the

meteorological observation network realising the fact that the research, observations and operational requirements in the Himalayan region are quite different from the rest of the country. It has even recommended the need for a dedicated institute for Himalayan Meteorology by the Govt. of India. The observational datasets will also help understanding the climate variability and change in the Himalayan region and its impact on different sectors, *viz.* water resources, agriculture, biodiversity, etc.

- River flow discharge is one of the most important parameters for developing flood forecast models. There should be a mechanism to share the information being collected by various dam authorities as well as CWC. Such data should be collected on priority at all places where higher order tributaries meet the main river, such as Mandakini, Alkananda, Yamuna, Bhagirathi, Pindar, Kali and other major rivers.

- The region being prone to seismicity, the existing network of seismograph and GNSS-CORS (*global navigation satellite system - continuously operating reference stations*) needs to be strengthened. These measurements can also be supported with satellite-based measurements.

- Apart from above, measurements on land, water and other air quality parameters are also critical in understanding the changes not only at specific places but also as a network across the state and even the Himalayan region, so that preventive/ mitigation measures can be taken in time.

4.11 Monitoring and Evaluation of Developmental Activities

- Various developmental projects and programmes taken up at the institution and community level ought to be monitored and evaluated to find out whether the objectives envisaged at the time of conceptualisation and beginning of the project is met or not; to carry out EIA; to evaluate if EMP is effectively implemented, etc. It is very important to assess the vulnerability of biologically rich areas to natural hazards and interference due to development. Environmental monitoring and protection of biological richness should be one of the top priorities and remote sensing and GIS can help in this direction.

- The baseline data/information on different aspects of the natural resources, environment and biodiversity captured through satellite imagery or field-based instrumental measurements prior to, during and after the project can be used for this purpose. The spatial databases at medium (*e.g.* 1:50,000) and large (*e.g.* 1:10,000) scales prepared by ISRO/DOS in collaboration with state remote sensing centres and other institutions using the satellite imagery under different national mapping missions, or that available from any other organisations/ line departments, can be used as the base data. The biological richness maps prepared by IIRS/ISRO will be of great value while undertaking any developmental activities related to R&R and also for environmental monitoring. Close range photo-grammetry and WebGIS are other important areas that will be extremely useful. The instrumental data collected by conventional means form the other important sources of data. While it is obvious that satellite imagery can play a great role in monitoring and evaluating the developmental activities and even for post-disaster damage/ impact assessment, a strong network of instrumented scientific measurement observatories is also necessary for not only validating the satellite-based observations but also for making the measurements on certain parameters which are not yet operationally retrievable from space data.

- ***Mapping and monitoring of Glacial lakes.*** It has been reported that there are 127 glacier lakes in Yamuna, Bhagirathi, Alkananda and Kali valley. The Chorabari glacier lake breach during the recent Kedarnath tragedy has highlighted the fact that all glacial lakes and potential sites of snow

melt accumulation zones need to be mapped and monitored to assess their breaching probability and downstream flooding. Satellite based temporal monitoring aided by aerial and ground survey will aid in the assessment of such lakes. Glacial Lake Outburst Flood (GLOF) and flash flood modelling are required for estimating peak discharge/ flood levels, inundation areas in the downstream, etc. It can also help in scenario generation to generate awareness among stake holders. Satellite images, DEM, river cross sections are some of the inputs that can be used for such studies.

4.12 Capacity Building

- Generating awareness amongst the people and capacity building of Panchayati Raj Institutions are of paramount importance in conserving and optimal utilisation of the natural resources in a sustainable manner. Watershed management, awareness of the technological advancements and innovation for increasing the agricultural and livestock productivity, use of local products for income generation, understanding of the disaster risks and safe construction for building disaster resilience community are some of the priority sectors for human capacity development. Young generation, especially students/ children, should be the focus for generating awareness so that sustainable management of natural resources becomes a culture in long run and vulnerabilities to natural and man-made/induced hazards are minimised while adaptive capacity of the society is enhanced.

- Capacity building in remote sensing and GIS technology and its applications is another area that needs attention as the planning process requires spatial data/ information. It involves short-term and long-term training of manpower and appropriate facility development in stakeholder departments along with policy framework for implementation of the same. IIRS can support in training the manpower through short, customised courses to meet the specific need of the stakeholder departments. Additionally, it also offers PG Diploma and M.Sc. courses in Natural Hazards and Disaster Risk Management (NHDRM) in collaboration with ITC, University of Twente, Netherlands.

4.13 Implementation Strategy

Implementation strategy towards R&R and developmental activities needs to be prioritised as short-term, medium-term and long-term activities. Damage assessment; identifying safer and environmentally sustainable places for R&R and developmental activities including detailed geo-morphological mapping along major river valleys and landslide inventory, characterisation and hazard zonation; and reconstruction of damaged houses, roads and communication infrastructure can be the part of short-term strategy. Strengthening communication systems for early warning and emergency response; enhancing livelihood opportunities for rural people; strengthening institutional capacity and linkage, mainstreaming remote sensing and GIS in developmental planning; and streamlining the mechanism for scrutiny of EIA and EMP of infrastructure projects and granting of environmental clearances can be part of medium-term strategy. Strengthening scientific observational network; monitoring and evaluation of developmental activities; and capacity building for sustainable management of natural resources, improving livelihood opportunities and preparing disaster resilient community can form part of long-term strategy.

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ANNEX-2 (A)

Medicinal and Aromatic Crop, Plant and Culinary Herb Species Growing at Different Elevations (Source: WMD, 2007).

S. No.	Name of Crops/Plant/Herbs	Botanical Name	Altitude (ft.)
	CROP SPECIES		
1	Satavari	Asparagus racemosus	2500-5500
2	Chirayata	Swertia chirayita	5500-7000
3	Aswagandha	Withania Somnifera	2500-4500
4	Giloy	Tinospora Cordifolia	2500-5000
5	MeethiTulsi	Stevia repaudiana	Upto 3000
	PLANT SPECIES		
1	Reetha	Sapindus mukorossi	Upto 5000
2	Baheda	Terminalia Bellirica	Upto 4000
3	Harar	Terminalia chebula	Upto 4000
4	Amla	Emblica officinalis	Upto 6000
	CULINARY HERB SPECIES		
1	Thyme	Thymus valgaris	Upto 4000
2	Rosemary	Rosmarinus officinalis	Upto 4000
3	Oregano	Oreganum valgare	Upto 4500
4	Sweet Marjoram	Origanum marjorana	Upto 3000
5	Mint	Mentha piperita	Upto 3500

ANNEX-2(B)

Status of tree species in the agro-forestry system of selected villages of Tehri Garhwal.

(source: Kala, 2010).

	Latin Name	Local Name	No. of Individuals - ha^{-1}	Major ethono-botanical uses
Trees	Grevia optiva Dumm.exBurret.	Bhimal	34	fodder, fibre, fuel
	Pyrus pashia Buch.-Ham.	Melu	42	fruit - edible
	Prunus persica (L.) Batsch	Aru	11	fruit - edible
	Celtris australis L.	Khadik	23	Fodder
	Sapium insigne Royle	Khinna	2	
	Pinus roxburghii Sarg.	Chir	1	timber, fuelwood
	Bombax ceiba L.	Semal	2	flower - vegetable
	Toona serrata (Royle) M. Roemer	Tun	1	Timber
	Prunus cerasoides D. Don	Paiyan	5	Religious
	Mangifera indica L.	Aam	1	fruit - edible
	Punica granatum L.	Anar	1	fruit - edible; fruit cover-medicine for cough & cold
	Melia azedarach L.	Daikan	2	Fodder;timber
	Ficus semicordata Buch.-Ham. ex Smith	Khainu	2	Fruit - edible
	Ficus auriculata Lour.	Timla	1	fruit - edible
Shrub	Berberis asiatica Roxb. ex DC.	Kingod	26	root - medicine; fruit - edible
	Rhus parviflora Roxb.	Shaunlu	10	stem - toothpaste; fruit - edible
	Rubus ellipticus Smith	Hisar	22	fruit - edible
	Ficus palmate Forsk.	Bedu	16	fruit - edible
	Carissa opeca Stapf.	Karonda	20	fruit - edible
	Vitex negundo L.	Shiwali	3	bio-fencing, medicinal
	Euphobia royleana Bioss.	Sullu	4	bio-fencing

ANNEXURE-3

A Note on

Landslide Hazard Zonation (LHZ) Mapping along the Pilgrimage Route Corridors of Uttarakhand and Himachal Himalaya

Prepared by

Indian Space Research Organization, Department of Space,

based on discussions with the Committee

October 2013

Landslide Hazard Zonation (LHZ) refers to division of terrain into zones of various susceptibility to slope failure. National Remote Sensing Centre (NRSC), ISRO, carried out LHZ Mapping along the corridors of the important pilgrimage/tourist routes in Uttarakhand and Himachal Himalaya in 2000-2001. Thus project covered a total length of about 2000 km and utilized appropriate Indian Remote Sensing Satellite data of 1998-2000, on 1:25,000 scale for mapping of various contributory factors of landslides as wells the landslide incidences. The corridor width for mapping was limited from ridge crest to ridge crest on either side of the main valley (limited to maximum of 5 km on either sides) along which the roads are aligned. Lithology, lineaments, slope-dip relation, geomorphology, slope, slope aspect and morphology, land use/land cover, soil depth, soil texture, weathering, drainage etc were mapped on 1:25,000 scale along the route corridors using satellite data and subsequently ground verification was carried out. The landslide incidences were also mapped and ground verified since understanding of the existing landslide scenario is important in quantifying the relative contribution of various causative factors towards slope destabilization.

The route corridors studied in Uttarakhand (figure 1) are: **1. Rishikesh-Rudraprayag-Chamoli-Badrinath. 2. Rudraprayag-Okhimath-Kedarnath. 3. Chamoli-Okhimath. 4. Rishikesh-Uttarkashi-Gangotri-Gaumukh and 5. Pithoragarh-Khela-Malpa.** In Himachal Pradesh the corridors (figure 2) included: **1. Dalhousie-Chamba-Brahmaur. 2. Shimla-Bilaspur-Kulu-Manali and 3. Shimla-Rampur-Sarhan-Sumdo.**

The contributory factors of landslides were integrated using Analytical Hierarchical Process (AHP) modelling to derive the weights of parameters and their classes. Spatial integration of the weighted themes and classes resulted in the cumulative relative contribution of all the factors and was segmented to generate LHZ classes as Very Low/Low/Moderate/High/Vey High and Severe Hazard classes (example given in figure 3). The hazard zones in the LHZ map indicate the susceptibility of the terrain to slope failure in qualitative terms, in the event of occurrence of triggering factors like rainfall, earthquake or anthropogenic activities. This project also recommended appropriate landslide hazard management measures for the study area based on the land use / land cover, slope, drainage conditions, lithology, slope-support removal (toe erosion/road cutting) and the assessed landslide hazard.

A few landslide events from Uttarakhand are given below, which validated the LHZ maps. The relevance of validation in Uttarakhand is based on annually recurring landslide damages along the pilgrimage routes leading to Badrinath, Kedarnath, Gangotri and Yamunotri

i) Phata Byung (Rudraprayag) Landslides, 2001

On 16 July 2001, heavy rainfall due to cloudburst in Phata Byung area of Rudraprayag district, Uttarankhand triggered more than 200 landslides. The LHZ map of the area prepared prior to the landslide event showed that the majority of the landslides occurred in the High and Very High Hazard zones (*Vinod Kumar et al., 2003,* "*Current Science"*).

ii) Varunavat Landslide, Uttarkashi in 2003

The Varunavat landslide occurred on 23rd September 2003, on the right bank of Bhagirathi river near Uttarkashi township along the Rishikesh-Gangotri route. This landslide was the result of above normal annual rainfall of 2003 and antecedent rainfall that accumulated in the preceding months. Comparison of the Varunavat landslide with the LHZ map shows that the slide had occurred in the High Hazard Zone. The landslide management measure suggested for this zone had been channelization and afforestation / forest conservation.

iii) Okhimath Landslides in 2012

The cloudburst in the Rudraprayag district on 14th September 2012 caused widespread damage to life and property and initiated nearly 475 landslides (*Tapas and Vinod Kumar, 2013, "Landslides"*). Visual comparison of the mapped landslides falling in the LHZ mapping project area shows that nearly 60% of the slides fall in the High/Very High/Severe Hazard zones and the remaining fall in the Moderate Hazard Zone, with a few exceptions in the Low Hazard zone.

iv) Uttarakhand landslides associated with June 2013 Extreme Rainfall

The extreme rainfall event of 16-17th June 2013 which caused widespread damage around Kedarnath and Uttarakhand in general had triggered more than 2000 landslides. It has been found that majority of these slides happened in the Moderate and Higher Hazard Zones.

The above examples cite the relevance of the LHZ maps in highlighting the landslide susceptible areas that stand relatively high in probability of slope failures in the event of occurrence of triggering factors. As slope stabilization measures for mountainous areas involve huge cost factor, the LHZ maps can be used for narrowing down selective slope stabilization and protection measures like provisions for water channelization, engineering structures, afforestation etc. in high and above hazard areas. The LHZ maps can also be used for prioritizing the developmental activities in hilly terrains by avoiding high and above hazard areas and with appropriate slope protection measures in the moderate hazard areas. The low and very low hazard areas are safer areas for development based on existing geological and topographical conditions. The LHZ maps from this project and landslide inventory associated with specific events like 2012 Okhimath cloudburst and 2013 Kedarnath extreme rainfall are available on ISRO's Bhuvan portal for visualization:

(http://bhuvan-noeda.nrsc.gov.in/disaster/disaster/disaster.php).

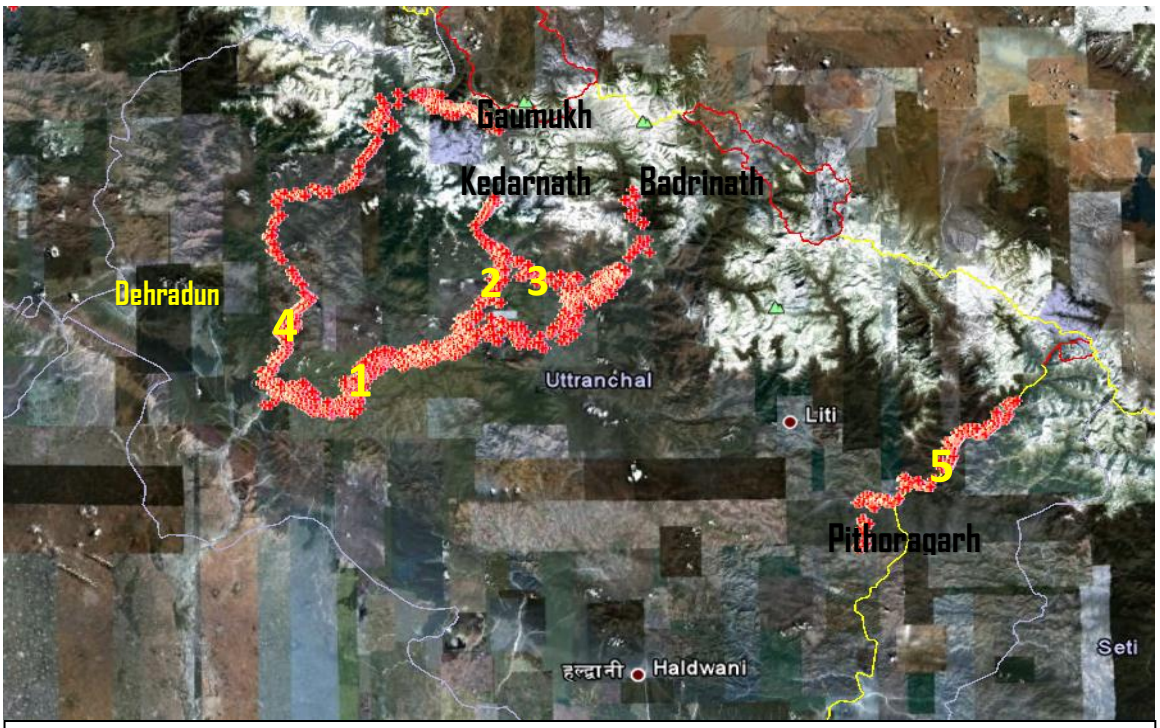

Figure 1. LHZ mapping routes in **Uttarakhand** (the red + symbols are

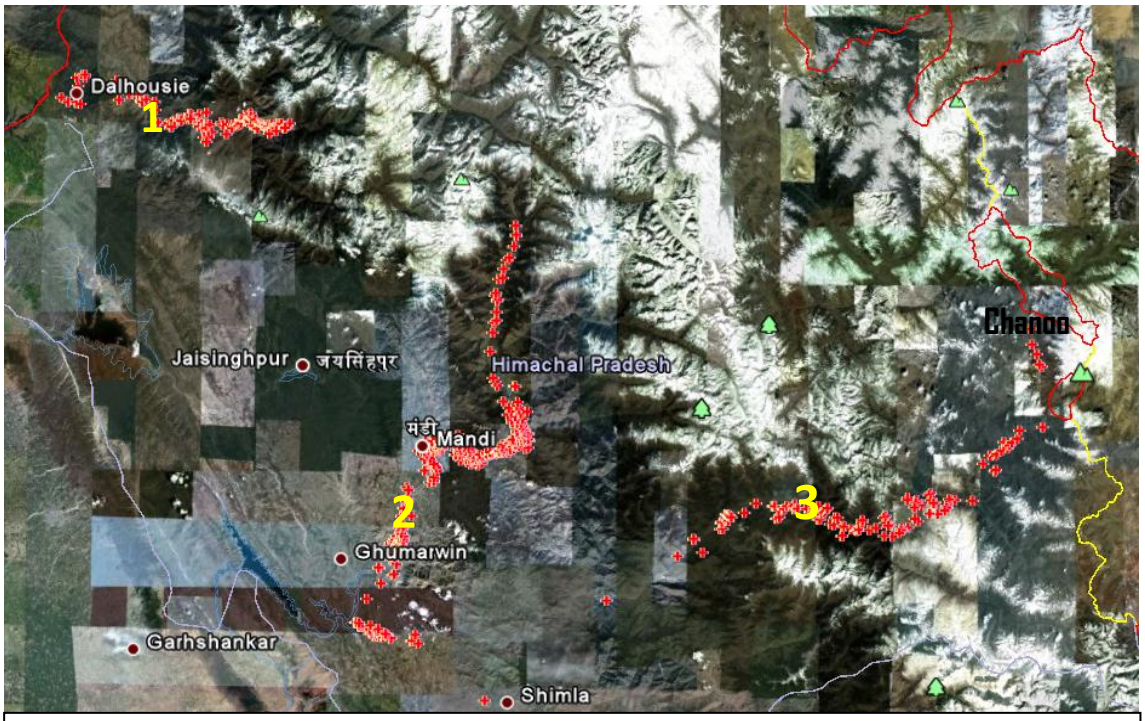

Figure 2. LHZ mapping routes in **Himachal Pradesh** (red + symbols are

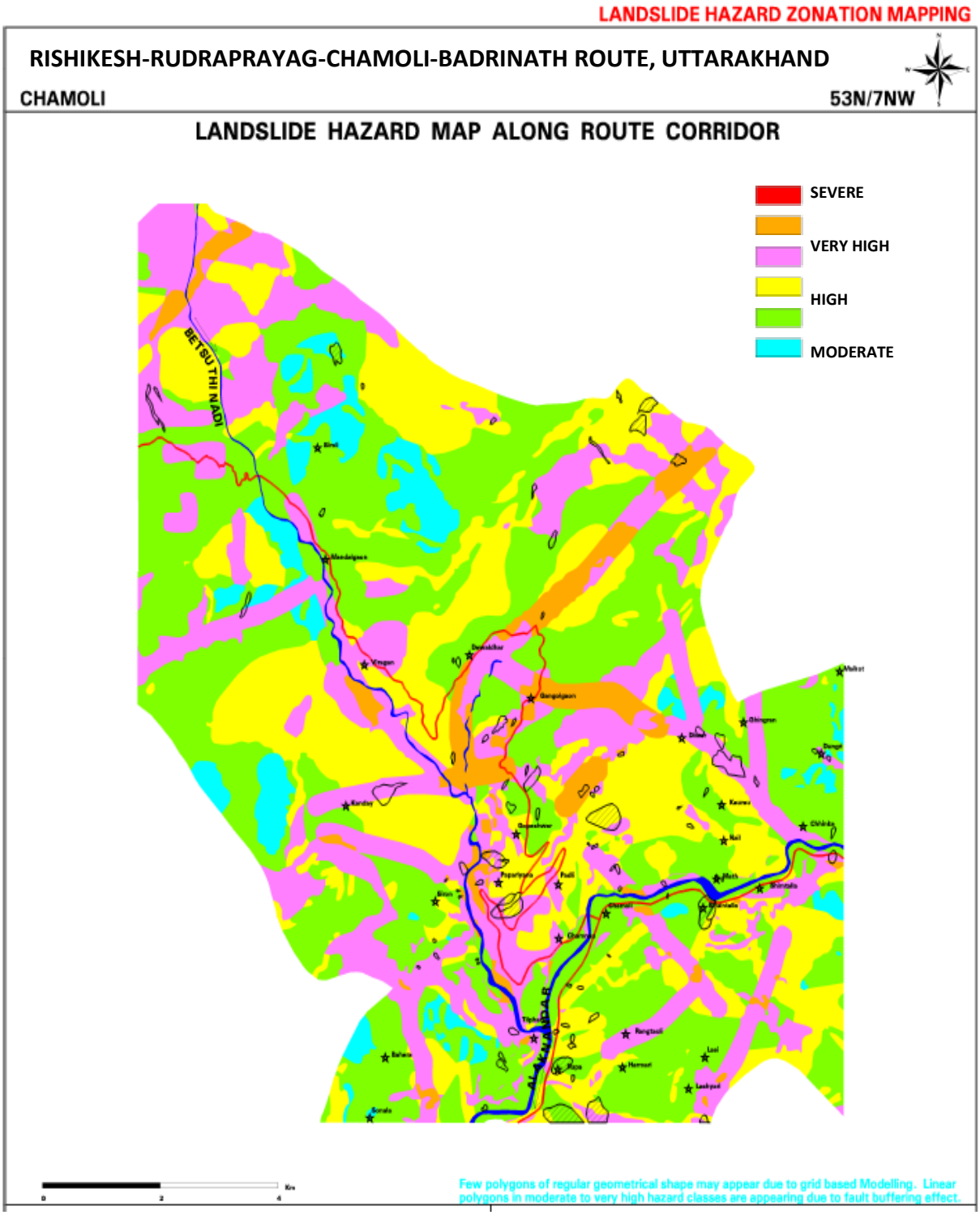

Figure 3 . LHZ map around Chamoli, Uttarakhand

ANNEXURE-4

CONCEPT PAPER

Creating a Facility for Disaster Risk Reduction and Sustainable Development in the Indian Himalayan Region

Prepared by

Indian Space Research Organization, Department of Space, based on discussions with the Committee

October, 2013

1. Preamble

The Indian Himalayan Region (IHR) is bestowed with a variety of ecosystems, large forest cover, rich floral and faunal biodiversity with unique habitations, abundant water resources, and diverse socio-cultural groups. It provides extremely valuable ecosystem services and livelihoods to not only to the people living in this region but also to those living in the downstream within and outside the country. However, the unique floral and faunal wealth of the Himalayas is undergoing structural and compositional changes due to climate change. Its difficult terrain, variable agro-climatic conditions, risks to natural hazards, poor accessibility and infrastructure and poor socio-economic development causes it to lag behind from rest of the country. The incidences of recurring floods, landslides and forest fires causing huge loss to life, property and natural resources are becoming regular phenomena. The mountain ranges are young and have unstable steep slopes due to active tectonics and have a climate that is difficult to predict. As a result, the region is highly susceptible to natural hazards such as flash floods, landslides and large magnitude earthquakes. Also, increasing anthropogenic pressures coupled with unscientific development, exploitation of natural resources and climate change in the recent times have threatened the sustenance of the ecosystem services being provided by the IHR and has even probably aggravated the frequency and intensity of the occurrence of natural hazards.

The recent disaster of Uttarakhand in June, 2013 bears testimony to this, wherein a large part of the state was affected by floods due to widespread and excessive rain in the upper reaches of the Himalaya accompanied with occurrence of landslides, glacial lake outburst flood (GLOF) and probably high snowmelt runoff. The event killed thousands of people and caused extensive damage to the infrastructure, property, agriculture and other natural resources of this mountain state. There was practically no system in place for early warning and preparedness to respond to disaster, at least for some days. The communication systems failed and the extent of disaster was not known for a long time. In order to ensure that such situations do not occur again and the ecosystem services provided by IHR are maintained, a *systems approach* with scientific developmental planning integrated with the *disaster risk reduction* (DRR) strategy is the need of the hour. Quite obviously, the Uttarakhand disaster has propelled a need for an initiative towards more sustainable development of the Himalayan region.

With the increasing realisation of the inherent fragility and vulnerability of the Himalayan ecosystems, development in the mountains has to have a scientific integrated approach, not only for sustaining livelihood needs and improving the quality of life, but also to integrate DRR strategies to ensure sustenance of the ecosystem services provided by the IHR.

2. Facility for Disaster Risk Reduction and Sustainable Development in Indian Himalayan Region

The issues in the Indian Himalayan region (IHR) are multi-dimensional and complex, having intricate linkages between social, economic and ecological concerns. This calls for evolving the developmental strategies based on reliable and comprehensive data on natural, socio-cultural and socio-economic resources, as well as on the environment. Therefore, a single-window facility with decision making capacity for holistic planning for faster and inclusive growth in IHR is proposed. This facility will be equipped with trained inter-disciplinary scientific staff, well-versed with cross-cutting technologies, such as remote sensing, navigation, GIS, communication and information technologies, and will use "**systems approach**" to promote "**sustainable development with main focus on disaster risk reduction**.' The facility shall have a strong network with all the concerned institutions and other stakeholder departments primarily concerned with disaster preparedness and also provide a platform for interaction and exchange of knowledge in multi-hazard risk assessment.

The proposed facility shall address the issues of IHR comprising of 12 states, viz. Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal.

2.1 Vision, Mission and Key Functions of the proposed facility

Vision:

- Building disaster resilient community and eco-friendly environment to ensure inclusive and sustainable growth across the Indian Himalayan region.

Mission:

- To integrate science, technology and indigenous knowledge for strategising governance in Indian Himalayan region to promote sustainable development while conserving the natural resources, maintaining the fragile ecosystem services and building resilience against disasters.

Key Functions:

- Provide inputs to the government and other stakeholders for developmental planning, sustainable practices for conservation and optimal use of natural resources, and overall socio-economic development of the IHR;
- Ensuring availability/accessibility of robust scientific data and value-added services on various hazard related aspects;
- Multi-hazard risk zonation, preparing response and mitigation plans, developing early warning systems and post-disaster damage assessment for facilitating timely relief;
- Monitoring, evaluation and impact assessment of developmental activities and large infrastructure projects taken up by the state/central governments;
- Promote systems approach through research, modeling and scenario generation on ecology, ecosystem services and disasters like cloud burst/extreme rainfall, landslides, GLOFs, forest fires and others;
- Maintain history and research previous disasters, continuously update disaster response plans keeping in view the lessons learned earlier;
- Provide guidelines for strengthening emergency communication systems for early warning and emergency response;
- Provide inputs to central/state governments towards formulation and evaluation of mountain-specific policies for effective governance;
- Maintain a strong network and linkage with knowledge institutions for sharing of data existing with them and with concerned state government departments and other stakeholders for accessing the outputs and services for suitable use at their end, through distributed GIS and other means of communication;
- Capacity building of state government and other stakeholder departments, local bodies of governance and community for effective utilisation of niche products and value-added services provided by this centre for disaster preparedness, mitigation and sustainable development.

2.2 Implementation strategy

For creating such a facility, the following three options are proposed:

- **Option-1:** Creating a new 'Centre' within the identified Ministry/ Department (e.g. DOS, MoES, MoEF, DST, etc.)

- **Option-2:** Creating a new 'Area/Entity' within an existing organisational set-up (e.g. G.B. Pant Institute for Himalayan Environment and Development, Almora; ISRO/ DOS or any other)

- **Option-3:** Creating a new 'Virtual Entity' in an existing set-up (e.g. NNRMS supported by ISRO/ DOS)

The requirements, advantages, limitations/ challenges, budgetary implications and a conceptual framework of organisation structure is shown in Table-1 (enlarged version of organisation structure is shown in Figures-1 to 3. The structure of the technical areas/ entities is shown in Figure 4. The facility shall have a close network with existing institutions, organisations, ministries, centres of excellence and academia for exchange of data and knowledge required in the decision making process. A mechanism should also be in place to generate new datasets by funding the projects to suitable organisation(s). The knowledge outputs through decision making process and tools will be shared with the concerned department of all the Himalayan States.

The **Governing Council/ Governing Board** (applicable in case of Option-1 and 3) would provide overall policy-direction, guidance, oversee overall implementation, review performance and approve any mid-course corrections/ improvements. The Governing Council consisting of chief ministers of the Himalayan states with Member, Planning Commssion as the Convener, may meet once a year; while Governing Board consisting of chief secretaries with Chief Executive of the propsed centre as the Convener. Both the Governing Council and Governing Board will provde overall direction to the centre based on actual needs of the Himalayan states. The **Advisory Committee** consisting of Experts from various ministries/Departments/Academia and network institutions shall provide guidance towards implemenation of the scientific programmes taken up the centre.

The technical programmes and projects will be implemented through the Project Executive Committees comprising of Poject Directors/ Dy. Project Directors/ Project Managers, essentially drawn from the concerned technical areas/ entities (Figure-4). The progress of the projects/ programmes will be monitored by the Programme Management Board, consisting of senior functionaries and subject experts within and outside the departments, at least once a year.

Table-1. ***Comparative evaluation of the proposed options for creating a facility in the Indian Himalayan region.***

Option-1 'New Centre within identified Ministry'	Option-2 'New entity within existing organisation'	Option-3 'Virtual entity within existing set-up'
Requirements		
Completely new infrastructure	Within the overall existing infrastructure by carving a separate Area/ Entity	Within existing infrastructure (may be separated slowly)
Fresh recruitments with immediate effect	Fresh recruitments within existing setup but temporarily delegating responsibilities to existing personnel	Assigning additional responsibilities to the existing personnel (in matrix mode)
Separate organisation structure with new guidelines	Modified organisation structure with existing operational procedures	Hybrid, existing setup to be amalgamated with new requirements
Advantages		
Dedicated setup	Effective liaisoning without gestation	Minimal gestation period
Limitations/ Challenges		
Grooming/ mentoring to meet immediate requirements	Hand-over and customization constraints	Resource-pooling for load on existing personnel to be evaluated
Need to freshly build coordination and communication between agencies/departments	Strengthen coordination and communication between agencies/departments	Strengthen coordination and communication between agencies/departments
Gestation period to adapt to requirements.	Immediate implementation	Small slack
Budgetary Implications		
Separate budget	Minimal budgetary implications	No additional direct cost
Organization structure		

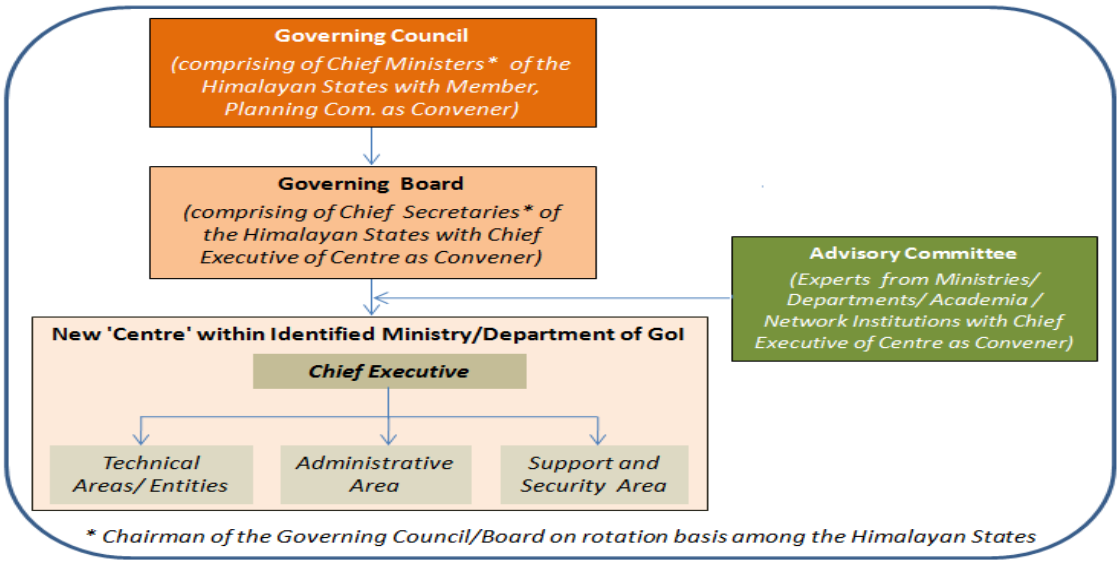

Figure-1: A broad framework of organisation structure of proposed facility (Option-1).

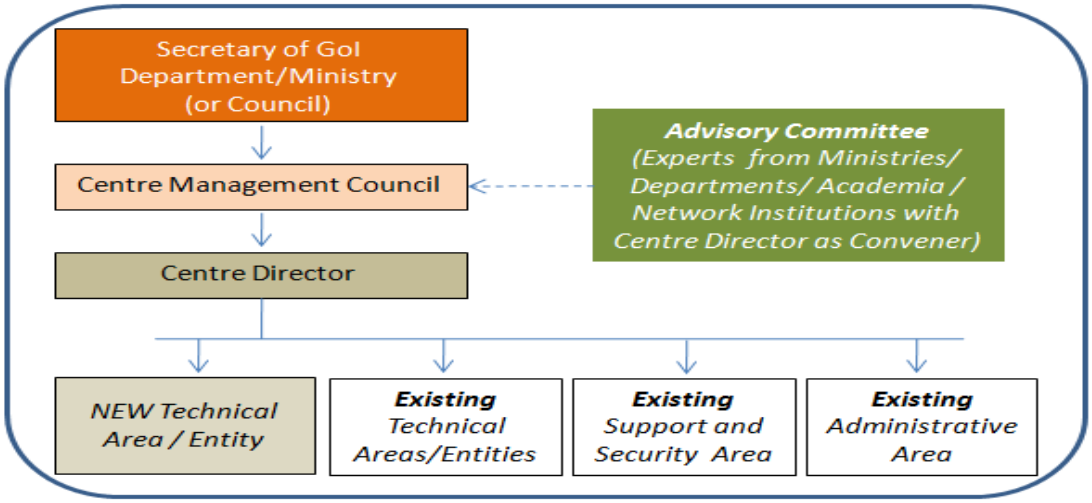

Figure-2: A broad framework of organisation structure of proposed facility (Option-2).

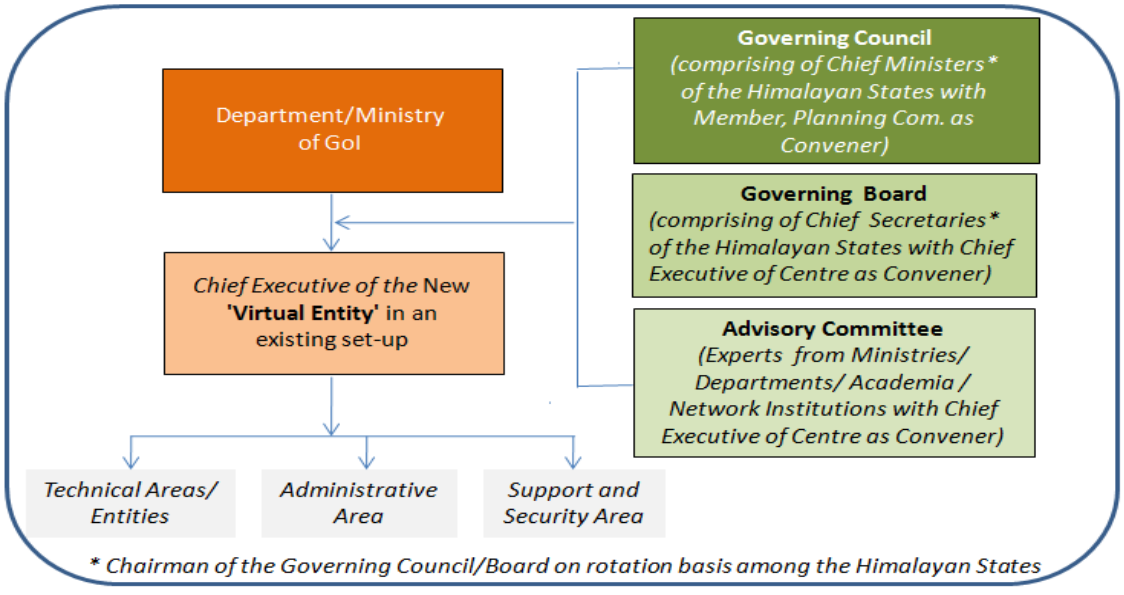

Figure-3: A broad framework of organisation structure of proposed facility (Option-3).

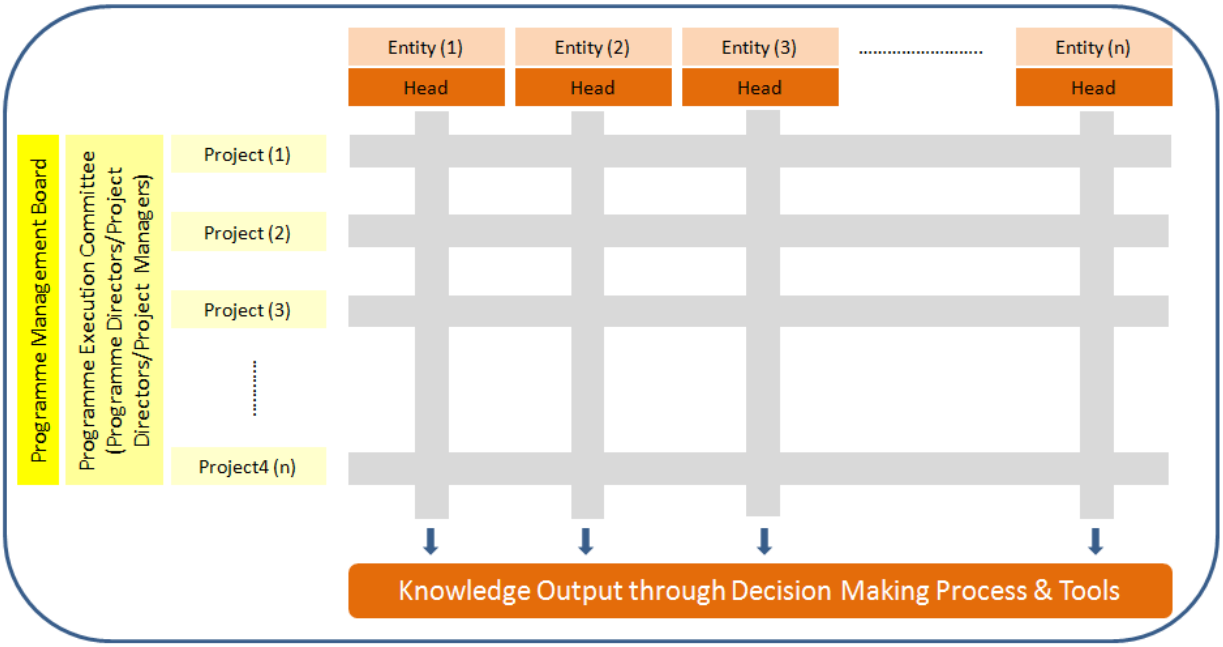

Figure-4: A broad framework of the technical areas/ entities.

2.3 Constitution of Technical Areas/Entities

The following technical entities (Groups/Departments/Divisions) are proposed to be created within this facility (or existing within the existing organisation set-up in case of Option-2 and 3):

- Natural Resource Management *(focussing on land and water management),*
- Ecology and Environment *(focusing on environmental assessment & management, biodiversity and ecosystem services),*
- Disaster Risk Reduction or Disaster Risk Management,
- Geospatial Modeling, Solutions and Services (geospatial data management, modeling, visualisation and geo-web services),
- Satellite Communication (focusing on communication systems for emergency response and early warning),
- Urban and Regional Planning (focusing on issues related to human settlements and infrastructure development planning),
- Socio-economic development/Human Development (focusing on improving livelihoods and adaptation issues),
- Himalayan Policy and Governance (focusing on legalaspects of governance and policy)
- Knowledge Management and Communication (focusing on communication with network institutions and community),
- Capacity building (focusing on training and general awareness amongst the stakeholder departments, local bodies of governance and community).

For execution of the technical programmes and projects, the facility will be equipped with trained inter-disciplinary scientific staff, well-versed with cross-cutting technologies, such as remote

sensing, GIS, communication and information technologies, and necessary state-of-the-art infrastructure. **Initially, about 30 dedicated scientific personnel will be required, which can subsequently be increased to 50-60.**

2.4 Institutional Linkage and Beneficiaries

As mentioned earlier, the proposed facilty shall have a strong network with all the concerned knowledge institutions for data and knowledge sharing, while knowledge output will be shared with the nodal departments of each of the twelve Himalayan states through a suitable mechanism (Fig.5).

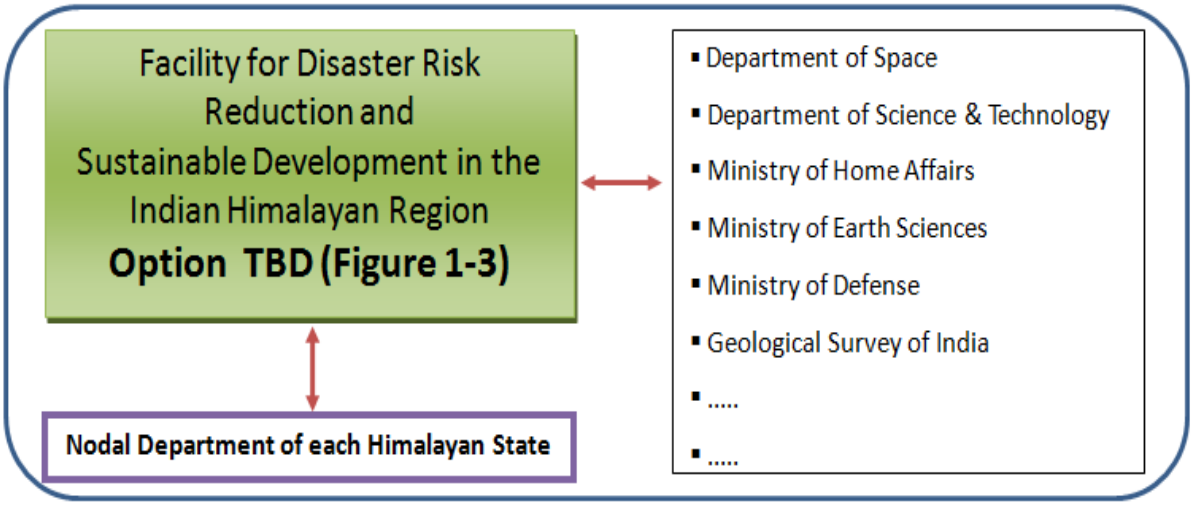

Figure-5: Network of proposed facility for exchange of data and knowledge. TBD-To be decided.

As planning process requires several spatial inputs, this facility will make use of the existing data by having strong linkage with all the concerned central and state government agencies to avoid duplication of efforts towards data preparation. The important primary and secondary datasets which will be generally needed for the Himalayan region include: satellite imagery, topography, administrative boundaries (up to village level), demography, infrastructure (e.g. road, railway, bridges, dams, hospitals, schools/colleges, airports/helipads, important administrative/ heritage buildings, etc.), socio-economic details, drainage and water bodies, geology, geomorphology, soil, land-use/land-cover, precipitation, flood inundation maps, glacier and snow cover, glacial lakes, GLOF hazard scenario maps, biodiversity, national parks/ sanctuaries and other ecologically sensitive areas, groundwater, landslides, seismicity, land degradation, wastelands, and such others. National agencies like National Natural Resources Management System (NNRMS), National Remote Sensing Centre (NRSC), Space Applications Centre (SAC), Survey of India (SOI), India Meteorological Department (IMD), National Centre for Medium Range Weather Forecasting (NCMRWF), Geological Survey of India, Wadia Institute of Himalayan Geology, Central Ground Water Board (CGWB) and many other such institutions under different departments/ ministries already have these datasets available at different scales. Remote Sensing Centres, Science & Technology Departments/ Councils and other departments under the state governments have all generated a lot of data pertaining to the concerned states. All these existing datasets can be accessed through distributed servers and

other suitable mechanism and integrated using scientific tools and techniques for decision making. Wherever there are data gaps, the same can be generated either internally by the proposed Himalayan facility or from external sources by funding the projects or through crowdsourcing.

Similarly, the proposed facility will also have close linkage with the nodal departments of the state governments and other stakeholder departments so that the outputs of its programmes/ projects can be shared for planning and implementation of developmental programmes and effective governance. The state government departments/ institutions which will be benefitted include State Disaster Management Centres, Public Works Department (PWD), Environment and Forest Department, local bodies and other departments related to providing infrastructure and basic facilities to the community. Besides state governments, some of the central government departments, such as Ministry of Environment and Forest, National High Authority of India, National Disaster Management Authority, etc. will also be benefited. The outputs and services provided by this facility can also be shared with public through geo-web services

A conceptual framework of communication mechanism (terrestrial and satellite links) between the proposed Himalayan facility and state nodal departments and mobile emergency response systems is shown in Figure-6. The facility can provide guidance to the state governments and enable them to deploy/strengthen the communication systems across the state (districts, talukas and critical areas) and networking them with the state and central nodes for effective early warning and response during emergency.

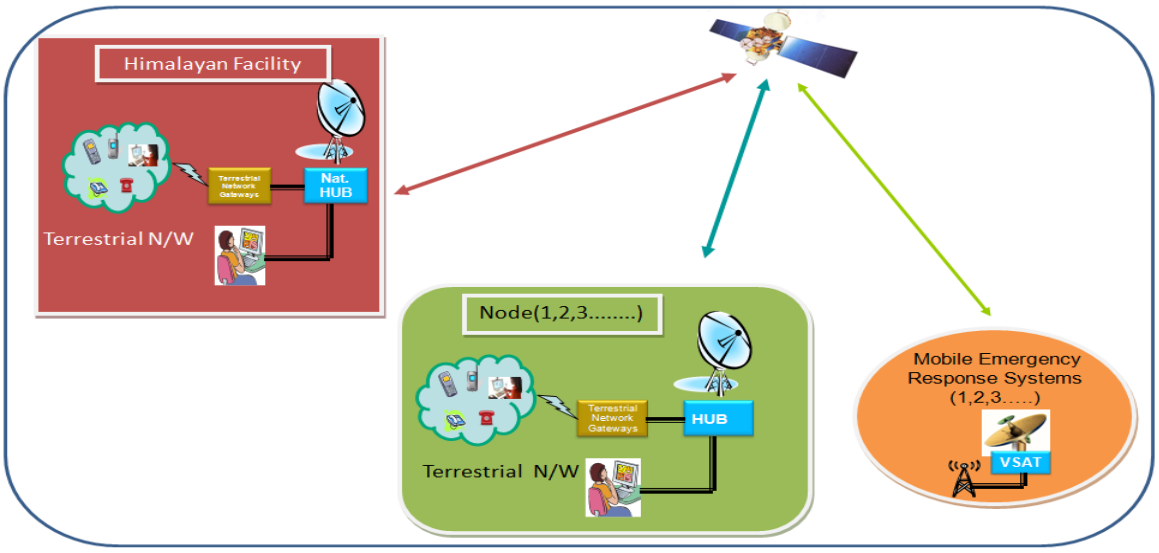

Figure-6: A framework of communication network.

2.5 Funding

The funding to the proposed facility can primarily be provided by the central government. Additionally, since Himalayan states will be the beneficiaries of this facility, some part can also be funded by them annually.

ANNEXURE-4A

Proposed Names of the New Facility

- Himalayan Ecology and Disaster Risk Management Support System (Hi-EDiMSS) or (HE-DiMSS), or
- Centre for Disaster Management and Ecological Studies in Himalaya (CD-MESH), or
- Himalayan Disaster and Ecology Systems Centre (Him-DESC) or (HDESC), or
- Himalayan Disaster Risk Reduction and Systems Centre (Him-DSC), or
- Disaster Risk Reduction and Systems Centre for Indian Himalayan Region (DSC-IHR), or
- Centre for Strategising Governance in Indian Himalayan Region (CSG-IHR), or
- Himalayan Centre for Disaster Risk Reduction and Sustainable Development (HC-DSD).

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