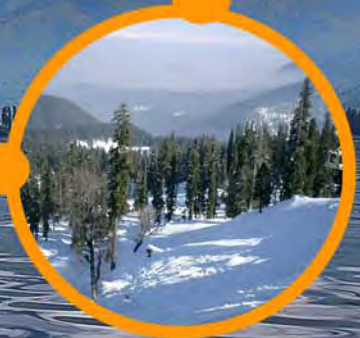


# STATE ACTION PLAN ON CLIMATE CHANGE JAMMU & KASHMIR





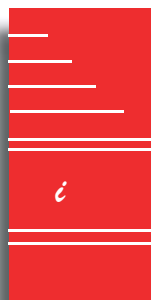
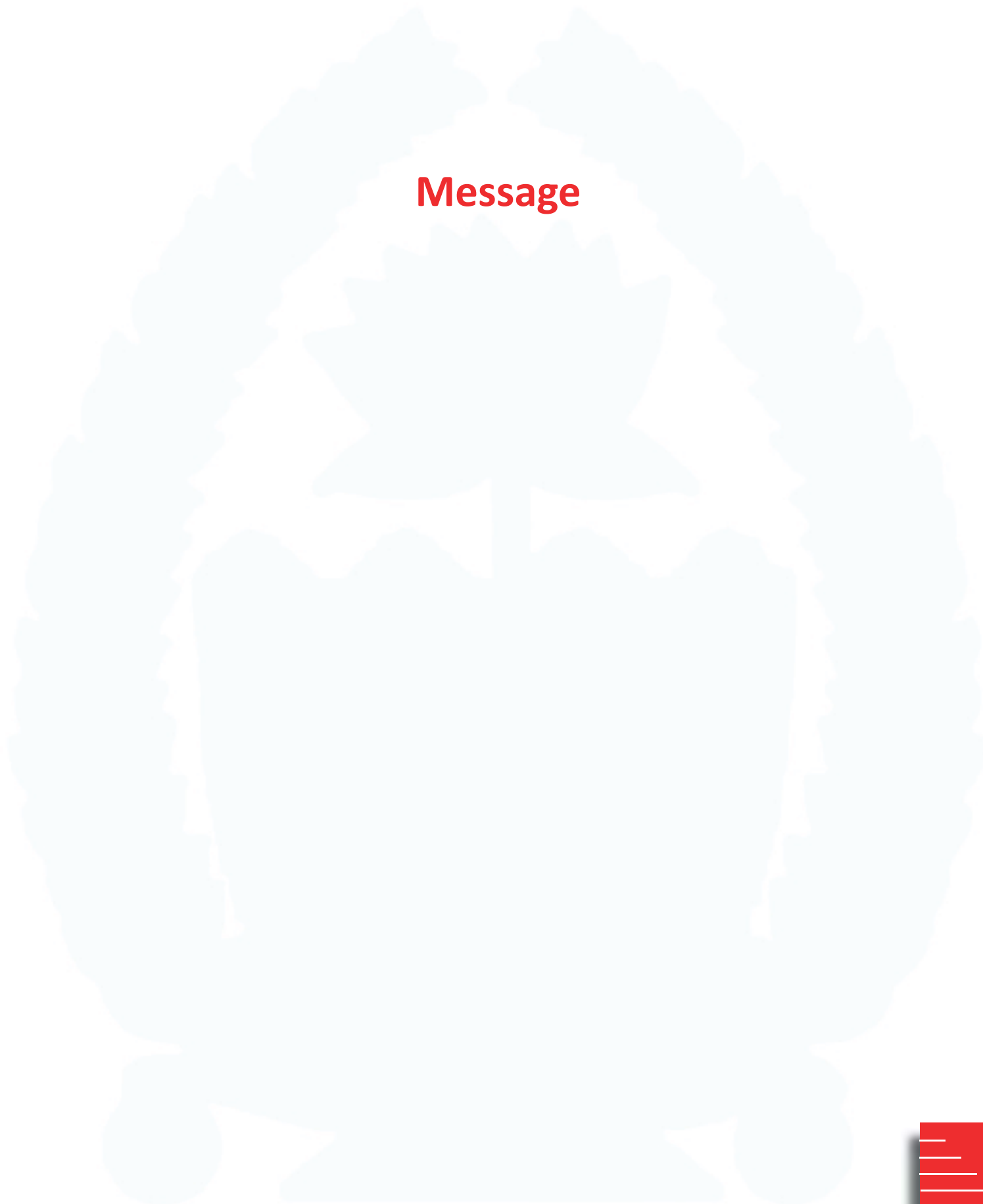


# STATE ACTION PLAN ON CLIMATE CHANGE

**JAMMU & KASHMIR**

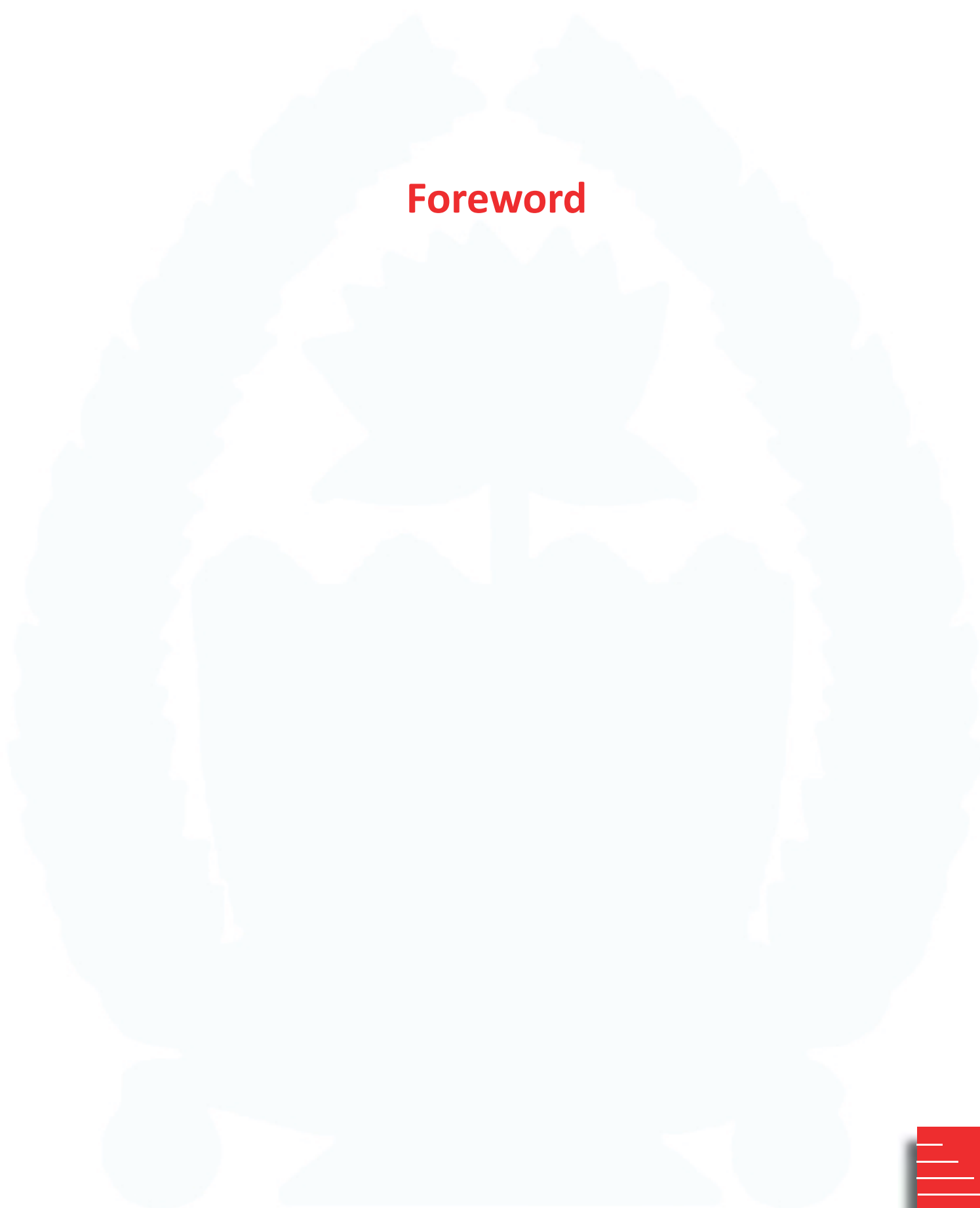


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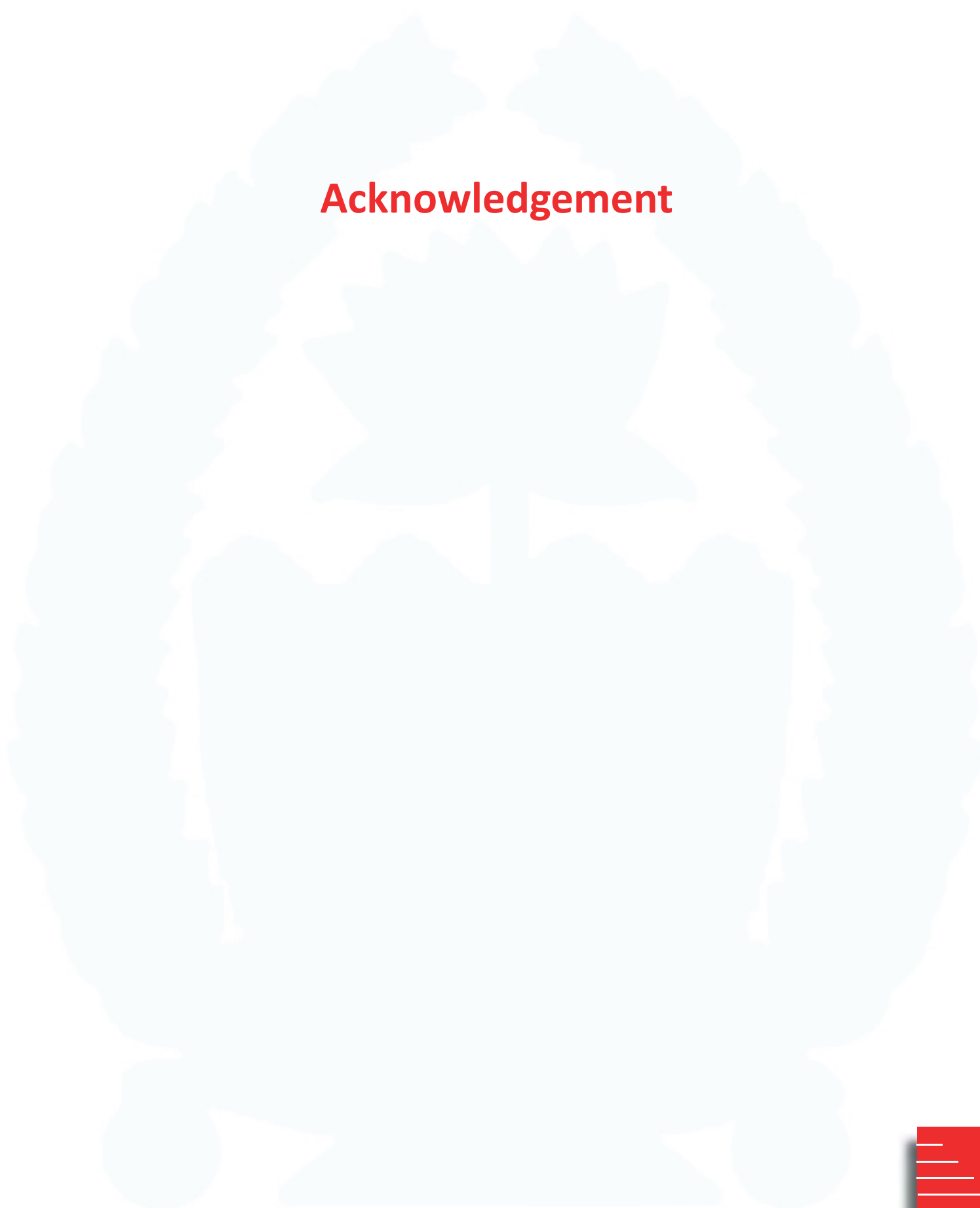


# Foreword





# Acknowledgement









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## Abbreviations and Acronyms

ABC	Aerial Bunched Cabling
AC	Alternating Current
AT&C	Aggregate Technical and Commercial
BEE	Bureau of Energy Efficiency
BOOT	Build Own Operate and Transfer
BMO	Block Medical Officer
BPL	Below Poverty Line
BPMU	Block Programme Management Unit
C:N	Carbon: Nitrogen
CBDRM	Community based Disaster Risk Management
CCAP	Climate Change Action Plan
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CFA	Central Financial Assistance
CFL	Compact fluorescent lamp
CGWB	Central Ground Water Board
CIC	Community Information Centre
CM	Chief Minister
CMO	Chief Medical Officer
CO <sub>2</sub>	Carbon - di- oxide
CPP	Captive Power Plant
CSDRM	Climate Smart Disaster Risk Management
CWC	Central Water Commission



CWPRS	Central Water and Power Research Station
DC	Direct Current
DM Act	Disaster Management Act
DMS	Distribution Management System
DPMU	District Programme management Unit
DPR	Detailed Project Report
DRDA	District Rural Development Agency
DRDO	Defence Research and Development Organisation
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSM	Demand Side Management
DT	Distribution Transformer
ECAP	Energy Conservation Action Plan
ECBC	Energy Conservation Building Code
EEFP	Energy Efficiency Financing platform
EFA	External Funding Agency
EMP	Environment Management Plan
EOC	Emergency Operation Centre
ESCCerts	Energy Savings Certificates
ESCO	Energy Service Company
ET	Evapotranspiration
FEEED	Framework for energy efficient economic development
FSI	Forest Survey of India
FY	Financial Year
GDP	Gross Domestic Product
GHG	Green House Gas
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Floods
GMC	Government Medical College
GoI	Government of India
GSDP	Gross State Domestic Products
H1N1	Swine influenza A H1N1 virus
H7N9	Avian influenza A(H7N9) virus
HCN	Hydrogen cyanide

HVAC	Heating, ventilation, and air conditioning
HVDS	High Voltage Distribution System
IAY	Indira AwaasYojana
IBIS	Integrated biosphere simulator : Vegetation Model
ICA	Irrigated Cropped Area
ICDS	Integrated Child Development Services
ICIMOD	The International Centre for Integrated Mountain Development
IGEA	Investment Grade Energy Audit
ILB	Incandescent Light Bulb
IL&FS	Infrastructure Leasing and Financial Services
IMD	Indian Meteorological Department
INCCA	Indian Network on Climate Change Assessment
INM	Integrated nutrient management
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
IRS	Incident Response System
ISTSL	India SME Technology Services Limited
IWT	Indus Water Treaty
J&K	Jammu and Kashmir
J&K EC act	Jammu and Kashmir Energy Conservation Act
J&K SPDC	Jammu and Kashmir State Power Development Corporation
JAKEDA	Jammu and Kashmir Energy Development Agency
JKSERC	J&K State Electricity Regulatory Commission
JKSPDC	Jammu and Kashmir State Power Development Corporation
JNNSM	Jawaharlal Nehru National Solar Mission
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KREDA	Kargil Renewable Energy Development Authority
LADF	Local Area Development Fund
LED	Light-emitting diode
LoC	Line of Control
LPG	Liquified Petroleum Gas
LREDA	Ladakh Renewable Energy Development Agency
MDF	Moderately Dense Forest

MDG	Millennium Development Goal
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forest
MOU	Memorandum of Understanding
MOWR	Ministry of Water Resources
MSME	Micro, Small and Medium Enterprise
MSW	Municipal Solid Waste
MTEE	Market transformation for energy efficiency
NAPCC	National Action Plan on Climate Change
NASA	National Aeronautics and Space Administration
NATCOM	National Communication
NBMMP	National Biogas & Manure Management Programme
NDMA	National Disaster Management Authority
NEWNE	North East West North-East Grid
NF	No Forest
NGO	Non-governmental organizations
NHPC	National Hydroelectric Power Corporation
NIC	National Informatics Centre
NIH	National Institute of Hydrology
NMEEE	National Mission on Enhanced Energy Efficiency
NPC	National Productivity Council
NSDP	Net State Domestic Product
NWFP	North West Frontier Province
O&M	Operation and Maintenance
OF	Open Forest
PAT	Perform Achieve and Trade
PDD J&K /JKPDD	Power Development Department J&K
PFC	Power Finance Corporation
PHC	Public Health Centre
PHE	Public Health Engineering
PMGSY	Pradhan Mantri Gram Sadak Yojana
PPA	Power Purchase Agreement
PoA	Programme of Activities

PRECIS	Providing Regional Climates for Impacts Studies
PV	Photovoltaic
PWD	Public Works Department
R-APDRP	Restructured- Accelerated Power Development and Reforms Programme
REC	Rural Electrification Corporation
REDD	Reduce Emission from Deforestation and Degradation
RESCO	Renewable Energy Service Company
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
RKVY	RashtriyaKrishiVikasYojana
RM&U	Renovation, Modernization and Uprating
RS	Remote Sensing
S&L	Standard and Labelling
SADP	Special Area Demonstration Programme
SAPCC	State Action Plan on Climate Change
SCADA	Supervisory Control and Data Acquisition
SDMA	State Disaster Management Authorities
SERC	State Electricity Regulatory Commission
SGA	Small Group Activity
SHLS	Solar Homelighting System
SIDBI	Small Industries Development Bank of India
SKIMS	Sher-i-Kashmir Institute of Medical Sciences
SKUAST	Sher-E-Kashmir University of Agricultural Sciences and Technology
SME	Small and Medium Enterprises
SOC	Soil Organic Carbon
SOER/SOE Report	State of Environment Report
SRES	Special Report on Emission Scenarios - IPCC
STP	Sewage Treatment Plant
SWH	Solar Water Heater
T&D	Transmission and Distribution
TEM	Total Energy Management
TOE	Tons of Oil Equivalent
UDD	Urban Development Department J&K
ULB	Urban Local Bodies

UNEP	United Nation Environment Programme
UNFCCC	United Nation Framework Convention on Climate Change
VDF	Very Dense forest
WGI	Working Group I of IPCC
WHO	World Health Organisation

## Units

° C	Degree Centigrade - unit of temperature
kVA	Kilo - volt - ampere - unit of electrical power
bcm	Billion Cubic Meter
GW	Giga watt
ha	Hectare
J	Joule
kg	Kilogram
km	Kilometer
km <sup>2</sup>	Square Kilometer
kW	Kilo - watt - unit of electrical energy
LPD	Litre Per Day
m	Meter
Mha	Million Hectare
mm	Millimeter
MT	Metric Tons
MU	Million Unit of Electrical Energy (1 unit = 1 kilo watt hour )
MW	Mega Watt
MWh	Megawatt hour
Wp	Watt peak





## Executive Summary

### Introduction

Climate projections suggest that impacts are likely to be varied and heterogeneous in India. Some regions will experience more intense rainfall and flood risks, while others will encounter sparser rainfall and droughts including spatial shift in the pattern of rainfall. The Fifth Assessment Report has further emphasized the loss of ice from glacial range and projected that the current glacial extents are out of balance with current climatic condition indicating that glaciers will continue to shrink in the future even without further temperature increase. This has a significant impact not only on the Himalyan ecosystem of State of Jammu and Kashmir but also several other regions in India and some regions in Pakistan Occupied Kashmir and beyond.

A global scientific consensus with regard to the unequivocal nature of the climate change and its association with increasing concentration of greenhouse gas emissions is widely established. Regional climate projection indicates that climate variability

will manifest through alteration in frequency, intensity, spatial extent, or duration of weather and climate extremes, including climate and hydro-meteorological events. This is likely to pose greater risks to human life and endanger the sustainability of the economy of several states in India. Indeed the likely projection of the hydrometeorological and geophysical hazards has the potential to derail the current growth strategy and deepen poverty amongst the vulnerable. The impacts of extreme climate-induced events (such as cloud burst, enhanced glacial flow, untimely dry and wet days) could result in loss of life, livelihoods, assets and infrastructure and affect the state's economic growth and pro poor initiatives. Given its profile, climate change is an important concern for the state as it is presently on a carbon-oriented development path and at the same time, it is vulnerable to climate variations owing to the fragile ecosystem. It is therefore in the context above, a comprehensive Climate Change Action Plan with institutional structure for its implementation has been conceptualized by the State of J&K that would address both adaptation and mitigation concerns with an

objective of increasing resilience and climate proofing of the sectors keeping in mind the conditions of the local vulnerabilities.

## Strategic Importance of J&K

J&K not only nestles in a fragile ecosystem but is also surrounded by hostile neighbours. The formidable challenges due to a rugged terrain are further compounded with the task of reconstructing an economy struck by militancy and terrorism and at the same time cater to growth and poverty reduction. This sometimes creates undue pressure on the environment rising from the need to add connectivity, tourism infrastructure and expanding urban neighbourhoods. To preserve the territorial integrity of India and fight anti-national and hostile elements, the military, civil administration, politicians and citizens often need rapid infrastructural development which sometimes contradicts the accepted environmental norms.

Developmental activities and environmental correlations are sometimes contradictory. While many reports suggest that anti national elements with vested interests often try to jeopardise infrastructure development in the name of environment, other activities in the name of national interest often takes a toll on environmental and ecological balance. Thus careful consideration of the threat perception is critical to achieve a balance between the developmental strategies and environmental concerns. It also requires diplomacy to address the common causes, for example warm air circulation in Tibet plateau caused due to destruction of environment and poor management and warming of Indus water

leading to GLOF can damage the hydrology of the region. If unchecked, it may even result in irreversible damage to the contiguous ecosystem. This makes climate change action planning even more challenging in case of J&K and several other border states.

## Process of formulating the CCAP

Immediately after the meeting of Chief Secretaries in February 2010 where the issue of developing the State specific Climate Change Action Plan was urged by Hon'ble Prime Minister, the State Government of J&K institutionalized the J&K State Council on Climate Change on 25th of April 2011. The State Council on Climate Change is a three-tier structure comprising of **Governing Council** headed by Hon'ble Chief Minister, **Executive Council** headed by the Chief Secretary and **Expert Committee** headed by the Director, Environment & Remote Sensing. While framing the council and the working group, the membership was drawn both from the linede partments and also from the different associated departments/ organizations. A nodal officer was appointed to co-ordinate the meetings, to collect/collate the required information and to develop the plans pertaining to each of the sectors.

***Following are the sectors identified as part of the Climate Change Action Plan.***

1. Energy - Solar Mission and Renewable Energy
2. Enhanced Energy Efficiency
3. Water

4. Sustainable Habitat
5. Sustainable Agriculture
6. Tourism
7. Sustainable Himalayan Ecosystem
8. Health
9. Disaster Management
10. Strategic Knowledge mission
11. Green India Mission

Both top down and bottom up approach was followed in developing the SAPCC. Consultations were carried out with members of working groups as well as with the administrative departments. Administrative heads were consulted recognizing the need for involvement of the senior bureaucracy within the government towards assessing climate change issues and mapping the solutions. Tools and templates were formulated for listing climate change specific issues, prioritizing the activities as “high”, “medium” and “low” and developing an outline of the sub-activities to be taken up under the high priority activities, estimating the budget and sources of funding as well as formulation of the monitoring and verification protocol. GIZ provided support for this action planning facilitation and engaged CTRAN to coordinate and manage the process on behalf of the Government of J&K.

## Vulnerability

In the context of India, especially Jammu and Kashmir, which nestles in fragile Himalayan Ecosystem; there are natural fluctuations

in climate, human induced changes due to large scale urbanization that drives the warming trend. The biodiversity loss and water stress owing to the climate change are the greatest challenge for the State over the coming decades. Climate change poses a serious threat to the species diversity, habitats, forests, wildlife, fisheries and the water resources in the region. Many wetlands in J&K that support 20% of the known range of biodiversity in the region are adversely affected. The climatic changes resulting in changing weather movements are relatively unpredictable, but could be important in the context of the incidence of different diseases like avian influenza. As per UNEP report some parts of the State are moderate to high vulnerability. As per INCCA assessment the number of rainy days in the Himalayan region in 2030s may increase by 5-10 days on an average, with an increase by more than 15 days in the eastern part of the Jammu and Kashmir region. The intensity of rain fall is likely to increase by 1-2 mm/ day. This is likely to impact some of the horticultural crops; though rangelands and livestock are likely to benefit. The rate of recession of glaciers is reportedly varying which is being attributed to winter precipitation climate warming and anthropogenic elements. Temperature, precipitation and cold wave are most likely to significantly impact the agricultures sector and enhance its vulnerability. Deficit in food production is growing in recent times in Jammu & Kashmir. With the reduction in rainfall, the rain-fed agriculture will suffer the most. Horticultural crops like apple are also showing decline in production and a real coverage particularly due to decline in snowfall. Study

by Indian Institute of Science using dynamic vegetation model has revealed that about 39% and 34% of the forested grids are likely to undergo shifts in vegetation type under A2 and B2 climate scenarios respectively with a trend towards increased occurrence of the wetter forest types. Approximately 47% and 42% of tropical dry deciduous grids are projected to undergo shifts under A2 and B2 scenarios respectively, as opposed to less than 16% grids comprising of tropical wet evergreen forests. Similarly, the tropical thorny scrub forest is projected to undergo shifts in majority of forested grids under A2 (more than 80%) as well as B2 scenarios (50% of grids). The increase in temperature may lead to increasing morbidity due to heat stress. Flash floods due to Glacial Lake Outburst Floods (GLOF) may lead to large scale landslides and affect food security and hence nutritional health.

## Sustainable Energy Mission

The action plan proposed under sustainable energy mission is strategized in line with the National Action Plan on Climate Change with objectives of meeting the country's development goals while simultaneously yielding co-benefits to address climate change effects. The state is currently focused on generation through big hydro power projects. Potential of micro hydel power and Solar are increasingly being tapped. The challenges in the sector are quite a few. Grid electricity penetration in remote hilly

areas of J&K is techno-economically unviable by virtue of geographical disadvantages and scattered household pattern. Moreover, the power sector of the State is already facing difficulties like slow rate of capacity addition, poor evacuation facility, high AT&C losses and mismatch in load profile and power utilization mix is not commensurate with the State climatic conditions. Promotion and utilization of renewable energy is the most feasible solution which would also promote low carbon growth and can meet the decentralized energy requirement of the remote locations. The power available in 2011-12 from all sources was able to satisfy only 64% of total power demand of the State. Due to the shortfall of 6,231.74 million units during 2011-12, the state faced problems of frequent power cuts for 8- 10 hours a day which has a detrimental effect on the growth potential of the State. To meet its power demand of 17,323.00 million units during 2011-12, the State has procured 66.76% of its total power supplied (i.e. 11,091.26 million units) from the NEWNE grid which is highly fossil fuel dominated. Promotion of renewable energy in this context will help in bridging up of the demand supply gap but will also promote low carbon development and meeting up of the electrical and thermal energy requirement without contributing to the greenhouse gas emission to the atmosphere. The key priorities proposed under the missions are as follows:



## Key Priorities: Sustainable Energy Mission

1. Promotion and implementation of solar city project
2. Promotion and facilitation of Off-grid and decentralized renewable energy generation for electrification, cooking and other thermal energy requirement
3. State Govt. by amendment of building bye-laws suitable to state condition would promote and mandate use of solar water heating and/or lighting systems
4. Institutional development and strengthening of JAKEDA, LREDA and KREDA for promotion of Renewable Energy technology applications.
5. Harnessing renewable energy potential of the state for power generation
6. Strengthening of technical competency of various stakeholders of renewable energy which includes O&M persons, technicians, installers, manufacturers and other relevant service providers as per international standard
7. Enhancing State's own power generation capacity through hydro power plant set up and provides support to private/public investors in projects implementation and undertakes micro/mini hydro projects for remote area to meet up local demand
8. Promotion of grid connected Rooftop and Small Solar Power projects in the state of J&K
9. Promotion of Green buildings in the state

## Mission on Enhanced Energy Efficiency

The power generation in the State is mainly governed by hydro power with a little share of fossil fuel based grid interactive power plant. Total estimated potential for hydro power generation in the state is 20,000 MW out of which 16,480 MW (excluding 251 Projects up-to 25 MW generation potential identified totaling to 986 MW Capacity) has been identified as the actual generation potential. Out of the identified potential only 2457.96 MW or 15% has been harnessed so far. The power sector of the State is subjected to high AT&C losses of the order of 61%. Technical losses pertain to outdated and old electrical device in the network. To minimize such losses, the system needs up-gradation and improvements. Commercial losses include

power theft, unaccounted and uncontrolled consumption beyond agreement load, unregistered consumers, lesser contract demand, etc.

Domestic consumers as a whole are the major electricity consuming segment in the State with cumulative consumption in tune of 34% followed by industrial 20.21%, government institution 17.6%, Public water works 14.50%, commercial 8.6%, agriculture 4.9% and public lighting in tune of 0.7% respectively. A substantial potential of energy saving are there across all the energy consuming segments. The energy saving potential across agricultural sector is highest in tune of 25-35%, followed by domestic sector 15-20%, building sector in tune of 20-30%, industrial sector 7-10% and municipalities around 20%. The key priorities proposed under the missions are as follows:

## Key Priorities: Mission on Enhanced Energy Efficiency

1. Establishment and incorporation of Bureau of Energy Efficiency, J & K EC act 2011
2. Promoting Energy Efficiency in Small and Medium Enterprises (SMEs)
3. Promoting Energy Conservation Building Code (ECBC)
4. Renovation and Modernization of Hydro-power Projects
5. Development of comprehensive scheme for promotion of energy efficient pumps in agriculture sector
6. Reducing Transmission and Distribution (T & D) Losses
7. Promoting Demand Side Management (DSM) and energy efficiency
8. Decentralized power generation
9. Harnessing the biomass potential
10. Development of policy for mandatory use of efficient light particularly for commercial organizations in the state
11. Expansion Conversion of conventional street lights to solar LED/CFL street lights
12. Maximizing solar power usage and Encouraging use of Solar Gadgets (especially in Industries)
13. State energy audit policy and Implementation of pilot Energy efficiency project and IGEA
14. Promoting Energy Efficiency Practices in the State
15. Awareness and implementation for use of CFL and replacing incandescent lamp under Bachat Lamp Yojna, and Umbrella program of BEE
16. Standards And Labelling Programme

## Mission on Sustainable Habitat

Urban areas face significant impacts of climate change. It impacts human health, livelihood and productive assets, especially for the urban poor, informal settlements and other vulnerable groups. Climate change impacts range from increase in extreme weather events, flooding to high temperatures leading to public health concerns, resource congestions, etc. As the urban regions of the state are dynamic systems that face unique climate impacts, their adaptation must be location specific and tailored to local circumstances.

The importance of infrastructure and improvement of living standards of population is crucial to sustain economic development. A detailed analysis of the development process over last four decades shows that one of the major reasons for slow economic and social development is the unplanned population growth. The capital cities and other district towns of the State are challenged with problems of rapid urbanization, expansion of informal settlements, substantial poverty, inadequate infrastructure and environmental degradation. These and other concerns plague cities' ability to grow and prosper. Many of these conditions also limit resilience to address current climate variability.

Solid waste management is the most emerging and pressing issues in the urban areas of the State. Agglomeration of solid and liquid waste not only contribute to water contamination and pollution but also its unplanned decomposition results into release



of methane to the atmosphere, ultimately factoring for health impacts. Sanitation possesses major stress in the urban areas as absence of adequate sewerage treatment facilities in urban areas results in release of effluent from domestic and hospitality industry into nearby rivers, lakes and streams leading to contamination of water sources. Indiscriminate developmental activities like jamming of drains and encroachment on rainwater flow paths add to the factors. The urban transport sector has been largely neglected in the State, characterized by heavy traffic congestion due to narrow roads, rapid growth in number of vehicles along with highly topographic and concentric development. Public transport is limited due to inadequate road network, poor infrastructure and scattered demand.

The State Government is thus planning to mainstream climate change adaptation in urban infrastructure development. Creating this new possibility of adaptive resilience would support a new future for cities in the face of climate change. The key priorities proposed under the missions are as follows:

### Key Priorities: Sustainable Habitat

1. Promotion of battery operated (charged from solar power) transport systems in tourist places, battery driven motor boats instead of diesel engine boats (battery charged from solar module mounted on the boat) and use of alternative fuel instead of diesel to drive Barges and other diesel driven equipment used for maintenance purpose in the lake

2. Capacity building of all of stakeholders to make them understand their role and maintain proper environment management system
3. GHG accounting study on emission by transport vehicles
4. Establishment of intelligent transport system
5. Policy framework in transport sector
6. Promotion of public transport and mass transport & Promotion of water transport
7. Reallocation of the hotels or application of STP near Dal lake & DPR preparation on STP
8. Establishment of end-to-end solid waste management system
9. Base line study on solid waste and industrial waste generation and DPR preparation & four pilot project implementation
10. Capacity Building/ Awareness Generation Program on segregation of solid waste at household level
11. Establishment of segregation mechanism of bio-medical waste in urban hospitals and in rural PHCs
12. Application of methane capture technology and preparation of fertilizer from weeds in Dal lake

## Green India Mission

According to the interpretation of satellite data collected for the period of October-December 2008, the forest cover of Jammu and Kashmir is spread over 22,539 sq. km (including area outside the LoC) accounting for 10.14% of the State's geographical area. The State of Jammu and Kashmir has rich diverse forest resources and plays an important role to preserve the fragile ecosystem of the State and it also serves as catchments for Himalayan Rivers. In Jammu and Kashmir, the perennial water supply including groundwater recharge, and health of soils, is primarily dependant upon the area and quality of forest cover. A healthy forest cover is essential for long term operation of hydroelectric projects. The State forest provides some environmental services like carbon sequestration, pollution abatement, amelioration of climate, in-situ conservation of biodiversity and maintenance of ecological balance. Since there is unique aesthetic value of forest landscape and huge potential for tourism in the State, the forests plays a pivotal role to make the State an ideal tourist destination. Forests and climate change are inherently linked. When kept healthy, forests play a key role in our national climate change strategy. Over geologic time, changes in disturbance regimes are a natural part of all ecosystems. However, loss of forest's ability to mitigate the effects of climate change will mean losing many important ecosystem good and services. Unplanned development, climate change, invasive species, unsustainable forestry practices, diseases and insects, all of these factors

and more, endanger the forests. Number of factors is responsible for deforestation and degradation in Jammu and Kashmir. Due to high dependency on forest for timber and fuel wood deforestation is an ongoing process. On the other hand the livestock population in the State is 9.90 million resulting in huge demand for fodder. In addition most of these livestock graze in forests. Grazing and trampling of saplings by livestock is the biggest threat to regeneration of vegetation in all forested areas of the State. Low tree density, low bio-diversity status as well as higher levels of fragmentation contribute to the vulnerability of these forests. The current biotic and abiotic stresses are likely to exacerbate the projected impact of climate change that indicates towards shift of vegetation of the forest grid including tropical dry deciduous grids, tropical wet evergreen forests and tropical thorny scrub forest. The key priorities proposed under the mission to reduce the impact of climate change are as follows:

### Key Priorities: Green India Mission

1. Implementation of J&K State Forest Policy
2. Capacity building and awareness for all levels of stakeholders
3. Gene bank development for climate adaptable species
4. Eco-restoration through afforestation and Climate oriented eco-restoration plan
5. Phenological Studies of Forest and other Tree Species

6. Flora and Fauna vulnerability study
7. Studies of carbon influxes/ out fluxes of various forest types / trees and their role in carbon sequestration
8. Study on per capita fuel wood consumption and alternative livelihood
9. Climate impact study in undisturbed/ protected forest areas.
10. E-green portal with geo-reference
11. Nursery development for climate adaptable species
12. REDD+ feasibility study for carbon sequestration
13. Study of climate change impact on wild life species
14. Climate change impacts on undisturbed forest area like national parks
15. Study on soil organic carbon of forest area
16. Studies of impact of managed watershed under different management system on sustained water availability

## Water Mission

Climate change is projected to influence the hydrological cycle of water bodies, water supply systems and exacerbate requirement of water in different regions. The disturbance of the hydrological cycle as projected due to the variability in the climatic conditions are

likely to enhance the current stress on water resources from surging population, growing economic development and land use change including urbanization. Increase in ambient temperature and changes in rainfall pattern might influence the hydrological cycle to a large extent. Other consequences like increase in rates of evapotranspiration decrease in fresh water availability, mass losses from glaciers and reductions in snow cover might severely impact the hydrological cycle. Change in the hydrological cycle may affect the spatial and temporal distribution of runoff, soil moisture, ground-water reserves and may increase the frequency of droughts and floods. Event of increased frequency of rainfall and variation in rainfall pattern including extreme events like flood poses challenge to the society, physical infrastructure and quality.

Economy of the State relies heavily on water intensive sectors like agriculture, horticulture, energy generation, tourism, etc. Since most of the water-bodies in the State are supplied by melt-water from mountain range therefore loss of glacier might reduce the water availability impacting hydro power potential and lower availability of water for irrigation impacting the agrarian economy in the State. Regions in the State that are already subjected to water stress are projected to be adversely affected with the potential of impact on multiple sectors e.g. agriculture, domestic water supply and health. The key priorities proposed under the missions to undermine the impact of climate change and also to enhance the sustainability of the sectors are as follows:

### Key Priorities: Water Mission

1. Generate baseline data with terrain analysis (contour/slope/ gradient/ aspect, etc.), with comprehensive land classification with catchment demarcation, river networks, lakes and water bodies, forest coverage, etc
2. Promoting and implementing water use Efficiency measures
3. Develop hydrological models for different seasons and calibration with the existing data
4. Comprehensive water budgeting in lieu of the current and future demand from domestic supply, irrigation, industry, tourism and for other sectors
5. Monitoring river flows and mapping of flood and drought zones
6. Formulate comprehensive rejuvenation plan for Dal Lake, Mansar Lake, Manasbal Lake, Pangong Lake and all other major lakes
7. Assessment and Implementation of rain water harvesting and artificial recharging of ground water
8. Emphasize the awareness and capacity building for conservation, concern and co-management of water
9. Dealing with flood in the changing climate scenarios.
10. Reducing impact of increased erosion and sedimentation
11. Creation of storage facilities on distributaries of river Chenab and Jhelum as per Indus Water Treaty

### Sustainable Mission

### Agriculture

Agriculture and its allied sector is the mainstay of State economy providing livelihood opportunity to 70% of the State's population and contributing to around 27% to the State's income. Horticulture plays a significant role in State's economy as the sector contributes 7% to GSDP and provides greater opportunities for development of agro-industries in the state. Weather variability or climate extremes resulting from climate change could have direct and indirect effects on the crops, soils, livestock and pests. While the magnitude of impact might vary over the region it is expected that variability of the climatic conditions will impact agricultural productivity and shifting crop pattern. The vulnerability of the State agriculture sector to climatic variability would be accentuated at multiple levels including the crops or livestock's, farm or cropping system and the food system. The implication of climatic variability or extremes over agricultural sector could be far reaching and it could affect food security, livelihoods trade policies, water conservation issues impacting large portion of population. In the absence of appropriate adaptation and mitigation measures there will be food shortage and consequent inflation which could endanger the food and livelihood security of the State. The key priorities proposed under the missions to undermine the impact of climate change both through adaptation and mitigation measures and also to enhance the sustainability of the sectors are as follows:

## Key Priorities: Sustainable Agriculture Mission

1. Planning of cropping system and crop varieties through Crop diversification, drought tolerant crops and water saving crops
2. Capacity building of Planners farmers and extension workers and dissemination of new and appropriate technology:
3. Integrated nutrient management (INM)
4. Promoting Zero Tillage
5. Introducing Trash mulching in agriculture 5000 ha are to be covered under mulching practice for Kashmir Division
6. Combating climate related risk through Micro Irrigation programme
7. Management of climate change risk for sustainable productivity
8. Weather based Crop insurance
9. Enhancing capacity for livestock disease management and forecasting monitoring and management
10. Conservation of water bodies and fish stock augmentation in natural water bodies and promotion of fish farming
11. Screening of crops for moisture/heat/disease/pest tolerance and nutrient use efficiency.
12. Crop yield and weather modeling for future projections
13. Carbon pool assessment/sequestration in forest and agricultural ecosystems
14. Conservation of pollinators, pollination and plant phenology mismatch
15. Grass Land Management / Forage/

Fodder production.

16. Developing Cold-Chain Infrastructure
17. Root-Stock & Progeny Plant Material
18. Protected cultivation and Precision Farming under Hi-tech Green Houses, Poly Green Houses & Shade Nets
19. In-situ moisture Conservation through Roof-top water harvesting (2500 RTWH Units with assistance of Rs 6000/ Per Unit), Storage tanks (291 Low cost storage tanks of 20x20x20 m<sup>3</sup> @ Rs 1.03 lac/tank assistance, Ponds/Trenches, Check-Dams (250 no @ Rs 2.00 Lac/CD), Land levelling by Laser leveller (100 units with Rs 1.5 lac/Unit assistance)
20. Establishment of two number of Bio-Diversity Parks (one in Jammu division and second in Kashmir division)

## Disaster Management

Adverse impacts of climate change on society often increases disaster risk, disasters themselves erode environmental and social resilience, and thus increase vulnerability to climate change. Moreover climate variability is projected to result in more frequent and intensive disasters – with most severe consequences on the infrastructure, food security and livelihoods vulnerable communities dependant on natural resource. Since both disaster risk (including climate associated disaster risk) and climate related vulnerabilities are likely to undermine the economic sustainability and development it is therefore planned that disaster risk management strategies and climate change adaptation planning be integrated in the State. J&K is a multi-hazard prone region with



natural disasters like earthquakes, floods, landslides, avalanches, high velocity winds, snow storms, besides manmade disasters including road accidents and fires, etc. Such incident frequently occurs thereby disturbing the ecological balance and in most of the case directly results to disastrous events. The key priorities proposed under the missions to undermine the impact of climate extremes are as follows:

### Key Priorities: Disaster Management

1. Hazard risk mapping using GIS and Remote sensing
2. Risk reduction through implementable planning and policy
3. Strengthening Communication Networks and Disaster Management Facilities
4. Hazard specific multi-parameter vulnerability assessment and social impact assessment at the regional and local levels for preparing contingency plan
5. Developing and promoting concept of Climate Smart Disaster Risk Management (CSDRM)
6. Preparation of disaster rescue and rehabilitation plan.
7. Awareness/ Sensitization/ Capacity Building in form of :
8. Community based disaster management in the Disaster Management Plan at all levels
9. Disaster response training at the community level to build infrastructure and human resources for medical

preparedness and emergency medical response to manage mass casualties during extreme events

10. Institutional development and operationalization of the regulatory framework for effective management of disaster under State Disaster Management Act 2005 for preparation of Disaster response and management plan

## Tourism

Other than the destinations of tourism value, climate is another principal attraction for tourists from all over the world. Preference of locations during a particular period of time and the profitability of enterprise is largely determined by the climatic conditions. Thus any regional manifestation of climate variability and extremes are likely to influence the popularity of any tourist destination. So the projected climate variability and change can severely affect the tourism industry in the State through increased infrastructure damage, additional emergency preparedness requirements, higher operational expenses and business interruptions. Barring the vulnerability of the sector the tourism sector also contributes to climate change through GHG emissions from transportation and accommodation facilities for tourists.

The unplanned and unprecedented growth of the tourism industry in the State has resulted in severe detrimental impact on local environment. The inflow of tourist beyond the carrying capacity of the location has put tremendous pressure on existing resources and infrastructure. The pressing issues are:



1. Increased Pollution load, enhanced health/safety concern
2. Increased issues of sanitation and garbage management
3. Weather related risks e.g. changes in temperature may discourage tourists to visit existing tourist destinations. Extreme climate events may lead to disruption of services.
4. Pressure on drinking water resources
5. Siltation and pollution of water bodies
6. Lack of collection and disposal mechanism of solid waste
7. Increased urban congestion and lack of proper transportation facilities
8. Lack of sewage disposal facility
9. Poor maintenance and use of existing tourist infrastructure
10. Inadequate medical and DRM plan at climate sensitive tourist spots
11. Deforestation and land degradation
12. Unplanned infrastructure in climate sensitive zones
13. Lack of proper transport infrastructure with sufficient connectivity with rest of the country and adjacent countries
14. Un-regulated development of tourists destination including problem of accommodation
15. Restricted & protected access to important tourist destinations in State.
16. Requirement of Herringbone drainage system

The key priorities proposed under the missions to undermine the impact of climate

change and also to enhance the sustainability of the sectors are as follows:

### Key Priorities: Tourism

1. Undertaking capacity studies and developing EMP for ten tourist locations
2. Construction of Bio-toilet
3. Implementation of solid and liquid waste management facility at six locations
4. Improve climate change related knowledge base of tour operators
5. Undertake study on tourist-related transport emissions
6. Strategizing restoration of Dal Lake
7. Undertake study to identify new environmental friendly natural tourist destinations for their full-fledged operation as tourist spots

## Health

Weather and climate variability has a profound influence on human health. The impact of climate change over human health is likely to be multifaceted involving increased incidence of vector, water and food borne diseases, malnutrition and undernourishment, injuries and death caused by extreme hydrogeological events and thermal stress. Temperature, precipitation and humidity have a strong influence on the reproduction, survival and biting rates of

the mosquitoes that determine the malaria and dengue fever, and temperature effects on the life-cycle of the infectious agents themselves. The same meteorological factors also influence the transmission of water and food-borne diseases such as cholera and other forms of diarrhoeal diseases. The vulnerability due to the incidence of diseases or hazards will however depend upon the level of exposure, sensitivity and the coping capacity of the populace. Short term impacts of climate change are likely to magnify the existing socio-economic threats due to rapid urbanization, population growth, poverty, health infrastructure, contamination of air and water, unplanned urbanization, issues of solid and liquid waste management resulting in high morbidity and mortality. Long term climate change impacts will exacerbate the existing stress while undermining growth and development. The key priorities proposed under the missions to undermine the impact of climate change are as follows:

### Key Priorities: Health

1. District wise inventory on water born and vector borne diseases with respect to weather variability
2. Capacity building of all stakeholders on preparedness and with action on health front in situations of flash flood and earthquake hazard
3. Research and study on impact of climate change on human health
4. Construction of new hospitals with modern infrastructure and equipment's to cope up with climatic impacts on human population

5. Modernization of existing hospitals and PHCs
6. Increase in disease surveillance
  - Systematic collection and analysis of data about vector borne diseases
  - Systematic collection and analysis of data about water borne diseases
  - Systematic collection and analysis of data about zoonotic diseases
7. Integration of GIS mapping for collection, analyse and share data and identification of spatial areas of high concern
8. Monitoring system -
  - To understand changes in pattern of diseases
  - To deal with new diseases from emigrants (H1N1, H7N9 etc.)

## Sustainable Himalayan Mission

In J&K, the major cause of increased vulnerabilities to the Himalayan ecology are unplanned construction, changing socio economic profile, over and unplanned exploitation of natural resource (e.g. Dal Lake or deforestation), unplanned urban growth, conflicts, insufficient institutional capacities and people getting aggravated due to climate variability and change. Climate change may adversely impact the Himalayan ecosystem through increased temperature, altered precipitation patterns and episodes of drought. Concerns have also been rising over the Himalayan glaciers along with other entities in the global cryosphere. The

Himalayan glaciers may lose significant ice-mass thereby endangering the river flow especially in the lean season when the North Indian Rivers depend on melting snow and ice.

As per IPCC, glacial meltdown is projected to increase flooding, snow avalanche fall from established slopes and diminish water supplies to rivers as glaciers recede. The biodiversity which resides in the higher altitudes will have lesser and lesser place to occupy and will be at increased risk of extinction. There will be a gradual shift of plant species towards higher altitudes. This will force local communities to shift to newer agricultural and fodder species. This coupled with the fact that that the area is in a highly sensitive seismic zone, there is bound to be a heavy stress on housing sector. Flash floods due to Glacial Lake Outburst Floods (GLOF) may lead to large scale landslides and subsequent loss of life and property. Changes in the rainfall pattern and relative humidity add to weather inconsistencies which also impacts plantation and harvesting. The Himalayan ecology is largely impacted by key human intervention like encroachment, pollution, siltation, increased resource extraction coupled with inadequate and inappropriate plantation. Sustainable development practice that aims at a balanced growth can arrest this regressive trend. The State Action plan for sustaining the Himalayan ecosystem aims to strike a balance between addressing the issues detrimental to the ecosystem while enhancing the activities for economic prosperity like tourism, infrastructure building etc. The key priorities proposed under the missions to undermine the impact

of climate change are as follows:

### **Key Priorities: Sustainable Himalayan Mission**

1. Baseline study of climate change impact on flora, fauna species and on glacial ecology
2. Study on vulnerability of mountain ecology
3. Community participation for protection and conservation of mountain ecology, terrestrial ecology and aqua-ecology
4. Capacity building and awareness for all levels of stakeholders
5. Institutional development on biodiversity conservation and protection
6. Identification of climate grids and effect on forest and ecological resources
7. Study on terrestrial and aquatic ecosystem
8. Study on anthropogenic intervention on ecological hotspot
9. Study of climate impact on migrated birds and their timings
10. Identification of current status of Himalayan ecology and climatic trend analysis for Himalayan ecology

## Strategic Knowledge Mission

While there has been significant improvement in scientific understanding of climate change in the past few decades, there remains considerable uncertainty about the nature, timing, spatial distribution and severity of the particular impacts. In this context, the State mission on Strategic Knowledge on Climate Change intends to create a knowledge system that would help implement adaptive actions to reduce vulnerabilities as well as take advantage of the mitigation opportunities. It is imperative to build a vibrant and dynamic knowledge system that would inform and support national as well as regional actions for responding effectively to the objective of ecologically sustainable development. A strong and strategic knowledge system is essential for identifying, formulating, planning and implementing policy driven actions while maintaining the necessary economic growth rate. Such a strategic knowledge system for informing and supporting climate sensitive actions will need to address a number of objectives. It is equally important to address climate science with region specific modeling; assessment of various technology scenarios and alternatives for complying with national objectives; leveraging international cooperation and strengthening initiatives for selection and development of new technologies for adaptation and mitigation; and ensuring that knowledge gaps are bridged. The key priorities proposed under the missions to enhance the coping capacity of the population are as follows:

### Key Priorities: Strategic Knowledge Mission

1. Map & Analyse knowledge sharing process, flow, protocol and priority
2. Compile currently available information for assessment frameworks, methods and tools for climate impacts, decision support tools, good adaptation practices
3. Establishment of weather and climate data and easy access of data to climate researchers and end users of vulnerable community as well as livelihood sector
4. Capacity building including developing of training module and imparting through regional workshop
5. Develop & maintain online portal on climate change
6. Organize, annual forum of learning seminar, workshop and dissemination of knowledge based products

## Gender Issues and Climate Change

Women are affected disproportionately and differently, due to climate change and associated natural disasters such as floods, droughts, cyclones and storms. This is largely because men and women are bound by distinct socio-economic roles and responsibilities that give rise to differences in vulnerability and ability to cope with these climate change consequence.

Women usually, require firewood, or even modern fuel and water for cooking and any constraint posed by lack of access or

contamination, affects in making them more vulnerable. The work participation rate of male and female vary significantly. In post disaster recovery period, the females stay in hostile terrain whereas males migrate.

Therefore it is important that issues relating to gender safety, violence against women during climate stressed scenarios and adaptation options which are gender segregated need to be worked upon and friendly policies for women needs to be incorporated.

## Actions and Budget

Both adaptation and mitigation actions are proposed under the SAPCC. The actions proposed under the action plan are prioritized as high, medium, and low based

on the degree of importance and barriers envisioned during its implementation. The proposed budgetary estimations for implementation of high priority action under the Climate Change Action Plan in different sectors are only a rough estimate. The total budget has been estimated at INR 67,394.10 million (6,739.41 crore) for a 5-year period. Parts of the Action Plan can be planned to be implemented based on the availability of resources of the departments and additional funds may have to be provided for certain activities. As the implementation activities make progress, the exact situation will be more easily visualized. The synopsis of the number of actions being proposed under each sector and the budget for the priority actions are as follows:

Sl No	Sector	No of high Priority Actions	Total No of Action Proposed	Indicative Budget (INR in Million)	
				Existing	Additional
1	Sustainable Energy mission	9	15	1,470.10	3,970.40
2	Enhanced Energy Efficiency	16	16	1,572.00	5,548.40
3	Sustainable Habitat	12	29	0.00	2188.50
4	Green India Mission	16	24	0.00	1276.00
5	Water Mission	11	24	0.00	45,676.00
6	Sustainable Agriculture	20	45	0.00	3,184.70
7	Disaster Management	10	21	0.00	223.50
8	Tourism	7	18	0.00	697.50
9	Health	8	22	0.00	1,047.00
10	Himalayan Mission	10	10	0.00	500.00
11	Strategic Knowledge	6	11	0.00	40.00
	<b>TOTAL</b>	<b>125</b>	<b>235</b>	<b>3,042.10</b>	<b>64,352.00</b>









# 1 Background

## 1.1. Introduction

The fifth assessment report of the Intergovernmental Panel on Climate Change has clearly established the evidences of variation in global climate parameters such as increase in global average air and ocean temperatures, widespread melting of snow-cover and ice and rise in global average sea level. As per the IPCC WGI Fifth Assessment Report (AR5) the earth has been witnessing radiative imbalance, with more energy from the sun entering than exiting through the top of the atmosphere, since at least circa 1970. It is virtually certain that Earth has gained substantial energy from 1971–2010. The estimated increase in energy inventory between 1971 and 2010 is 274 [196 to 351] x 10<sup>21</sup>J). The Global Mean Surface Temperature has increased since the late 19<sup>th</sup> century with the last three decades being comparatively warmer with the decade of 2000 being the warmest. The global combined land and ocean temperature data show an increase of about 0.89°C [0.69–1.08] over the period 1901–2012 and about 0.72°C [0.49–0.89]

over the period 1951–2012. Global mean sea level has risen by 0.19 [0.17 to 0.21] m, estimated from a linear trend over the period 1901–2010 with mean rate of sea level rise around 1.7 [1.5 to 1.9] mm/year between 1901 and 2010. Between 1993 and 2010, the rate was very likely higher at 3.2 [2.8 to 3.6] mm/year. Further to AR4, AR5 reveals that glacial changes have increased substantially in number. There is very high confidence that, during the last decade, most ice was lost from glaciers in Alaska, the Canadian Arctic and the periphery of the Greenland ice sheet, the Southern Andes and the Asian mountains. Total mass loss from all glaciers in the world, excluding those on the periphery of the ice sheets, was very likely 226 [91 to 361] Gt/year (sea-level equivalent 0.62 [0.25 to 0.99] mm /year)

A global scientific consensus with regard to the unequivocal nature of the climate change and its association with increasing concentration of greenhouse gas emissions is widely established. The change in climatic condition has manifested through alteration in frequency, intensity and spatial extent of

weather and climate extremes. The range of hydro meteorological events include heat waves, heavy precipitation, drought and tropical cyclones which have emerged as serious threats to both human and natural systems. Such climatic variability is likely to lead to extreme conditions or impacts. The impacts over economy or sustainable development are severe when the intensity of the event goes beyond a critical threshold in a social, ecological, or physical system, or through interplay with any other event.

Climate model projections indicate that global average temperature would increase with disproportionate increase in the tropics and poles and increased frequency and intensity of extreme events. South Asia is likely to be more vulnerable to climate change issues due to high population density, poverty and high dependence on natural resources. Climate projections for India suggest that impacts are likely to be varied and heterogeneous, with some regions experiencing more intense rainfall and flood risks while others might encounter sparse rainfall and prolonged droughts. A projected spatial shift in pattern of rainfall towards the flood-prone areas and drought towards water scarce regions are among the more severe effects. Climate variability and climate change pose huge risks to human life in India and threatens the sustainability of the economic growth. India's geographic diversity adds to the complexity of developing and implementing unified adaptation strategy. The impacts of climate change vary across states, sectors, locations and populations thus there can be no uniform climate change

strategy. The approaches need to be tailored to address the state specific issues and local vulnerabilities and conditions.

In June 2008, Government of India's (GoI) National Action Plan on Climate Change (NAPCC) was announced. The objective of NAPCC is to adopt and enhance ecological sustainability of India's development path. In August 2009, the Hon'ble Prime Minister of India urged each state Government to formulate its own state level action plan in line with the strategies of the National plan. This was re-emphasized by the Union Minister of State, Environment & Forests (MoEF), at the meeting of the Chief Secretaries in February 2010. The State Government of J&K has thereafter institutionalized a three tier State Council for formulation of the State Action Plan on Climate Change.

The state of J&K located in the northern part of the Indian sub-continent and sharing international border with Pakistan, Tibet and China has the most strategic locations among the states in the country. It falls in the great northwestern complex of the Himalayan Ranges with marked relief variation, snow-capped summits, antecedent drainage, complex geological structure and rich temperate flora and fauna. Irrespective of the ethereal beauty, majesty and grandeur, the ecosystem of the state is considered the most fragile on the earth. The lives and livelihood of the state are heavily dependent on the natural resources and climatic conditions. Agriculture and allied sectors including horticulture, floriculture, sericulture remains the mainstay of the state's economy followed

by tourism, mining and MSME sector. Apart from agriculture and allied activities, the economy and livelihood in the state is largely dependent on tourism sector. Owing to the dependency on natural resources and the weather condition, the livelihood of the people needs to be climate independent as far as possible.

The state economy is characterized by steady growth. However it is impossible to attain a sustainable economic development even with strong economic growth, revenue realization if social issues like poverty, unemployment and gender inequality are not properly addressed. In order to promote sustainable development and enhance the adaptive capacity as well as resilience of the social sector, the state Government has been emphasizing upon improving and strengthening livelihood status, healthcare facilities, disaster management, poverty alleviation, literacy and minimising gender inequalities. Moreover the State Government has also recognized that the climate change is detrimental to economic progress. Owing to its importance, Government of Jammu and Kashmir has committed to demonstrate continued leadership in this new and important area.

## 1.2 Objective

The main objective of State Action Plan on Climate Change (SAPCC) is to strategize adaptation and mitigation initiative towards emission stabilization and enhancement of ecosystem resilience, climate proofing of the livelihood sector and diversification of dependency on the natural resources. This

exercise would serve as a platform to forward the State climate change agenda which in future could be a combination of advocacy, knowledge deepening, policy analysis and operational work. However, there is also a need for encouraging public investment to make the State and community more climate resilient.

## 1.3 Methodology

Government of India has drafted the National Action Plan on Climate Change (NAPCC) to meet the challenge of sustaining economic growth in an ecologically sustainable manner as well as framing of adaptation strategies to manage the risk associated with extreme weather and climate change related events. In order to achieve the objectives of the NAPCC and link state's initiative for climate proofing life and livelihood of the vulnerable section of the society, Government of Jammu and Kashmir had constituted the J&K State Council on Climate Change on 25<sup>th</sup> of April 2011. The State Council on Climate Change is a three tier structure comprising of Governing Council headed by Hon'ble Chief Minister, Executive Council headed by the Chief Secretary and Expert Committee headed by the Director, Environment & Remote Sensing. The first meeting of the Expert Committee held on 9<sup>th</sup> August 2011 drew the road map of the SAPCC. Considering the issues related to the impacts of climate change on the ecologically sensitive as well as economically important sectors, ten missions were identified specific to the state and corresponding ten working groups were identified and sanctioned by the Government. While framing the council



and the working group, the membership was drawn both from the primary department and also from the different associated departments/ organizations. A nodal officer was appointed to co-ordinate the regular conduct of meetings, to collect/collate the required information and to develop the plans pertaining to each of the sectors.

### Sectors in J&K as mapped to National Missions

1. Energy - Solar Mission and Renewable Energy [directly linked to NAPCC mission]
2. Enhanced Energy Efficiency [directly linked to NAPCC mission]
3. Water [directly linked to NAPCC mission]
4. Sustainable Habitat [directly linked to NAPCC mission]
5. Sustainable Agriculture [directly linked to NAPCC Mission]
6. Tourism (indirectly linked to 3, 4 and 7)
7. Sustainable Himalayan Ecosystem [directly linked to NAPCC mission]
8. Health (indirectly linked to 3, 4) and NRHM
9. Disaster Management (indirectly linked to 5, 7 and 3)
10. Strategic Knowledge mission [directly linked to NAPCC mission]

A top down and bottom up approach was followed in developing the SAPCC. Consultations were carried out with members of working groups as well as with the administrative departments. Administrative heads were consulted recognizing the need for involvement of the senior bureaucracy within the government towards assessing climate change issues and mapping the solution. Tools and templates were formulated for listing climate change specific issues, prioritizing the activities as high, medium and low and developing an outline of the sub-activities to be taken up under the high priority activities, estimating the budget and sources of funding as well as formulation of the monitoring and verification protocol.

As part of the above exercise sectoral vulnerability was mapped and climate sensitive issues were identified. These were presented in course of assessment before the working group. A list of possible activities relevant in the climate change context were formulated and deliberated on. Stakeholders consultation workshop were also convened to obtain specific feedback in regard to climate change issues and possible actions to address the concern of anthropogenic emission of GHG into the atmosphere as well as climate proofing of the sectors. Recognizing that all activities are not equally important, a prioritization exercise was undertaken to divide the comprehensive list of activities into high, medium and low priority. Subsequent brainstorming exercise was undertaken for a sharper focus and to finalize 10-12 key priorities for immediate implementation under the five year plan

Figure 1: Sectors of J&K mapped to National Mission

period. Descriptions of the key priorities were developed, implementing organizations were identified and budgets were estimated. Additional funding requirement was assessed for actions that have linkage with existing programs. The brief of the proposed and the priority actions formulated was shared with external stakeholders from academics, civil societies and government agencies.

The purpose of the consultation was to make the climate change agenda inclusive, transparent and validated through ownership of the different stakeholders. Initially, the process started with involvement of administrative and technical groups within the government, but it was extended to

public to validate the proposed actions from the point of view of the wider interest group. giZ provided support for the planning process and engaged CTRAN to coordinate the inputs on behalf of the Government of J&K. The report tries to best capture the views of the stakeholders and put them together in an unbiased and professional manner. The team with the knowledge partner CTRAN, has tried to use the various frameworks of the National Climate Change Action Plan in the sub-national context encompassing vulnerability, resilience and climate governance to frame policies at the State level. Efforts were put to support climate change adaptation policies and manage the potential social risks associated with climate change mitigation.



The brief methodology adopted is presented as follows

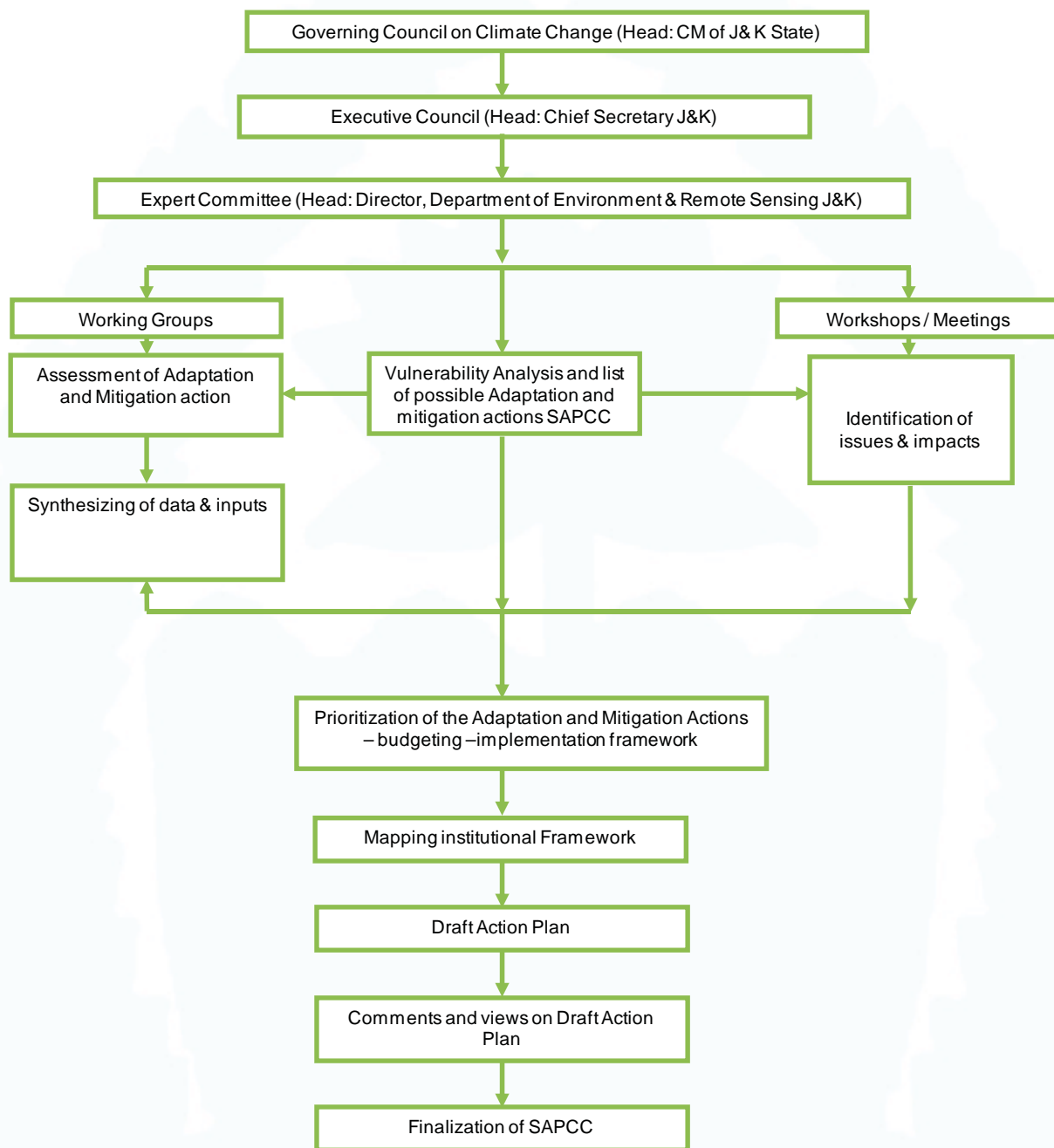


Figure 2: The process of formulation of SAPCC in J&K

## 1.4 Structure of the Report

- The SAPCC document begins with the background chapter introducing the context. The chapter provides an insight into the methodology and outlines the structure of the document.
- The second chapter gives an overview of the National Action Plan on Climate Change, eight missions and other initiatives.
- The third chapter describes the vulnerability assessment of the State



of Jammu and Kashmir and highlights climate sensitivity from both biophysical and socio economic perspectives.

- The fourth to fourteenth chapter highlight a detailed overview of the sectoral Climate Change Issues and describe actions including prioritized

ones to address the issues across all the ten sectors.

- The fifteenth chapter outlines the cross cutting issues.
- The final chapter provides the conclusions and recommendations.







## 2 National Action Plan on Climate Change

### 2.1 Introduction

National Action Plan on Climate Change emphasizes the overriding priority of maintaining high economic growth rates to raise the living standards. The NAPCC aligns the measures to promote development objectives with co-benefits for addressing climate change effectively. It also advocates strategies that promote, firstly, the adaptation to Climate Change and secondly, further enhancement of the ecological sustainability of India's development measures.

### 2.2 Domestic Actions

India's National Action Plan on Climate Change emphasizes on promoting inclusive and sustainable development strategy sensitive towards climate change so as to protect the poor and vulnerable section of the society. Eight National Missions form the core of the National Action Plan

representing multipronged, long term and integrated strategies for achieving key goals in the context of climate change. The focus is to promote understanding of Climate Change, framing adaptation and mitigation strategy and promoting energy efficiency and natural resource conservation. While many of these programmes are already a part of the current actions, the Action Plan seeks to enhance them in scope and effectiveness and implement them in an accelerated manner through time bound plans.

### 2.3 National Mission

The National Action Plan on Climate Change (NAPCC) outlines the existing and future policies and programs to implement climate related mitigation and adaptation measures. The plan identifies eight core 'National Missions' running through 2017. The various missions are presented in the following diagram.





*Figure 3: Eight fold mission under NAPCC*



The following table gives an overview of the Eight National Missions, the objectives and the responsible entity for the same:

*Table 1: National Mission on Climate Change its goal and link with development goal*

Mission	Goal	Link with Development Goal
<p>National Solar Mission</p> <p>Responsible Entity: MNRE</p>	<ul style="list-style-type: none"> <li>Enabling environment to deliver 20 GW of solar power by 2022</li> <li>Grid-connected solar power capacity of 1 GW by 2013</li> <li>Additional 3 GW through mandatory purchases backed with preferential tariff by 2017</li> <li>Favorable conditions for solar manufacturing capabilities</li> <li>Off-grid applications: 1 GW by 2017, 2 GW by 2022</li> <li>15 million m<sup>2</sup> solar thermal collector area by 2017 and 20 million m<sup>2</sup> by 2022</li> <li>20 million solar lighting systems for rural areas by 2022</li> </ul>	<p>Capacity addition of 16,553 MW hydro, 3380 MW nuclear (out of the total of 78,577 MW capacity addition)</p> <p>Ensuring electricity connection to all villages and below poverty line (BPL) households by 2009 and reliable power by the end of the plan [56% electrification rate (2000–05), 487.2 million population without electricity (2005)]</p> <p>20% rise in real wage rate of unskilled workers [Youth literacy rate of 76.4% (for ages 15–24)]</p> <p>Reduction in head-count ratio of consumption poverty by 10 percentage Points</p>
<p>National Mission for Enhanced Energy Efficiency</p> <p>Responsible Entity: Ministry of Power</p>	<ul style="list-style-type: none"> <li>Specific energy consumption (SEC) reduction targets for energy-intensive units</li> <li>Incentivizing action through Energy Savings Certificates (ESCerts) – traded and used for compliance</li> <li>National energy efficiency Clean development Mechanism(CDM) roadmap</li> <li>National energy efficiency financing platform</li> <li>Creating markets for energy efficient products and services</li> </ul>	<p>Increase energy efficiency by 20% by 2016/17</p>



Mission	Goal	Link with Development Goal
<p>National Mission for Sustainable Habitat</p> <p>Responsible Entity: Ministry of Urban Development</p>	<ul style="list-style-type: none"> <li>Increasing energy efficiency in buildings: building bye laws and standards, energy performance monitoring, national standards for construction and recycling of construction waste</li> <li>Urban transport: norms integrating congestion charges, parking, etc., norms for pedestrian and cycling, integrating transport planning with spatial planning</li> <li>Water supply: mandatory rainwater harvesting, water and energy audits</li> </ul>	<p>Develop minimum standards of education at elementary level, to ensure Quality</p> <p>To attain WHO quality of air standards in all major cities by 2011/12</p> <p>Provide homestead sites to all by 2012 and step up the pace of house construction for rural poor to cover all the poor by 2016/17</p>
<p>National Water Mission</p> <p>Responsible Entity: Ministry of Water Resources</p>	<ul style="list-style-type: none"> <li>Comprehensive water database in public domain and assessment of impact of climate change on water resources</li> <li>Promotion of citizen and State action for water conservation, augmentation and preservation</li> <li>Focused attention to vulnerable areas including over exploited areas</li> <li>Increasing water use efficiency by 20%</li> <li>Promotion of basin level integrated water resources management</li> </ul>	<p>Ensuring water security and food security (MDG 1: Eradicate extreme poverty and hunger) through efficient use of water and adaptation to climate change</p> <p>Ensure integrated water resources management (MDG 7: Ensure environmental sustainability)</p>
<p>National Mission for Sustaining the Himalayan Ecosystem</p> <p>Responsible Entity: Ministry of Science &amp; Technology</p>	<ul style="list-style-type: none"> <li>Continuous monitoring of Himalayan ecosystems</li> <li>Identification of desirable adaptation and development policies (sustainable urbanization, water security: rejuvenation of springs, infrastructure development: green roads)</li> </ul>	<p>Ensure all- weather road connection to all habitations with population 1,000 and above (500 and above in hilly and tribal areas) by 2009, and all significant habitations by 2015</p>
<p>National Mission for a Green India</p> <p>Responsible Entity: Ministry of Environment &amp; Forests</p>	<ul style="list-style-type: none"> <li>2 Mha of moderately dense forests</li> <li>4 Mha of degraded forests regenerated/afforested</li> <li>0.10 Mha of mangroves restored, 0.1 Mha wetlands conservation</li> <li>0.20 Mha urban/peri-urban forests, 1.50 Mha degraded land under agro-forestry</li> </ul>	<p>Increase forest and tree cover by 5 percentage points [22.8% of forest cover of the total land area with an annual change of 0.4% between 1990 and 2005]</p>

Mission	Goal	Link with Development Goal
National Mission for Sustainable Agriculture Responsible Entity: Ministry of Agriculture	<ul style="list-style-type: none"> <li>Use of genetic engineering to produce carbon responsive crops</li> <li>Low input sustainable agriculture: enhanced water use efficiency</li> <li>Micro-irrigation for efficient use of water</li> <li>Water conservation in rain-fed areas</li> </ul>	<p>Average GDP growth rate of 9% [between 1990 and 2005, 34.3% of population earning US \$1/day, while 80.4% earning US \$2/day]</p> <p>Agricultural GDP growth rate on average of 4%</p>
National Mission on Strategic Knowledge for Climate Change Responsible Entity: Ministry of Science & Technology	<ul style="list-style-type: none"> <li>Climate change research and fellowship programme</li> <li>Climate Change Professor Chairs</li> <li>National Research Chairs Climate Research Institute</li> <li>Network of climate change research institutes and scientists</li> </ul>	

Source: Planning Commission; UNDP (2007); NAPCC (2008)

The idea of a sub-national action plan emerged to address the local issues with high ownership. This would generate better awareness rising from experiences on climate related issues to corrective actions, better preparedness and also to set strategic priorities at the Sub-National level. These priorities would enable the leaders in the States to plan for the resources and also to monitor the savings in terms of long run cost associated with climate change.

## 2.4 Other Initiatives

Apart from eight fold National Missions, there have been several market based initiatives that have positive influence on mitigating the adverse impacts of climate change. These include

a. Establishment of market based instruments in sectors that have maximum influence on climate change viz. Perform Achieve and Trade for

energy efficiency, white certificates in renewable in energy sector, air pollutant trading in industry and mining sector and offset instruments in forestry sector such as compensatory afforestation.

- b. Encouraging Kyoto market instruments like Clean Development Mechanism (CDM).
- c. Other initiatives like Bio-Diversity Conservation, Wetland Management.
- d. Research & development in the area of designing efficient thermal power plants, promoting energy efficiency in transmission and distribution sector including adoption of high-voltage AC and high-voltage DC transmission to reduce technical losses, promoting small and large scale hydro power project, promotion of renewable energy technologies such as bio-mass combustion and gasification-based power generation and geothermal

based energy generation.

- e. Enhancements in the regulatory/tariff regimes to help mainstream renewable-based sources in the national power system and renewable energy technologies for transportation and industrial fuels.

## 2.5 National Mission and Objectives

### 2.5.1. National Solar Mission

The NAPCC aims to popularize the use of solar energy for power generation and other purposes over other fossil-based energy options. The plan includes:

- Specific goals for increasing use of solar thermal technologies in urban areas, industry and commercial establishments;
- A goal of increasing production of photo-voltaic power to 1000 MW/year;
- A goal of deploying at least 1000 MW of solar thermal power generation machineries.

Other objectives include the establishment of a solar research centre, increased international collaboration on technology development, strengthening domestic manufacturing capacity, and increased government funding and international support.

### 2.5.2. National Mission for Enhanced Energy Efficiency

Current initiatives are expected to yield savings of 10,000 MW by 2012. Through buildings adhering to the Energy Conservation Act 2001 which recommends:

- Mandating specific energy conservation options decreases consumption in large energy-consuming industries, with a system for companies to trade energy-savings certificates;
- Energy incentives, including reduced taxes on energy-efficient appliances;
- Financing for public-private partnerships to reduce energy consumption through demand-side management programs in the municipal, buildings and agricultural sectors.

### 2.5.3. National Mission on Sustainable Habitat

The National Mission on Sustainable habitat comprises of three components, viz.

- Promoting energy efficiency in the residential and commercial sectors
- Management of municipal solid waste and
- Promotion of urban public transport

To promote energy efficiency as a core component of urban planning, the plan calls for:

- Extending the existing Energy Conservation Building Code (ECBC);
- For addressing component 2 on management of municipal solid waste, a greater emphasis on urban

waste management and recycling, including power production from waste is envisaged;

- For addressing promotion of urban public transport the following are promoted:
  - o Strengthening the enforcement of automotive fuel economy standards and using pricing measures to encourage the purchase of fuel efficient vehicles;
  - o Incentives for the use of public transportation.

#### **2.5.4. National Water Mission**

Some of the major areas of intervention identified in the Water Mission are to increase efficiency of water use, to explore options to augment water supply in critical areas and to ensure more effective management of water resources. With water scarcity projected to increase as a result of climate change, the Mission sets a goal of a 20% improvement in water use efficiency through pricing and other measures.

#### **2.5.5. National Mission for Sustaining the Himalayan Ecosystem**

The Himalayan Ecosystem is vital to the ecological security of the Indian landmass, through supporting forest cover, feeding perennial rivers which are sources of drinking water, irrigation and hydropower, conserving biodiversity, providing a rich base for high value agriculture, and spectacular landscapes for sustainable tourism. Climate

change may adversely impact the Himalayan ecosystem through increased temperature, altered precipitation pattern, glacial melting and episodes of drought. The plan aims to conserve biodiversity, forest cover and other ecological values in the Himalayan region, where glaciers which are major sources of India's water supply are projected to recede as a result of global warming.

#### **2.5.6. National Mission for a Green India**

The Mission aims at addressing climate change by enhancing carbon sinks in sustainably managed forests and other ecosystems, enhancing the resilience and ability of vulnerable species/ecosystems to adapt to the changing climate, and enabling the adaptation of forest dependant local communities in the face of climatic variability. Goals include afforestation on 6 million hectares of degraded forest lands and expanding forest cover from 23% to 33% of India's territory.

#### **2.5.7. National Mission for Sustainable Agriculture**

The National Sustainable Agriculture Mission aims to focus on four areas crucial to agriculture for adapting to climate change, viz., dry land agriculture, risk management coupled with weather insurance, access to information and use of Biotechnology. The Mission aims to support climate adaptation in agriculture through the development of climate-resilient crops, expansion of weather insurance mechanisms and agricultural practices.

### 2.5.8. National Mission on Strategic Knowledge for Climate Change

To gain a better understanding of climate science, impacts and challenges, the plan envisions a new Climate Science Research Fund, improved climate modeling, and increased international collaboration. It also encourages private sector initiatives to develop adaptation and mitigation technologies through venture capital funds.

## 2.6 Mapping National Missions in the State

The following section maps the State missions according to the National Action Plan. Therefore it would have the following kind of linkages as detailed out in the table below:

Table 2: Relating State Mission under Climate Change and National Mission

National Mission	State Mission	Key Issues to be Addressed
Solar mission	Energy Mission	<ul style="list-style-type: none"> <li>Reduction of carbon foot print – Bringing about grid parity for solar PV and solar thermal technology including concentrator</li> <li>Address energy security</li> <li>R&amp;D collaboration, technology transfer and Capacity building</li> <li>Promotion of Renewable energy technology other than Solar</li> <li>Address issues of Energy Security – Electrification and issues of rural energy</li> <li>Green building and energy security</li> </ul>
Enhanced Energy Efficiency Mission	Enhanced Energy Efficiency Mission	<ul style="list-style-type: none"> <li>Energy efficiency in industrial (MSME sector) facilities, commercial, agricultural and residential sector ,</li> <li>Fuel switch (shifting of Diesel based decentralized power generation option to Renewable based power generation option and also addressing the issue of lowering T&amp;D losses</li> <li>Financial mechanism (ESCO)</li> <li>Renovation and modernization of existing hydro power project</li> </ul>
Sustainable habitat Mission	Sustainable Habitat mission	<ul style="list-style-type: none"> <li>Climate resilient urban planning</li> <li>Solid Waste Management</li> <li>Efficient public transport mechanism</li> </ul>



National Mission	State Mission	Key Issues to be Addressed
Water Mission	Water Mission	<ul style="list-style-type: none"> <li>Water management and water use efficiency</li> <li>Basin management</li> <li>Management and regulation of ground water</li> <li>Conservation of wetland</li> </ul>
Mission on Himalayan Ecosystem	Mission on Sustainable Himalayan Ecosystem	<ul style="list-style-type: none"> <li>Academic research on glacial flow, delta management, local variability</li> <li>Appropriate land use planning</li> </ul>
Green India Mission	Green India Mission	<ul style="list-style-type: none"> <li>Forestry, Bio-diversity conservation</li> <li>Livelihood promotions</li> </ul>
Sustainable Agriculture Mission	Mission on Sustainable Agriculture	<ul style="list-style-type: none"> <li>Develop new varieties of crops</li> <li>Flood resistant varieties and dry land agriculture</li> <li>Methane management from rice cultivation</li> <li>Soil and water conservation</li> <li>Promotion of Horticulture , Floriculture and Sericulture</li> <li>Climate proofing of the animal husbandry sector</li> </ul>
Strategic Knowledge for Climate Change	Strategic knowledge on climate change	<ul style="list-style-type: none"> <li>Enhanced research on Climate modeling</li> <li>Capacity building and awareness generation</li> </ul>
Cross Cutting	Tourism mission	<ul style="list-style-type: none"> <li>Climate proofing of the fragile and sensitive tourist destination</li> <li>Climate resilient planning</li> </ul>
	Health Mission	<ul style="list-style-type: none"> <li>Improving health infrastructure</li> <li>Early warning system of health related stress</li> <li>Reduce surface water contamination and prevention of water borne diseases</li> </ul>
	Disaster Risk management	<ul style="list-style-type: none"> <li>Disaster management planning and infrastructure development</li> <li>Awareness creation amongst the community on climate related vulnerability and preparedness</li> </ul>

Apart from eight national missions the State has proposed three separate missions under cross-cutting themes. Cross-sectoral working groups are formulated to improve the climate related governance so that the issues can be addressed in a holistic manner. The State has decided to focus on a comprehensive strategy for adaptation to climate change in different sectors and for mitigation the State would follow the national policy and no sectoral targets have been set as a part of the action plan. Inclusion of market mechanism like CDM, REDD+ will be a co-benefit.

## 2.7 Institutional Mechanism

The State Missions are to be implemented by the respective departments with support of the inter-sectoral groups. Appropriate

mechanisms including public private partnership and civil society actions, are to be devised, as suited, for effective achievement of each individual Mission's objectives. The State has proposed constitution of J&K Climate Change Cell which would act as a nodal entity to coordinate the climate change issue in a holistic manner.

The proposed institutional mechanism consists of the J&K State Council on Climate Change and Climate Change Cell. These bodies would coordinate among departments on cross cutting issues. It would also interpret the various national missions, objectives and the strategy in the context of the State. The body would forge partnership with private sector, academic institutions and civil society to facilitate the implementation of various proposed actions in the State.





## 3 Vulnerability Analysis

### 3.1 Introduction

Climate change has become the key environmental concern around the globe, and Governments, Non-Governmental Organizations, Environmentalists, Conservationists and Donors around the globe are focusing on this issue. Since the industrial revolution, the mean surface temperature of the Earth has increased by 10°C and temperatures are likely to rise, with serious consequences on biodiversity, natural ecosystems, agricultural productivity, food security and human livelihoods. In the context of India, especially Jammu and Kashmir, which nestles in fragile Himalayan Ecosystem; there are natural fluctuations in climate, human induced changes due to large scale urbanization in the valley driving the warming trend. The biodiversity loss and water stress owing to climate change are the greatest challenges for the state over the coming decades. Climate change poses a serious threat to the species diversity, habitats, forests, wildlife, fisheries and the water resources in the region. Many wetlands

in J&K that support 20% of the known range of biodiversity in the region are adversely affected. The climatic change resulting in changing weather movements are relatively unpredictable, but could be important in context of the primary incursion of different diseases like avian influenza. However, the Governments, local communities, NGOs, civil society, scientists and conservationists need to deliberate on the more important issues of the role that natural ecosystems, biodiversity and nature-based solutions can play in increasing resilience and reducing vulnerability to climate change.

The vulnerability and adaptive capacities are diverse and varies from state to state based on several sectoral and cross sectoral parameters. Sectoral parameters include key sectors of the state's economy and cross sectoral factors include (a) Poverty (b) inequality and social discrimination over property rights and (c) access to resources (d) social attrition/migration and (d) unequal and unsustainable competition for scarce natural resources.





Figure 4: Vulnerability Profiling

### 3.2 Climate Sensitivity

The district level data to compute climate change risk for J&K is not available. The map below describes relative vulnerability of the state spatially. Vulnerability map of Indian Subcontinent

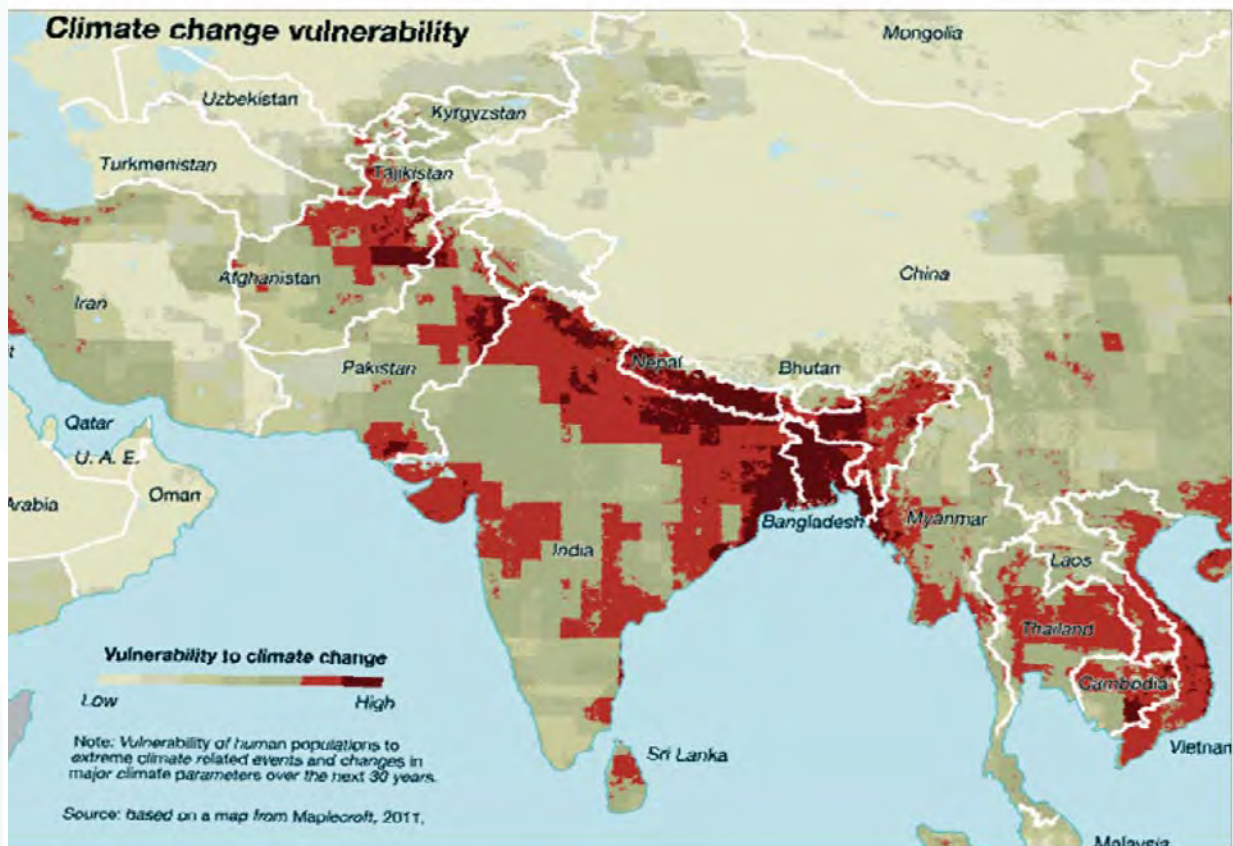


Figure 5: Vulnerability Map, spatially adjusted for the state, UNEP

From the above picture, it is clear that some parts of the state are having moderate to high vulnerability. A large part of the state are under seismic zone but that cannot be strictly linked to climate change.

Climate profile of J&K indicates variation in climate characteristic over the years. According to IMD<sup>1</sup>, there is increase in an average temperature in Jammu & Kashmir. Kashmir valley has shown rise of 1.45°C & Jammu region has shown a rise of 2.32°C over last two decades. Maximum temperature has increased by 0.5°C per year in Kashmir valley. In Jammu region, maximum temperature has risen by 0.08°C per year. Also amount of snow fall has reduced over the years. As per UNEP and ICIMOD, the temperature in Himalayan region has risen by 1°C since 1970s. This has caused meltdown of snow and glaciers at rate of 15 m/year even in winter. As a consequence, the water availability is reduced. Further, changes in the rainfall pattern and relative humidity add to weather inconsistencies which exist at the time of plantation and harvesting.

As per IPCC 2007, glacial melt is projected to increase flooding, snow avalanche fall from established slopes and diminishing water supplies and decrease in river flows as glaciers recede. The impact of change in climate shall be severe on natural resources and the environment associated with urbanization, industrialization and economic development. In the context of climate change scenario in J&K, it is pertinent to study the climate change projections in J&K.

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<sup>1</sup>IMD: India Meteorological Department, ministry of Earth Sciences, Govt. of India

Projection for Climate Change for Jammu and Kashmir is predicted on 4x4 report of The Indian Network for Climate Change Assessment (INCCA), 2010 covering the Indian Himalayas including Jammu and Kashmir. In this report, the future period 2021–2050 under SRES scenario A1B (atmospheric CO<sub>2</sub> concentration of 490 ppm by 2035) is considered. The mid-year for this future period is 2035, and hence assessment period is referred as the ‘2035’ scenario. It should be noted that scenario ‘2035’ does not represent the exact year 2035: rather, it refers to the climate averaged over 2021–2050. Comparison of the results of 2035 scenario with the ‘baseline’ scenario has been made, which represents the averaged observed climate over the period 1961–91. ‘Baseline’ is also referred to as either the ‘reference’ or ‘control’ case.

### 3.2.1 Precipitation

*The projections as per INCCA show the following:*

**Extreme precipitation:** The number of rainy days in the Himalayan region in 2030’s may increase by 5-10 days on an average, with an increase by more than 15 days in the eastern part of the Jammu and Kashmir region. The intensity of rain fall is likely to increase by 1-2 mm/day. This is likely to impact adversely some of the horticultural crops though rangelands and livestock are likely to benefit.

**Projection of Precipitation:** The PRECIS run



for 2030's indicate that annual rainfall in the Himalayan region is likely to increase in 2030's with respect to 1970's range from 5% to 13% with some areas of Jammu and Kashmir showing an increase of up to 50%. All seasons in the Himalayan regions would receive increased rainfall, with monsoon

months of June, July, August and September showing the maximum increase. The winter rain in the month of January and February are also projected to increase whereas minimum increase is indicated in October, November and December.



### 3.2.2 Temperature

The temperature variations have been shown in the table below:

Table 3: Temperature variation at Srinagar (°C)

Sl. No.	Month	1985	1990	1995	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1.	January	-1.3	-1.1	-4.7	-2.7	-3.2	-0.8	-2.0	-3.6	-2.8	-2.9	0.3	-0.3	-01.3	-02.5	-02.5	0.4	-01.5
2.	February	-1.3	1.5	-0.7	0.7	-0.8	2.2	-0.3	-0.3	-0.5	0.4	1.1	0.7	03.3	02.9	01.4	1.5	00.4
3.	March	4.7	2.5	3.4	4.9	4	4.6	2.9	3.2	4.5	3.7	5.6	5.3	04.7	03.0	05.3	5.0	06.5
4.	April	8.6	6.9	7.4	7.5	7.4	8.3	7.9	8.5	8.6	8.6	8.5	7.1	07.2	08.9	07.7	8.0	09.0
5.	May	10.9	11.9	10.5	10.0	9.6	11.4	13.2	14.5	11.3	9.1	10.7	9.9	13.3	11.9	11.5	10.8	11.1
6.	June	14.1	16.3	14.1	15.4	14.7	14.4	16.3	17.4	15.2	14.9	15.0	14.4	14.7	16.0	18.3	13.0	13.5
7.	July	19.1	18.5	18.7	17.8	20	18.4	18.7	19.5	17.1	18.9	16.9	18.0	19.3	17.8	19.1	16.9	17.7
8.	August	17.9	18.3	18.5	17.5	17.1	17.3	17.7	17.6	18.2	17.1	17.1	16.9	18.3	17.8	17.8	17.9	18.8
9.	September	12.5	14.1	11.4	13.8	13.8	14.5	11.3	11.2	11.6	13.6	12.6	13.7	12.3	13.3	11.3	11.9	13.3
10.	October	6.5	4.7	6.5	5.9	7.6	5.1	5.6	6.1	6.6	5.1	6.2	5.8	08.0	03.9	06.9	5.1	07.3
11.	November	0.3	0.3	-0.6	1.1	2.3	2.5	2.5	0.9	0.7	0.7	1.1	-0.02	03.5	-01.1	01.0	0.5	02.2
12.	December	-0.8	-1.7	-0.3	-3.1	0.5	-3.9	-0.7	-0.9	-0.8	0.0	-0.7	-0.03	00.0	-02.0	00.7	-0.8	-3.7

Source: Regional Meteorological Centre, Srinagar

### ***Projections of Surface Temperature***

The annual temperature is projected to increase from 0.9 +/- 0.6°C to 2.6 +/- 0.7°C in 2030. The net increase in temperatures ranges from 1.7°C to 2.2°C with respect to 1970's. Seasonal air temperatures show rise in all seasons. However, one simulation (Q1 simulation) shows a decrease by 2.6°C in October, November and December.

Summary of data on Climate Change and its impact indicate that since July (1901-1950), the maximum temperature in July (1976-96) has increased by 2-4°C. As per SASE report, Himalayan region has grown warmer by 2.2°C in last two decades. Between 1901 and 1996, rainfall has declined in Kashmir Valley. This has implication for change in cropping pattern and food security of the region.

### **3.2.3 Glacial Change and cold wave**

Trend analysis of change in glacial cover projects future scenario, though has not been well represented by PRECIS modelling. Glacial melting is likely to increase due to warming thereby leading to increased river flow during summer. According to IPCC, the increase in temperature by 0.74°C over 150

years have caused glaciers and snow cover to decline leading to reductions in melt water discharges.

### ***Glaciers in the context of Himalayan Region***

Major glacier-fed Himalayan rivers, along with glaciated catchments, have regional importance. The water from the glacial melt sustains stream flow in these rivers through the dry season. The 'frozen water' in the Himalayas is crucial for the people inhabiting the mountain areas as well as those inhabiting the downstream regions. The Indus and the Ganges— the two major rivers in western Himalayan region – directly impact the lives of a large population living in the northern part of India, and even beyond the national boundaries.

The Indus basin has 7,997 glaciers with a total glacier cover of 33,679 sq. km and total ice volume of 363.10 cu. km. The Ganges basin has 968 glaciers with a total glacier cover of 2,857 sq. km and total ice volume of 209.37 cu. km. The contribution of snow to the runoff of major rivers in the eastern Himalayas is about 10% but more than 60% in the western Himalayas. Major glaciers in Indus basin are given in table 4.



Table 4: Major glaciers in the Indus basin of India

Basin	No. of glaciers	Glacier covered Area (sq. km)	Ice volume (cu. km)
Ravi	172	193	8.04
Chenab	1,278	3,059	206.30
Jhelum	133	94	3.30
Beas	277	579	36.93
Sutlej	926	635	34.95
Upper Indus	1,796	8,370	73.58
Shyok	2,454	10,810	NA
Nubra	204	1,536	NA
Gilgit	535	8,240	NA
Kishenganga	222	163	NA
Total	7,997	33,679	363.10

Table 5: Characteristic of glacial coverage in the state is given below.

Glaciers (no.)	Area (sq. km)	Average Size (sq. km)	Glacier %
526	29163	10.24	61.8

The rate of recession of glaciers is reportedly variable which is being attributed to winter precipitation climate warming and anthropogenic elements of landscape. Recent trend related to glaciers are given in table below.

Table 6: Recent retreat pattern of selected glaciers in Jammu and Kashmir

Name of the Glacier	Retreat of snout (m)	Observation Period	Trend	Avg. retreat rate (m/year)
Drang-Drung	-	2004-07	No Change	-
Kangriz	-	1913-2007	No Change	-
	NA	1862-1909	Advancing Retreating	15.42
	--do--	1909-1929	Retreating No	2.50
	--do--	1929-1958	Change Retreating	14.00
	- NA	1958-1985	No change	-
	-	1985-2004		3.00
		2004-2005		-

### ***Observed changes in glaciers in Jammu and Kashmir***

Studies conducted during last three decades by the National Institute of Hydrology, Roorkee, reveal that in Ladakh, Zaskar and the Great Himalayan ranges of Jammu and Kashmir are generally receding, and the glacier volume change ranges between 3.6% and 97%, with the majority of glaciers showing a degradation of 17%–25%. The 23 km long Drang- Drung glacier in the Zaskar valley is highly affected by western disturbances (ablation rate variations between 0.75 cm/day and 2.67 m/ day during July and August). The studies, however, do not reveal any significant retreat during 2004–07.

The Nubra valley of Jammu and Kashmir has 114 small-sized glaciers varying between less than 5 km and 10 km in length. The glaciers of the valley do not show much change in their length and area during the period 1989–2001. However, variable decline in the glacial area of the Siachin glacier has been observed. The area has reduced from 994.99 sq. km in 1969 to 932.90 sq. km in 1989. However, small change in the area (932.90 sq. km to 930 sq. km) has been noticed during the decade of 1989–2001. Recession patterns of 466 glaciers in the Chenab, Parbati and Baspa basins of the western Himalayas have been studied for the period 1962–2008. Here, a reduction in the glacial area from 2,077 sq. km to 1,628 sq. km and an overall de-glaciation of 21% has been observed.

Most of the glaciers in western Himalayas are receding (except a few in Jammu and Kashmir, which do not show any change or are advancing). The processes controlling the rate of retreat of glaciers are complex and vary with location and topography of the area. However, the impact of rising temperature and reducing snowfall on glacier mass balance is reflected in these findings, which may require a sound long-term database for precise climate change assessment.

Further, quantity of snow fall has reduced (reported 0.60 m of snow today as compared to 3 m 40 years back in Fakir Gujri). Total loss in extent of glaciers is reported to be 17.8 sq. km between 1911 and 2001. For example, reported retreats in Kolhai glacier from 112 sq. km to 94 sq. km between 1911 and 2004. Large glaciers are fragmented and small ones have diminished e.g. more or less disappearance of Nijwan Akal glacier in Sindh valley, change in maximum and minimum rainfall in Kashmir valley (Minimum has fallen from 181 mm to 84 mm and maximum from 65.89 mm to 21.7 mm between 1901 to 1994); extent of wetlands also decreased between 1911 & 2004.

### **3.3 Vulnerability of agriculture and allied activities due to climate sensitivity**

Temperature, precipitation and cold wave significantly impact the agricultural sector and enhances its vulnerability. This happens due to the early onset of rain or increased



number of dry days. The valley has been receiving less amount of rainfall.

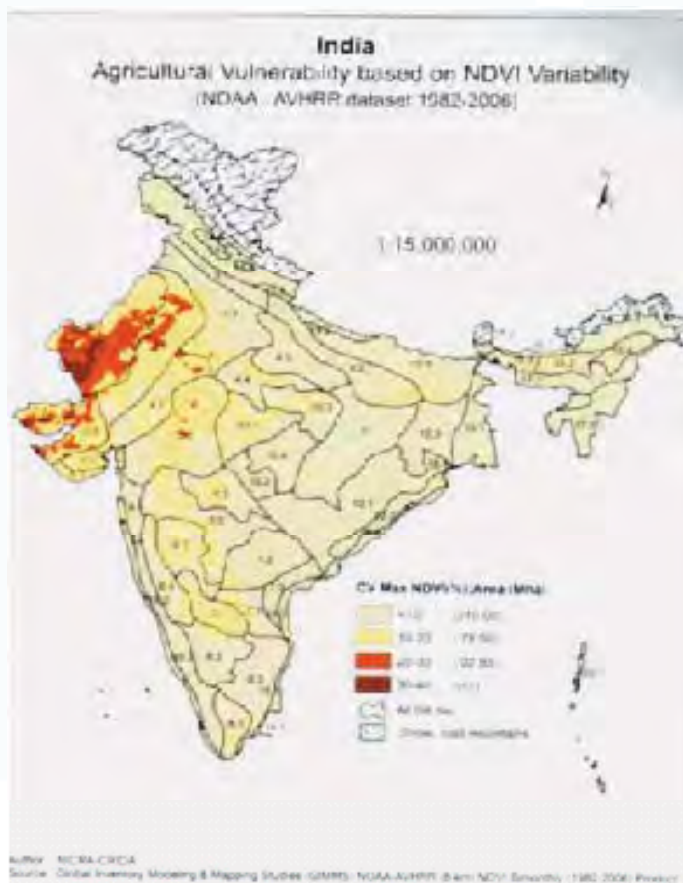
**Agriculture and Allied Crop Production practices in the Himalayan region**

In western Himalaya, the traditional farming operation is a complex product of crop husbandry, animal husbandry and forest resources constituting interlinked diversified production systems. However, with changing land use, the area under cultivation for many traditional crops has been reduced and some others are on the verge of extinction. Deficit in food production is rampant in recent times in Jammu & Kashmir. With reduction in rainfall, the rain-fed agriculture will suffer the most. Horticultural crops like apple are also showing decline in production and a real coverage particularly due to decline in snowfall.

**Thermal stress effects on livestock productivity**

The THI changes in three distinct areas of the Himalayan region has been analyzed for the months of January, February, March, May, June and July. The regions defined for this analysis include Jammu & Kashmir, Himachal Pradesh and Uttaranchal in the Himalayan region. The analysis for the baseline period and the 2030 scenario has predicted an increase in THI in many parts of Himalayan region between March-September with a maximum rise between April- July. In the Himalayan region for 2030 scenario, thermal discomfort is likely to increase with THI > 80 than the baseline scenario, thereby indicating that in 2030's, most places in this region are likely to remain under high temperature stress as compared to the baseline period.

Figure 6: Agricultural Vulnerability based on NDVI variability



The climate change indicators represent environmental conditions and increase our understanding of the cause and effects of climate change and act as tools for evaluating on-going and future development programmes. Some of these indicators include: (a) Increase in average temperature regime in State (b) Shift in rainfall pattern & deficit snow fall (c) Decrease in water levels of rivers and streams (d) Reduced snow fall as a result of heat-trapping gases (e) Drying up of springs & reduction in the flows (f) Shift in snow fall timing (e.g. February & March winters receive heavy snowfall whereas December & January, the usual snow time receiving less snowfall (g) Reported decline in glacial area in Chenab basin e.g. glacial area has reduced from 1 sq.km to 0.3 sq.km between 1962 – 2004 (h) Rising temperature & flash floods (i) Altitudinal movement of temperature sensitive plant species.

Plant species responding to high temperature would grow at higher altitudes e.g. red algal bloom increased in Dal Lake due to water temperature rise.

## 3.4 Bio-Physical Factors

### 3.4.1 Forest

Indian Institute of Science has conducted an

assessment of the impact of climate change on forest ecosystems in India. A dynamic vegetation model IBIS (Integrated Biosphere Simulator) was used to assess the impacts of climate change on forests in India. The study indicates that about 39% and 34% of the forested grids are likely to undergo shifts in vegetation type under A2 and B2 climate scenarios, respectively with a trend of increased existence of the wetter forest types.

Approximately 47% and 42% of tropical dry deciduous grids are projected to undergo shifts under A2 and B2 scenarios respectively, as opposed to less than 16% grids comprising of tropical wet evergreen forests. Similarly, the tropical thorny scrub forest is projected to undergo shifts in majority of forested grids under A2 (more than 80%) as well as B2 scenarios (50% of grids). According to another study, projected impacts of climate change, using a moderate A1B scenario and IBIS vegetation model for the period of 2030 -2080 are projected in figure 3.3 and 3.4, which show the impacts on current forested locations in India. The figure shows that Jammu and Kashmir is projected to undergo vegetation change in both A1B (2035 and 2085) scenarios.



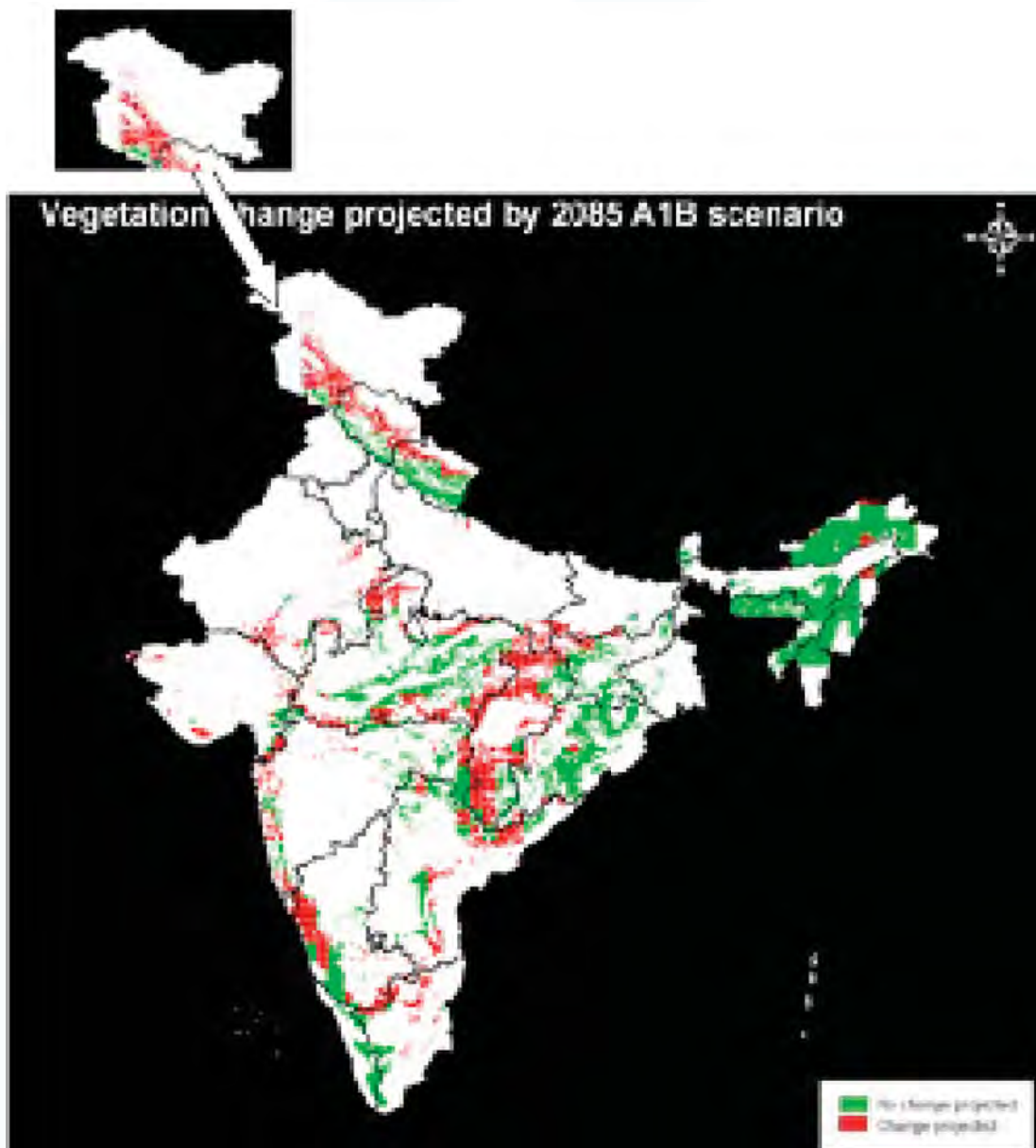


Figure 7: All forested grids in India

All forested grids in India are shown in color (red or green): red indicates that a change in vegetation is projected in that grid during the time-period of 2021-2050, and green indicates that no change in vegetation is projected by that period.

**Impact of climate change on forests**

The impact is assessed with respect to the potential shift in vegetation types or Plant

Functional Types and changes in NPP. An Indian Institute of Science (IIS) study, this region is defined by forests that lie in the States of Jammu and Kashmir, Himachal Pradesh and Uttarakhand. Much of the dense forests of these areas are part of the Himalayan biodiversity hotspot as defined by Conservation International. The entire Himalayan region is covered by 98 IBIS grids, out of which 55 (56%) are projected to undergo change. Thus, over half of the



forests are likely to be adversely impacted in the Himalayan region by 2030's. NPP is projected to increase in the region by about 57% on an average by 2030's.

### 3.5 Soil Water Regime

#### *The Hydrologic Simulation with Climate Change Scenario in 2030s*

The Himalayan region is mainly fed by the Indus river system. The whole area exhibits an increase in the precipitation in the 2030s scenario. The increase varies between 5% - 20% in most areas, with some areas of Jammu and Kashmir and Uttarakhand showing an increase up to 50%. The impact of the increase in precipitation in this region is reflected in an almost similar pattern of increase in the evapotranspiration (ET). This is expected to happen presumably on account of (a) the increase in the amount of moisture in the soil and land surface and (b) the increase in temperature.

Both these factors enhance the opportunity for ET. The water yield, which is the total surface runoff, is usually a function of precipitation and its distribution. The other factors that influence water yield are the soil profile and land use in the area. It may be noted that for the Himalayan region there has been a general increase in the water yield for the 2030s scenario. However, it may be noticed that the increase in the water yield is more for those areas where the increase in ET is less. The increase in water yield has been up to around 50% for some areas of Indus River for the 2030s.

The general impact of increase in the

precipitation is reflected in the increase in sediment yield. This is quite evident in the Himalayan region as well. The other major factors that dictate sediment yield are the intensity of rainfall, land use and the soil type of the area. The increase in the sediment yield in the Himalayan region is up to 25%, which can be detrimental for the existing water resources projects and has the potential to cause considerable damage to the environment.

#### *Aquatic ecosystems*

Aquatic ecosystems have played an important role in the socio-cultural system of the State. The economy of many people is dependent on these systems as they provide livelihoods to boatmen, agriculturists, tourism industry, etc. The aquatic systems in the State are however, confined to only approximately 0.8% of the total land mass, yet they have a tremendous impact on the lives of the people. The State also depends mainly on hydel power generation. The main aquatic systems found in the State are:

- a) Low altitude lakes which are fresh water and high in productivity. These are mainly found in the Jammu region.
- b) Valley Lakes: The valley abounds in lakes of varying sizes and shapes. These are all fresh water bodies.
- c) **Forest Lakes:** Found within the hills, these lakes are small as compared to the valley lakes.
- d) **Glacial Lakes:** These are high altitude lakes and are found in and above the alpine areas.



### ***Pressures/ Threats to Aquatic eco-systems***

1. **Encroachments:** This has been the main threat to lacustrine systems of the valley with the two major lakes i.e. the Wular Lake and the Dal Lake shrinking to approximately half their size in the last 50 years or so. Encroachments along the Wular Lake are mainly from expansion in arable fields for paddy whereas those within the Dal Lake are for housing and vegetation purpose. The Dal Lake traditionally has floating gardens (made from dug up weeds from the lake) along its north-western edge. These have increased in size and extent and the older ones have been reclaimed to build permanent settlements. A direct consequence of encroachment into the lake has led to degradation of the Aanchar Lake on the north-western part of Srinagar city. A major part of this lake is now a residential colony and the remaining portion is a swamp. This lake, a few years ago used to provide a major supply of reeds to Kashmir vally for making mats and also lotus stems (*Nelumbo* sp.) used as food during winters. This supply has now dried up.
2. **Pollution:** Three main sources of pollution to the water bodies of the State are identified as:
  - a. **Solid waste:** non-degradable materials like polythene and plastics which are dumped into the lakes and rivers by the local people.
  - b. **Organic pollutants:** Most of the human habitations are settled

around the water bodies, i.e. the rivers and the lakes. They become the main channel to carry the organic wastes and night soil from the city and villages. Mushrooming of hotels around the famous Dal Lake also discharge the night soil produced from these, in absence of a proper drainage (sewage) system. The houseboats also have contributed the organic pollution of the Dal Lake by discharging organic effluents directly into the lake.

- c. **Inorganic pollutants:** The chemical fertilisers and pesticides used by agricultural farmers around the Dal and Wular Lake seep into the water. This has caused a build-up of inorganic pollutants and other heavy metals, injurious to the life forms in the lake. Aspects of bio-magnification have not been studied but could be a major cause of concern.

All these have been a cause of Eutrophication, especially of the lakes which are enclosed and have a weak water flow.

3. **Siltation:** Degradation of catchment areas of the lakes and water-bodies have brought down large sediment loads into the river and lake systems causing an appreciable increase in the quantity of suspended particulate matter. The water bodies lose transparency which may cause changes in the biota. Heavy particulate matter also causes siltation and subsequent choking of lakes and

rivers. The Jhelum River is a case in point where the depth of the river is barely a few inches at certain points.

- 4. Increased Resource Extraction:** The water bodies have provided many resources to the people of the State. In addition to the vegetable growth in the lakes, the water bodies also provide large stocks of lotus stem and water chestnut. The lakes also provide reeds for making mats. In addition to this, fish abound in the water systems of the State which provides cheap protein. However, over exploitation of these resources, especially fish resources have caused major decline in fish yields.

## 3.6 Socio-economic factors contributing to the vulnerability

### 3.6.1 Economic growth

Latest 2001 census reveals that the population of Jammu and Kashmir is 10,069,917 which is about 0.98% of India's population. The population growth rate in the state has been consistently high and during 1981-2001 it was more than 2% p.a. Its geographical area is 222,236 sq. km., with a share of 6.76% of the country's total size. About 54% of the population in the state is literate, as against the national literacy rate of 65.38%. The age structure of the population indicates a high dependency ratio both in the 1971 and 1981 census. The trend in the development of Jammu and Kashmir is not so encouraging. It has been lagging behind most of the major states in regard to the

growth of Net State Domestic Product (NSDP) at current prices. The average annual growth of NSDP at current prices during 1980-81 to 1999-2000 was 12.45% for Jammu and Kashmir against 15.01%, 14.28%, 13.83% and 14.3% for Andhra Pradesh, Gujarat, West Bengal and Kerala respectively. In the case of the growth of Per Capita NSDP at current prices also, the state of Jammu and Kashmir was lagging behind most Indian States. The average annual growth of Per Capita NSDP at current prices during 1980-2000 was estimated as 9.63% for Jammu and Kashmir against 12.9%, 11.63%, 11.63%, and 12.86% for Andhra Pradesh, Gujarat, West Bengal and Kerala respectively.

### *Impediments to growth in J&K*

The slow growth of the state of Jammu and Kashmir can be attributed to various factors. Armed militancy in Kashmir during the past decade has been a major factor. Low productivity in agriculture and allied sectors has impeded employment and income generation. Poor industrial infrastructure along with the poor investment climate has left the industrial sector dormant.

### 3.6.2 Poverty and Hunger

Though the growth figures are not robust, the state has emerged in terms of poverty alleviation. Food related vulnerability is not as high as compared to some other Indian states. Official data suggests that indeed levels of poverty are negligible in the valley. As compared with 28.3% people officially estimated to survive below the poverty line in India in the year 2004-05, the comparable ratio for the state of Jammu and Kashmir in

the same year was pegged by the Planning Commission at a meagre 4.5%. Kashmir is one of the most egalitarian societies in the country, in which land reforms were implemented with greater vigor than in most regions of India. In the first decade after India's Independence, big farms were abolished resolutely, and subsequently surplus lands were distributed among landless farmers.

of which are imported into the state from the rest of India. These crises of livelihoods have been aggravated by the collapse of the carpet weaving industry, and setbacks to tourism. The per capita income of the state is only two thirds of the national average, at Rs. 17,174 against Rs. 25,907 in India taken as a whole. Its unemployment rate is 4.21%, against a national rate of 3.09%.

Table 7: Estimates of Poverty of J&K

Year	Poverty Line (I)\$		Poverty Ratio (%)\$\$			Population BPL (in millions) \$\$\$		
	Rural	Urban	Rural	Urban	Combined	Rural	Urban	Combined
1973-74	46.60	NA	45.51	21.32	40.83	NA	NA	NA
1977-78	NA	NA	42.86	23.71	38.97	NA	NA	NA
1983	91.80	99.62	26.04	17.76	24.24	1.311	0.249	1.560
1987-88	NA	NA	25.70	17.47	23.82	NA	NA	NA
1993-94	213.83	253.61	30.34	9.18	25.17	1.905	0.186	2.092
1999-00	367.45	420.20	3.97	1.98	3.48	0.297	0.0049	0.346

### 3.6.3 Livelihood scenario and extreme weather events

A careful examination of the disaggregated official data also suggests that although overall ratios of poverty are much lower in Jammu and Kashmir than in the rest of India, the state lags behind many others in several specific indicators of poverty. This is a predominantly agrarian economy, in which 80% of the population of the state is dependent on agriculture directly or indirectly. 97% of the cultivators are small or marginal farmers, with average land holdings as small as 0.7 hectares. There has been a worrying deceleration of agricultural production in the state. The valley suffers from a 44% deficit in food grain production, 33% in vegetables and 69% in oilseeds, all

In recent years, the state has seen large scale migration to cities and resource congestion and pollution has increased significantly. Coupled with this fact, there are a large number of people moving out of hill agriculture affecting the ecological balance in the region. Especially, the Leh region has rapidly changed in last few years. The growing numbers of tourists has led many in Ladakh to abandon agriculture and move to the city for tourism-related businesses. The rapid urbanisation is also leading to overcrowding with an influx of migrant workers. Day-to-day life has been impacted as young Zahakis increasingly adopting new and mainstream ideas of development. Local elders are concerned that these changes are resulting in the breakdown of their traditional value system and an abandonment of

the longstanding ecological approach and indigenous wisdom. The negative impact of these changes has become more apparent in recent times. Two severe flash floods, a phenomenon uncommon for the region, devastated Leh in 2006 and 2010. The damage was exacerbated by the overcrowding and encroachment on water channels. At the same time, Ladakh has been witnessing a fast depletion of glaciers and snow cover, erratic water supply in the glacier fed streams, warmer temperatures, and new pest species that often destroy annual yields. These new realities have left Zaskhis increasingly insecure and uncertain about their future. Changes are happening at multiple levels and at a rate faster than can be managed and understood. According to scientists at the Indian Institute of Tropical Meteorology at Pune, the August 2010 flood phenomenon in Ladakh is due to the impact of global warming. With higher average temperatures in high regions, monsoon winds have reached Leh. Geologists of Kashmir University have also identified human folly as a factor. Unplanned urbanization and drainage congestion leads to such disasters.

The problem in Ladakh is unique as it is a high altitude cold desert. Traditional material of sun-baked mud bricks is ecologically sound in one fundamental aspect. In winter with sub-zero temperature, it keeps the interior warm. Over the years, cement has come in use which freezes the interior in winter. Much more heat and energy is needed to keep it warm inside. With change in rain pattern to rain, new material has to be used with a design that can bear rain and also help in heating

the interiors. Getting the right material at affordable prices is the new challenge.

Similarly, earthquake and flood in northern and north western parts of Kashmir caused significant devastation. The economic was remittance and border trade decline, collapse of traditional routes and nallas and security related restrictions enhanced the vulnerability of the affected population in both 2005-06 and 2010.

### 3.6.4 Human Development

Economic Survey of J&K 2010, mentioned that more than 42% population of Scheduled Tribes, majority of them Gujjars and Bakerwals, live below poverty line in the state and are highly vulnerable to climate change. A study by Mr Harsh Mander also highlights the vulnerability in the region due to food deficit. Given that this is a food deficit state, the contribution of the Public Distribution System (PDS) to food security of Kashmir cannot be understated. The researchers found functioning ration shops even in the deep interior, and less than 4% people did not have ration cards. Most reported that they were able to access subsidized grains, even if sporadically. But the shops are opened only for one or two days in a month, and if they miss their chance, their share of food grains, and are presumably sold in the black-market. The study found gaps in the opening of ICDS centers in some remote locations, but the supply of hot cooked food to children was poor. However, in most locations, the centers functioned as little more than feeding points. Children were not weighed, and malnourished



children were not identified or treated. Few centers run pre-school classes, and expecting mothers are not examined or advised about proper nutrition. 98% children reported that they ate hot cooked meals at school, although there are months in which the meals are not served due to lack of supply.

The scenario gets worse in some northern and northwestern areas in Greater Kashmir region, where poor land man ratio, feudal system society and poor outreach of the public services due to the armed conflict in the region have made the population highly vulnerable. Even the livelihood programmes proposed under National Rural Livelihood Mission for the state that is supposed to cover all the villages can hardly benefit these areas.

### 3.6.5 Impacts of climate change on human health

The impacts of climate change on health have been deduced in quantitative as well as qualitative terms. The quantitative aspects that have been studied are only for the transmission of malaria in the 2030s. The transmission windows have been determined in terms of (a) temperature only and (b) temperature plus the relative humidity requirements for transmission.

Based on minimum required temperature for transmission of malaria, a district-wise map of India was generated to show the distribution of different categories of transmission windows under baseline and by the year 2030s. The climate projections for

2030s are derived from the PRECIS, regional model developed by the Hadley centre and forced by the GHG emission scenarios arising out of the IPCC defined A1B socio-economic scenario for the future. The transmission windows in some parts of the Himalayan region i.e. Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh however, continue to have only 0-2 months open for transmission even in the 2030's.

**Himalayan region:** The increase in temperatures may lead to increasing morbidity due to heat stress. Flash floods due to Glacial Lake Outburst Floods (GLOF) may lead to large scale landslides and affect food security and hence nutritional health.

It is important to note that the entire region of Jammu & Kashmir is eco-sensitive and contiguous and any development to adapt to climate change requires a holistic approach rather than piecemeal and regional basis. Ultimately the vulnerability of the ecosystem will affect not only the nomads, rare faunas and flora in the region but also every life form in the region. The region is in seismic zone, several areas are flood prone and the Indus water treaty many times poses developmental challenge to the valley. Similarly, geo-strategic issues with the neighboring countries like Pakistan and China initiates much developmental trade-offs for strategic region that may not be ecologically sustainable.

***Some tentative conclusions are:***

- (a) There have been extreme weather events in North Pakistan, Jammu and Kashmir and even parts of the high altitude region of Himachal Pradesh. The need is to study this phenomenon to better understand the science of climate change as its impacts the region.
- (b) Adaptation to extreme weather events must be done in a scientific manner. Local governments, non-governmental organizations and the people must be empowered with resources. Local solutions may provide best answers. Documentation and mainstreaming of indigenous practices that is highly climate resilient need to be taken up for the region.
- (c) Study and understanding of relationship of trees with rainfall needs immediate attention. The phenomenon could well be due to global warming and climate change. Local narratives, though anecdotal, must be merged to get a scientific picture from the bottom. Relying on computer simulation may not be enough.
- (d) The observed data in the region is rather limited which makes planning and district level vulnerability assessment quite difficult and extent of exposure needs to be estimated to compute the index.
- (e) The emission and pollution index for major cities need to be computed to estimate the extent of vulnerability.
- (f) Drainage congestion due to urbanisation must not be allowed to happen. Infrastructure building must be given priority to build resilience. The design and material of building should be such so as to cater for expected rain in future. Scientists, architects and construction engineers in India must rise to the occasion to suggest the most cost effective architecture. Climate resilient building (GRIHA/IGBC) standard may be incorporated in the building codes and development regulation.









## 4 Sustainable Energy Mission

### 4.1 Introduction

Energy is a vital component for sustained economic growth and the energy mix is an indicator of sustainable development of a State and the country. Also proportionate growth in power sector is essential to maintain the economic growth. With enhanced modernization, industrialization and change in life style; the energy demand has increased several folds in across the last decade. Energy demand across the country is met primarily through conventional energy resources which not only raises the concern on energy security but also results in increased accumulation of green-house gas in the atmosphere. As per IPCC Fifth Assessment Report Green House Gas emissions resulting from provision of energy services have contributed significantly to the phenomenal increase in atmospheric concentration of Green House Gas concentration. Thus, the States with high dependency on conventional energy sources for meeting the energy demand contribute significantly to environmental degradation.

Through, the demand for energy to meet economic development exists, a strategy should be developed towards lowering the Green House Gas emissions from the energy system besides satisfying the global demand for energy services. Increasing the share of renewable sources in the existing energy generation mix is assessed as the best possible option towards meeting the global energy supply challenge.

The action plan proposed under State energy mission while catering to the objective of national solar mission aimed at enabling communities to understand the uncertainty of future climatic conditions and engage them effectively in a process of developing adaptation and mitigation programmes. The Climate Change Action Plan for solar & renewable energy technology is strategized in line with the National Action Plan on Climate Change with objectives of meeting the country's development goals while simultaneously yielding co-benefits to address climate change effects.

The social, cultural, economic and other developmental aspects of any region are

influenced by climate. The State of Jammu & Kashmir has a diverse physiographical characteristic and climatic condition ranging from extreme hot zones/areas to snow-capped hills to cold arid deserts. With the presence of several glaciers; hilly and rugged topography of the land and extensive network of canals and streams the State has immense potential for mini, micro and small hydro projects.

The State is currently focused on generation through big hydro power project. Potential of micro hydel power and Solar are increasingly being tapped. Grid electricity penetration in remote hilly areas of J&K is techno-economically unviable by virtue of geographical disadvantages and

scattered household pattern. Moreover, the power sector of the State is already facing difficulties like slow rate of capacity addition, poor power evacuation facility, high AT&C losses and mismatch in load profile. Power utilization mix is not commensurate with the State's climatic conditions. Promotion and utilization of renewable energy is the most feasible solution which would also promote low carbon growth and can meet the decentralized energy requirement of the remote locations.

The State population has increased by 23.71% in the period of 2001- 2011. Interestingly the urban population has increased at a rate of 27.21% in the same period which has certainly increased the energy demand.

*Table 8: population distribution of Jammu & Kashmir*

Sl. No	State	Population 2011	Percentage decadal growth rate	Population density per sq. km.	
		Total	2001-2011	2001	2011
1	Rural	91,34,820	19.77	100	124
2	Urban	34,14,106	35.66		
	Total	125,48,926	23.71		

*Source: Digest of Statistics for 2010 -11, Directorate of Economics & Statistics, Govt. of J&K*



The power available in 2011-12 from all sources was able to satisfy only 64% of total power demand of the State. Due to the shortfall of 6,231.74 million units during 2011-12, the State faced problems of frequent power cuts for 8-10 hours a day which has a detrimental effect on the growth potential of the State. To meet its power demand of 17,323.00 million units during 2011-12, the State has procured 66.76% of its total power supplied (i.e. 11,091.26 million units) from the NEWNE grid which is highly fossil fuel dominated.

## 4.2 Key Trends in the sector

The State is largely dependent on the power generated from hydropower projects and thermal power plants besides supplements from DG set. Jammu & Kashmir has a total power generation capacity of 2,648.46 MW under central and State sector. The State is heavily relying on power purchase from the NEWNE grid and thermal power generation units and gas and diesel based power units during winters when its own hydro power generation reduces and power demand rises. The State is facing power crisis owing to untapped renewable energy, high rate of AT&C losses including pilferage.

*Table 9: Electricity Demand in the State*

Peak Power Demand	2,500 MW
Peak Power Met	1788.9 MW
Energy Requirement	17,323.00 Million units

Source: [http://www.jandkplanning.com/index.php?option=com\\_content&view=article&id=2307&Itemid=295&lang=en](http://www.jandkplanning.com/index.php?option=com_content&view=article&id=2307&Itemid=295&lang=en)

Out of total power demand of 17,323 million units, power generation from the State owned power houses is only 2,562.723 million units. Bulk of electricity consumption in the State is by the domestic sector. With modernization and increased urbanization, per capita energy consumption of the State has increased from 849.98 kWh in 2010-11 to 882.82 kWh in 2011-12. The energy demand has gradually increased during last five years at an annual rate of 5 to 6%. According to the sixteenth All India Power Survey, the power requirement of the State is expected to reach 19,500 million units during 2020-21.

In addition to in-sufficient power generation capacity of the State, high transmission and distribution losses of 61.61% and loss due to collection inefficiency accumulating to 72.68% of total power demand as AT & C loss adds to the power crisis.

The State of J&K has vast hydro potential estimated at 20,000 MW out of which only 16,480 MW is identified till date mainly due to resource constraints. Approximately, 15% of total identified hydro power potential i.e. 2,457.96 MW has been exploited so far; out of which the States sector projects is only 760.46 MW.

The primary sources of cooking fuel in rural areas of Jammu & Kashmir are firewood and chips followed by LPG. Urban cooking fuel demand is mainly met through LPG. Electricity is the main energy source for urban lighting. The scenario is same in the rural areas too; kerosene is being seldom used as an alternative. Although the State is fairly electrified with 97% of villages lit, but



providing continuous power at cheaper rate is difficult.

### 4.3 Vulnerability of the sector

Climate change can adversely impact water resources and other sectors of the State. The source of water is mainly summer and monsoon precipitation and melting of the large reserve of snow and glaciers in the Himalayan region. The high rate of warming will result in rapid shrinking of majority of glaciers in Himalayan range. Formation, growth and likely outburst of glacial lake are directly related to climate change and deglaciation.

Strategies for linking climate change and energy sector are usually centered on mitigation efforts as, the prevalent fossil fuel based energy generation methods contribute to climate change in a big way. Developing options for low carbon growth and reducing carbon footprint are important to limit the degree of future climate change.

Energy and water sector are closely and dynamically associated. Research by World Bank<sup>2</sup> establishes that, the climate change might impact hydropower generation in three possible ways. Firstly, the available discharge of a river may change, since hydrology is usually related to local weather conditions, such as temperature and precipitation in the catchment area. Secondly, an unexpected

increase in climate variability may trigger extreme climate events, i.e., floods and droughts and thirdly, changing hydrology and possible extreme events may increase sediment risks. More sediment, along with other factors such as changed composition of water raise the probability that a hydropower project suffers greater exposure to turbine erosion. Moreover; an unexpected amount of sediment will also lower turbine and generator efficiency, resulting in a decline in energy generated. Since, the majority of power is generated from hydropower sources; hence, there are high chances that, the State may face power crisis if the projected impact of climate change happens. As a result, the State will become highly dependent on thermal power plants and also higher carbon intensive power procurement from the NEWNE grid.

The projected impacts of variation in cold wave level would result in more intense winters in some areas. The peak winters would enhance the electricity demand since the consumption rises due to usage of power for heating purpose. The power shortage in winter would also lead to exploitation of other energy sources and fuel wood in rural areas and will lead to affecting the forest cover of the State.

Regions with increased temperature would face rise in electricity demand because of higher use of electrical cooling and would

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<sup>2</sup> Policy Research Working Paper on Estimating Global Climate Change Impacts on Hydropower Projects: Applications in India, Sri Lanka and Vietnam –The World Bank



thereby enhance the pressure on electricity distribution network through increased seasonal demand.

Higher demand of energy due to climatic variability and lower generation due to projected impact of climate change would widen the power supply-demand deficit in Jammu & Kashmir. Extreme weather events are also likely to pose threat to physical infrastructure assets. Impact of extreme weather events on energy sector due to climate change can harm economic and social infrastructure because of the fact that,

centralized power plants tend to serve large section of population and are also sensitive to climate change.

Biomass still dominates the State domestic energy profile e.g. fire wood, dung, etc. which are more vulnerable to effect of climate change. With the increased cold wave, the efficiency of bio-digesters also deteriorates.

The envisaged climate change could impact different components of the electricity sector as outlined below.

*Table 10: Possible Climate Change Impacts on the Energy Sector*

Climate Change Indicators	Impacts on Energy Sector
Variation in Hydrological cycle	<ul style="list-style-type: none"> <li>• Availability of water in hydro power plants.</li> <li>• Increased possibility of sediment and climate extreme events</li> </ul>
Reduced Temperature	<ul style="list-style-type: none"> <li>• Higher Demand of electricity resulting to increased drawl resulting to high dependency on fossil fuel based energy generation and increase in GHG emission</li> <li>• Energy demand will increase in domestic sector for room heating, hot water requirements and as well as in commercial sector.</li> <li>• Increase in use of firewood in rural area leads to affecting the forest cover of the State.</li> <li>• Could impact renewable energy generation potential like, solar, biogas, hydro, etc.</li> </ul>
Increased Temperature	<ul style="list-style-type: none"> <li>• Increased need of energy in household sector for cooling particularly in areas like Jammu.</li> <li>• Could impact renewable energy generation potential, especially solar</li> </ul>
Extreme events (landslide, cloudbursts, etc.)	<ul style="list-style-type: none"> <li>• Could affect the transmission and distribution infrastructure in the State.</li> <li>• Effect power plant infrastructure including transmission and distribution network</li> </ul>

Assessing the vulnerability of energy supply to climatic events and longer term climate change needs a strategic approach to ensure that timely and effective adaptation measures are adopted for coherence across different sectors and effective governance to reduce the sector's vulnerability to the impact of climate change.

## 4.4 Key issues in the sector

Though around 17,426 villages/hamlets<sup>3</sup> of the State are electrified but providing continuous power supply particularly during winter when the energy demand of the State is very high is still a challenge for the power department of Jammu & Kashmir. With 73% of population living in rural areas, the extensive use of firewood is leading to forest degradation. Infrastructure constraints are also rampant in both rural and urban areas.

The power supply scenario of the State is characterized by persistent power shortage. The State has very low electricity generation capacity as majority of hydro power potential is still untapped due to resource constraint and lack of interest in project investment amongst local entrepreneurs.

As power plants located in Jammu & Kashmir are largely run-off the river based hydro power plants, change in climate systems and variation in hydrological cycle at the both basin/catchment level across Himalayan region has direct impact on energy generation. Temperature variability and rise

in humidity index leads to enhanced energy consumption across the states, thereby increasing the supply-demand deficit.

During winter the problem is aggravated as the discharge rate in the rivers falls subsequently leading to generation drop to one-third of that of the generation during summer whereas energy demand increases due to heating loads. Thus, the overall impact in the State would be manifested through the supply-demand deficit.

However, the supply from the NEWNE grid is unable to meet the entire demand of the State especially during the long winter when the State faces deficiency in both peak and off peak hours. This makes the population suffer from long hours of load shedding, with the rural areas being the worst hit. The supply is also affected in terms of low voltage. The shortage during peak hours for sustained periods also calls for drawl of power resulting in higher cost of grid electricity.

The geographical condition of the State with many villages in remote and far-flung areas makes access difficult, in addition to the frequent natural calamities such as landslides, cloudbursts, etc.

Due to hilly and difficult terrain and dispersed population in rural areas, the transmission and distribution network systems are still unviable and moreover the operation and maintenance cost are also high.

<sup>3</sup> 2010-2011 information from Digest of Statistics 2010-2011

The low-temperature condition lowers the efficiency of the biogas projects, one of the best choices to meet the cooking energy requirement in rural areas. Though areas like Ladakh, etc. receive heavy sunrays and have high potential of solar energy generation but the remoteness and difficult terrain are the major barriers for the grid connection. The distance of the Ladakh -Kargil region from the other main areas like Jammu-Srinagar would result in high T&D loss in power evacuation from the solar power plants. The remoteness of villages and transportation problem in winter due to snow fall is the major barrier in providing access to maintenance service for the users or beneficiaries of the remote villages for almost ¼<sup>th</sup> of the year.

## 4.5 Programme and Policies in the sector

JAKEDA since its inception in 1989 has been making stride in promoting renewable energy technology across the State and meeting the power demand of remote locations through decentralised renewable energy generation under various schemes and programmes of the Ministry of New and Renewable Energy (MNRE). Along with JAKEDA, Ladakh Renewable Energy Development (LREDA) and Kargil Renewable Energy Development Agency (KREDA) are also actively involved in renewable energy implementation projects. The renewable energy project implementation is undertaken under following programmes-

1. Remote Village Electrification Programme (RVEP)
2. Jawaharlal Nehru National Solar

Mission (JNNSM) –

- a) Solar Lanterns
- b) Solar Home Lighting
- c) Off-grid Rooftop Solar Power Plants
- d) Grid connected Rooftop Solar Power Plants
- e) Grid connected Solar Power Plant
- f) Solar Street Lighting
- g) Solar Water Heating
- h) Solar Cookers

3. National Biogas & Manure Management Programme (NBMMP)
4. National Biomass Cook stove Initiative Programme
5. Small hydro power programme
6. Small Wind Energy & hybrid systems programme
7. Biomass Co-generation (non-bagasse) in industry Programme
8. Special Area Demonstration Programme (SADP)

### Achievements:

#### RVEP:

JAKEDA, since 2004, is electrifying un-electrified remote census villages and hamlets as approved by Rural Electrification Corporation (REC) where grid connectivity is either not feasible or not cost effective. It has electrified 440 villages and hamlets so far. Around 37,700 solar home lighting systems have been distributed across 16 districts of the State under remote village electrification programme.

## JNNSM:

- 13,000 solar lanterns are being distributed under the solar lantern programme of MNRE to 73 Remote Gujjar & Bakerwal Bastis located across Jammu & Kashmir province. The State govt. has already distributed 19,531 SPV home lighting systems till date to general category across the State.
- **Off-grid Solar Power plants:** 13 solar power plants of capacity ranging from 5 – 25.50 kW are being installed under JNNSM scheme in district / sub-district hospitals with cumulative capacity of 123.90 kW. Apart from central schemes, the State under BADP programme is also implementing 15 solar power projects of 5 kW capacities in Community Information Centres (CICs) accumulated to 75 kW.

### ***Solar power projects under commissioning:***

Total 33 projects are under installation cumulating to 550.00 kW capacities in District/

Sub-District Hospitals, stadium, shrines etc. Simultaneously with the implementation of JNNSM scheme, JAKEDA is also undertaking implementation of 5 solar power plants under BADP programme of 5 kW capacities across the State.

JAKEDA is presently undertaking implementation of 6 solar power projects cumulating to 550.00 kW capacity in Sheep Breeding Farm - Daksum, Anantnag, University of Kashmir - Main Campus, Srinagar, Sainik School Manasbal, Ganderbal, Kashmir, Village Trehgam, Kupwara, J&K Institute for Management & Public Administration, Sidhara, Jammu and Panjbakhtar Temple, Jammu.

- **Solar Water Heating System:** Under JNNSM scheme, total 25,000 LPD<sup>4</sup> of Solar water heating system is installed at 11 sites across the State. In addition to this, 51 solar water heating systems are installed in commercial complexes, institutions, district/ sub-district hospitals, municipal corporations, etc. accumulating to 64,500 LPD.

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<sup>4</sup> LPD refers Litre Per Day





- **Solar Cookers:** JAKEDA, considering high solar energy potential of the State, has also promoted and implemented 6,000 nos. of Box type solar cookers in Kishtwar area.

**Biogas Programme:** To reduce climate change impact and prevent black carbon and GHG emission, the State has installed 2,063 biogas plants of 2 cum capacity. Under the programme of National Biogas & Manure Management Programme (NBMMP), the

State is implementing 294 biogas plants.

**National Biomass Cook stove Initiative**

**Programme:** To achieve the objective of low emission cooking and conservation of forests by reducing firewood consumption, the State has distributed 4,50,000 improved cook stoves under the NBIC programme.

**Micro Hydrel projects and Water Mills:**

6 Mini Hydro projects are considered for implementation under IPP Mode (Phase-I).

*Table 11: List of Mini Hydro Project Considered Under Implementation*

Sl. No	Project Name	Project Capacity
1	Paristan MHP, Ramban	2 * 1 MW = 2.00 MW
2	Ukhral MHP, Ramban	2 * 0.875 MW = 1.75 MW
3	Buta-kulan MHP, Ganderbal	2 * 0.875 MW = 1.75 MW
4	Rayil MHP, Ganderbal	2 * 0.725 kW = 1.45 MW
5	Surasyar MHP, Budgam	2 * 0.60 MW = 1.20 MW
6	Dandipora Daksum MHP, Anantnag	2 * 0.90 MW = 1.80 MW
	TOTAL	9.95 MW

**Water Mills:** 50 traditional water mills have been upgraded for the mechanical and electrical output of 3 -5 kW.



## Wind Power Projects:

A project of 8 MW is being implemented in Bidda (Reasi). Apart from standalone wind power project, the State is also implementing 5 Wind Hybrid Systems at following sites:

*Table 12: List Of Wind Power Project Under Implementation*

Sl. No.	Site	Capacity (kW)
1	PHC, Narbal	7.0 (4.2 kW from Wind + 2.8 kW from SPV)
2	SDH, Ganderbal	8.8 (6.6 kW from Wind + 2.2 kW from SPV)
3	SDH, Akhnoor	11.8 (8.4 kW from Wind + 3.4 kW from SPV)
4	Deera ki GaliRajouri in lieu of SDH, Sunderbani	8.8 (6.6 kW from Wind + 2.2 kW from SPV)
5	SDH, Banihal	10.0 (6.6 kW from Wind + 3.4 kW from SPV)
<b>TOTAL</b>		46.40

## 4.6 Key Priorities

With the vision of providing energy access to all and improved energy security for the State, key elements for mitigation and adaptation were identified after detailed deliberation with the working group. With a very little or no net emission from energy sector, the State continues to be “carbon neutral”, despite the steep growth in energy consumption.

To promote low carbon sustainable growth, the State Government has planned to promote green energy by increasing share of renewable energy in generation mix, scaling up decentralized renewable energy application, etc. The strategies towards increasing resilience of the State’s energy sector lie in up scaling of current programmes and activities along with new interventions. The priorities are in line with the concerns raised due to impact of the climate change and the State’s response.

### 1. Promotion and implementation of solar city project

Around 100% of the urban population of Jammu & Kashmir is dependent on grid power or energy from DG set for lighting purposes. Urbanization and economic development are leading to a rapid rise in energy demand in urban areas leading to increase in greenhouse gas emission. The State is also experiencing rapid growth in peak electricity demand and the power department is not able to cope up with the rise in peak demand. Incorporation of the solar city programme would prove crucial towards supporting the development of renewable energy application and energy efficiency measures, thereby curbing grid power demand by 10% in next five years. The activities to be undertaken are:

- A. Preparation of a master plan for all district headquarters under the “Solar City project” for increasing renewable energy supply and energy efficiency

measures in the city.

B. Set-up institutional arrangements for implementation of the master plan.

- a. Formation of a Solar City Cell.
- b. Approval and Monitoring of projects implemented under “Solar City” plan.

C. Awareness generation and capacity building activities by managing publicity programmes, conducting training programmes/business meets for stakeholders like architects, builders & developers, engineers, RWAs, manufacturers/suppliers, financial and technical institutions, NGOs.

D. Promotion of cities as Solar and carbon neutral city in next five years through implementation of pilot solar city project in phases-

- Phase I - Jammu, Srinagar and Katra
- Phase II - Kupwara&Udhampur
- Phase III - Rajauri, Poonch and Baramula,

The following measures are proposed under solar city project -

- Installation of solar street lighting and load management of municipality
- Solar power packs, solar water heaters, solar air heaters/ coolers, rooftop solar plant for common area lighting, energy

efficiency measures to be undertaken in government owned and government aided institutions and organizations.

- Solar water heating systems for residential buildings, institutions, commercial buildings, hospitals and industries.
- Municipality waste or kitchen waste utilization for energy generation.

## 2. Promotion and facilitation of Off-grid and decentralized renewable energy generation for electrification, cooking and other thermal energy requirement.

Around 73% of the State population resides in rural areas<sup>5</sup>. More use of renewable energy technology would ensure energy security, reduce local pollution and increase access to energy in areas where distributed and decentralized forms of energy production would be economically convenient. Hence, renewed efforts to set up decentralized renewable energy solutions, would be undertaken primarily through a combination of off-grid solar power plants, small solar-wind hybrid generators, bio-digesters. This would ensure cooking energy supply for 50 -100 people in institutions, hospitals, industries, etc. and fulfill the energy demand for lighting of rural households. The activities planned are

A. Facilitating deployment of stand-alone off-grid solar power plants of capacity

<sup>5</sup> Economic Survey Report of Jammu & Kashmir -2012-13

within 50 - 100 kW for fulfilling the power demand of 5 MW in dispersed locations by 12th plan period. The electrical energy from the off-grid power plants would empower the population of the higher terrain and far-flung areas in the country to sustain under extreme weather conditions and severe impact of climate change.

- B. Installation of 300 kW solar-wind hybrid power plants with capacity of 20 kW to meet the power demands in 12th plan period.
- C. Maximizing use of stand-alone Solar Home Lighting System (SHLS) in rural household through distribution of 20,000 SHLS of 40 Wp capacity annually.
- D. Implementation of pilot scale 15 nos. bio-digester systems annually for cooking energy generation for 50 -100 people from kitchen waste and wastes from hostels, hospitals, small scale industries and institutions, etc.

The energy requirement for cooking purposes in the commercial establishment and institutions is met with firewood gathered mostly from forest areas or LPG. This not only reduces the area under carbon sink and depletes the conventional fuel reserve but also enhances the vulnerability of the area in light of the proposed climate change impact through top soil denudation in case of flood or other impact, greenhouse gas emission, etc. The use of kitchen waste or other industrial wastes in bio-digester

would help in reducing waste generation and dependency on conventional fuel sources. Moreover, the utilization of wastes would help in keeping the environment clean.

### 3. State Govt. by amendment of building bye-laws suitable to State condition would promote and mandate use of solar water heating and/or lighting systems.

The State govt. in line with the objective of national solar mission would promote and mandate the use of solar water heating and/or lighting systems according to the State geographical condition, climate scenario and energy usage pattern. Use of Solar Energy for water heating has high potential in the State because of high solar incident radiation and longer daytime. A large amount of energy is consumed for water heating in places like hotels, government offices hostels, guest houses, nursing homes, hospitals, residences due to long winters and extreme cold. Enhancing usage of solar water heating systems will replace use of crude and inefficient electric heaters and address problem of inadequate power supply. Solar driers can be promoted across small scale as well as medium scale units like agro processing units etc. The Forest Rest Houses, Circuit Houses, PWD Bungalows, District Collectorate buildings, Govt. Guest House and Primary Health Centre's, Hospitals using electric geysers contribute higher power demand and green-house gas emission as the power demand is majorly met either using electrical energy or liquid fossil fuel. The activities planned are:



- A. Amendment of building bye-law considering State demographic profile for mandatory use of solar water heating systems in
- All District Head Quarters of the State by year 2015
  - All commercial and institutional buildings of urban and semi urban areas by 2017
  - All private residential houses of urban areas with more than 1000 sq. ft. area by 2018
  - By 2020, in all towns and small cities; solar water heating system usage by the private households and commercial buildings.
- B. Promotion & facilitation for setting up of Solar Water Heating (SWH) systems in all Govt. establishments by undertaking pilot projects –
- Pre-feasibility study for SWH system in Govt. establishments.
  - Preparation of bankable DPR
  - Arrangement and management of project fund for implementation.
  - Facilitating deployment of SWH system in Govt. establishments –
    - o Primary Health Centre's - 10 Nos. of 1,000 LPD each
    - o Hospital - 10 Nos. of 3,000 LPD each
    - o Govt. Higher Secondary School - 10 Nos. of 500 LPD each
    - o District Collectorate Building and other govt. establishments -20 Nos. of 1,500 LPD each
  - Training to users on operation and maintenance of the system
4. Institutional development and strengthening of JAKEDA, LREDA and KREDA for promotion of Renewable Energy technology applications.

To ensure proper implementation of climate friendly sustainable initiatives and to sustain the benefits for longer duration, a detailed strategy for project implementation and rigorous monitoring protocol of implementation initiatives under the State climate change action plan needs to be developed. Therefore, a Programme Management cell (PMC) is to be established under the Chairpersonship of Administrative Secretary, Science and Technology for a comprehensive review and to propose future directions including identification of financial mechanism and bridging of the investment gap for promoting renewable energy technology. This Cell, besides monitoring and oversight would also issue guidelines with respect to renewable energy usage, green building concepts etc. and would issue green practices certificates to various projects through regular check mechanisms. A corpus fund will be created with inclusion fund from Govt. of India schemes and State government schemes which will be utilized for following activities -:

- A. Training of the working group members and their representatives from JAKEDA, LREDA and KREDA and other concerned departments and organizations on sector specific climate change issues and enhance knowledge about the policy measures.
- B. Introduction of e-governance system and enabling IT based operation in the JAKEDA, LREDA and KREDA and capacity building of all officers at district level.
- C. Development of Projects in JAKEDA, LREDA & KREDA by way of:
  - Identification of projects,
  - Development of Pre-Feasibility Report, Detailed Project Report,
  - Arrangement of fund,
  - Monitoring of project implementation and operation.

All the programs and initiatives proposed under State climate change action plan for solar energy sector will be implemented through these agencies and other line departments in coordination with PMC. The PMC would report to the Central Advisory Council for Climate Change constituted by the State government. The PMC would help in effective project implementation, monitoring & evaluation, easier documentation, learning, sharing & dialogue on climate change initiatives by the State on solar, small hydro and wind sector.

## 5. Harnessing renewable energy potential of the State

The main objective of the action plan is to improve the productive potential of natural and renewable energy sources and reduce the huge dependency on thermal energy supply to the State. Each of the renewable energy sources can be an eco-sustainable practice; hence this needs to effectively manage for increased supply of electrical and thermal energy and achievement of consequent economic and social growth. The activities planned are -

- A. Assessment of Biomass potential and availability for energy generation in the State and demarcation of biomass potential sites in the map:

The State particularly Jammu region with large no. of agro-processing units has huge potential for biomass based energy generation. To assess the bio-energy available in the State and initiate biomass project implementation following sub activities are planned –

- i. Identification of agency for assessment study
- ii. Study on biomass availability for energy generation in the State for demarcation of biomass potential map.
- iii. Risk assessment of bio- energy sources in anticipated climate change situations (variable rainfall, snowfall, temperature, extreme events)
- iv. Risk assessment of bio-energy infrastructure in climate change situations including extreme events.
- v. Projection and risk assessment of energy demand.

- vi. Conducting detailed feasibility study and identify viable biomass power project
  - vii. Awareness programmes and capacity building of nodal agency on technological and regulatory aspect
- B. Assessment of Solar irradiation, temperature, wind speed at district level across the State for solar mapping.

The State having high incident solar radiation and having longer daytime, has tremendous solar energy potential particularly in the Ladakh region. But, due to rugged hilly terrain and extreme weather conditions in some areas of the State it is needed to identify the solar project sites and assess the energy generation potential of the sites for promotion of solar energy project in the State.

- i. Assessment of Solar irradiation, temperature, wind speed at district level across the State for solar mapping.
- ii. Risk assessment of solar energy sources in anticipated climate change situations (variable rainfall, temperature, extreme events).
- iii. Risk Assessment of solar energy infrastructure in climate change situations including extreme events.
- iv. Projection and risk assessment of energy demand.
- v. Identification of appropriate sites for solar energy projects
- vi. Awareness programmes and capacity building of nodal agency on

technological and regulatory aspect.

- C. Assessment of Wind energy potential of the State, wind mapping and identification of wind project sites.

The State is experiencing high wind speed suitable for wind power projects but due to high rugged hilly terrain and large forest area, the wind power projects have not yet scaled up in the State. Moreover, the detailed assessment of wind potential is not carried out and sites appropriate for project set up is also not identified. To promote wind power projects it is therefore needed to conduct a detailed study for wind project site identification and assess its power generation potential.

- D. Detailed assessment of Waste to Energy projects from Municipal Waste, Industrial and other wastes in the State.

Waste disposal in today's urban areas is a major problem. It not only requires a large land area but also leads to major environmental concern. Therefore, there is a great potential for diversification of waste to energy projects that would contribute to mitigate power demand supply gap in urban areas as well as help to overcome the problem of waste handling. While significant potential exists for waste to energy projects, geographic location, end-use function, technology diffusion and grid-parity pricing are the key determinants in technology penetration. To promote waste to energy projects and publicize its importance, following actions planned -

- i. Identification of agency for assessment study
  - ii. Study on waste availability for energy generation in the urban areas and industrial areas for demarcation of waste mapping.
  - iii. Risk Assessment of waste to energy projects viability in anticipated climate change situations (variable rainfall, snowfall, temperature, extreme events)
  - iv. Projection and risk assessment of energy demand.
  - v. Conducting detailed feasibility study and identify viable project
  - vi. Awareness programmes and capacity building of nodal agency on technological and regulatory aspect
- E. Undertake R&D work to improve the performance of biogas plants in low temperature condition and with reduced livestock waste in high temperature zones like Jammu.

The State is way behind its target for implementation of biogas plants under central scheme. Due to low temperature condition and collection inefficiency of livestock waste, the biogas plants installed in low temperature areas are not running successfully. Whereas collection of livestock is a constraint in high temperature zones; hence, technology innovation is needed to operate biogas plants efficiently with reduced livestock wastes for high temperature zones. To harness and implement biogas

technologies R&D initiative needs to be undertaken for improved biogas plant technology and operations.

## 6. Strengthening of technical competency of various stakeholders of renewable energy which includes O&M persons, technicians, installers, manufacturers and other relevant service providers as per international standard

Even though the Govt. of India is running several promotional programmes and schemes for renewable energy implementation but one of the main reasons for failure of renewable energy sources is the lack of technical support in terms of proper and adequate installation, maintenance and repair of renewable energy systems due to insufficient or technical competency. The State of Jammu & Kashmir being the extreme northern State and having scattered population distribution, the renewable energy technology manufacturer has low interest in hilly regions. Therefore, the introduction of training courses in all ITI's, engineering colleges would be beneficial for successful implementation and operation of the renewable energy projects and reduce dependency on external technical experts for operation and maintenance, repair, etc. The activities designed are:

- A. Introduction of curriculum and assessment on Renewable Energy system installation, Operation & Maintenance, repair, etc. in all ITIs of the State to meet the local demand of



technician and installer for RE.

- B. Introducing technical course on Renewable energy technology and Energy management at Poly-technic/ Engineering colleges of the State to achieve increase in availability of technically qualified manpower.
  - C. Conducting certificate courses for strengthening of technical competency of the existing solar and other renewable energy technology service providers.
  - D. Supporting State level entrepreneurs to become RESCOs, Channel Partners under JNNSM scheme and renewable energy device manufacturers, distributors, installers, etc.
  - E. Linking promotions of technical personnel with certification in renewable energy technology, O&M, repairs etc.
7. **Enhancing State's own power generation capacity through hydro power plant set up and provides support to private/public investors in projects implementation and undertakes micro/mini hydro projects for remote area to meet up local demand.**

The State energy sector has taken a lead in creating awareness and committed to go for hydro technologies for improving the scientific knowledge regarding the direct as well as indirect parameters of environmental impact. The State has hydro potential of

20,000 MW but identification of only 16,480 MW has achieved. Therefore, a detailed reconnaissance study is needed to assess the present hydro power potential and to identify project sites. These include analysis of hydrological data of major rivers of Jammu & Kashmir and its tributaries and regular petrographic analysis of major rivers of the State for assessment of the rate of erosion and analyzing the causes, apart from regular monitoring of the isoceraunic conditions of the region. The above data shall be analyzed on regular basis and study of its impact on the efficiency of the system can be estimated. This would also addressing the issue of "energy access" to people by providing them with "clean energy" and thereby reducing usage of highly polluting thermal power and reducing power procurement from northern grid is the prime focus of the State govt. The following activities are planned:

- A. Detailed reconnaissance study on water availability and hydrology data evaluation for identification of new hydro projects and demarcation of hydro power sites with specific capacity mapping.
- B. Promotion & facilitation of hydro power project implementation by providing adequate support from the State government in terms of clearance, land acquisition, power transmission network development and funding. Encouragement of greener construction technologies in new Hydro power project implementation.
- C. Declaration of water policy and mandate siltation and pollution control in water

bodies of hydro power projects.

- D. Implementation of 50 MW mini, micro hydro project in already identified project sites within next 5 years through IPP mode and 50 MW through IPP mode.

Following sub-activities will be undertaken to achieve the target of 60 MW hydro power project -

- Identification of project sites
- Bankable DPR preparation
- Identification and selection of project investor and fund
- Undertake project clearances, grid connectivity
- Implementation of hydro power project

## 8. Promotion of grid connected Rooftop and Small Solar Power projects in the State of J&K

Since, the State does not have adequate electricity generation capacity to meet the growing power requirements, renewable energy generation capacity addition particularly solar energy needs to be considered. Though multiple renewable energy projects have been implemented; still the grid interactive solar power generation option has not been explored so far. To mitigate power demand –supply gap of the State, particularly to meet the high peak demand, the State is focusing to explore its solar power potential for grid connected power generation and set the target for 25 MW grid connected solar power project.

Implementation of solar power grid connected projects will address the livelihood concerns of related stakeholders, strengthening supply chains of solar energy products in the State. The actions planned are:

- A. Implementation of 25 MW grid connected Rooftop and small solar power plant up to 2 MW capacities across the State within 2017-18 by Independent Power Producers (IPP) and also through PPP mode.

Participation from all type of investors is necessary to emerge the solar technology based power project which is new concept to the State. Hence, investments from private sector entities, central and State governments and also public sector entities should be encouraged and following activities to be executed -

- Identification of project sites
  - Bankable DPR preparation
  - Identification and selection of project investor and fund
  - Undertake project clearances, grid connectivity
  - Implementation of solar power plant
- B. Development of disposal policy towards proper decommissioning and recycling of solar panels installed across the State.

Even though solar photovoltaic based power generation is clean and environmentally sustainable; but use of harmful chemicals like mercury and chromium in solar cell manufacturing may prove to be detrimental

is not disposed properly. With the increase in solar project implementation environment degradation due to solar cell disposal will also increase which may affect the environment as well as the ecosystem of the State. Hence, policy needs to be developed for adequate disposal measures including recycling of disposed solar cells. Separate solar cell disposal site and training of recycling of solar cells is also needed.

## 9. Promotion of Green buildings in the State

The climatic condition of the State varies from region to region with hot climate conditions in Jammu and cold climate in Kashmir. This leads to higher power demand throughout the year. Due to land shortage in urban areas for construction and with ever increasing urban population it is much more crucial to have scientifically built and climate friendly buildings are inevitable. Conventional method of construction uses large quantity of material and many of them are non-renewable and toxic leading to environmental degradation. Green buildings would not only reduce the impacts but would consume less energy and water, generate less waste, conserve natural resources, would be climate friendly. The activities planned are –

- A. Development of policy framework on green building considering State geographical location, prevailing climatic condition.
- B. Introducing mandatory norms for undertaking green building measures

in all new govt. buildings and residential buildings of more than 1500 sq. ft. in cities of Jammu & Srinagar in line with Green building standard and Energy Conservation and Building Code (ECBC) of the Bureau of Energy Efficiency, Govt. of India and mandatory compliance of energy efficiency measures, rain water harvesting measures, recycling measures for water and wastes in all big hotels. The policy would also mandate the buildings to implement green building standard and should have green building certification. It is also recommended that till the point compliance is being made mandatory for the residential building, special incentives may be offered so as to encourage the technology and increase awareness about the potential benefit of using the green building concept.

- C. Capacity Building of authorities (Housing & Urban Development Department, PHE, Irrigation & Flood Control Department, Public Works (R&B) Department, JAKEDA, LREDA, KREDA) on green building policy and its requirement. Awareness generation through workshop and advertising media on green building standard and involve NGO, community groups, social Organisation for creating awareness.

The green building would contribute in energy security of nation and also reduce the overall carbon footprint.





## 4.7 List of Key Priority Action

Table 13: List of Key Priority Action Proposed under Sustainable Energy Mission

Sl. No.	Title	Organizations	Budget (Rs. In Million)			Source of Funding
			Existing	Additional	Total	
1	<b>Promotion and implementation of solar city project by</b>	JAKEDA, LREDA, KREDA, Housing & Urban Dev. Dept.	20.00	20.00	40.00	MNRE, Govt. of J&K, Dept. of Urban Development
A)	Preparation of a master plan for all district HQs under the "Solar City project"					
B)	Set-up of institutional arrangements for implementation of the master plan					
C)	Awareness generation and capacity building activities by managing publicity programmes, conducting training programmes/business meets for stakeholders					
D)	Implementation of pilot solar city project in phase wise- Phase I - Jammu, Srinagar and Katra, Phase II - Kupwara & Udhampur, Phase III - Rajauri, Poonch, Baramula,					
2	<b>Promotion and facilitation of Off-grid and decentralized renewable energy generation for electrification, cooking and other thermal energy requirement.</b>	JAKEDA, LREDA, KREDA, Rural Dev. Dept.				MNRE, Govt. of J&K, User or Beneficiary Department or Organization, External Agencies
A)	Facilitating deployment of 5 MW stand-alone off-grid solar power plant of capacity within 50 - 100 kW for fulfilling the power demand in dispersed locations by 12th plan period.		1,125.00	125.00	1,250.00	
B)	Installation of 300 kW solar-wind hybrid power plants with capacity of 20 kW in 12th plan period.		3.40	1.10	4.50	

Sl. No.	Title	Organizations	Budget (Rs. In Million)			Source of Funding
			Existing	Additional	Total	
C)	Maximizing use of stand-alone Solar Home Lighting System (SHLS) in rural household level through distribution of 20,000 SHLS of 40 Wp capacity annually.		324.00	756.00	1080.00	
D)	Implementation of pilot scale 15 nos. bio-digester systems annually for cooking energy generation for 50 -100 people from kitchen waste and other waste in hostels, hospitals, small scale industries and institutions etc.		1.50	1.50	3.00	
3	<b>State Govt. by amendment of building bye-laws suitable to state condition will promote and mandate use of solar water heating systems and/ or lighting</b>	JAKEDA, LREDA, KREDA, Housing & Urban Dev. Dept.				MNRE, Govt. of J&K, Dept. of Urban Development, Municipality of J&K, User or Beneficiary Department or Organization, External Agencies
A)	Amendment of building bye-law considering state demographic profile for mandatory use of solar water heating systems in <ul style="list-style-type: none"> <li>All District Head Quarters of the state by year 2015.</li> <li>All commercial and institutional buildings of urban and semi urban areas by 2017.</li> <li>All private residential houses of urban areas with more than 1000 sq. ft. area by 2018.</li> <li>By 2020, in all towns and small cities; solar water heating systems usage by the private households and commercial buildings.</li> </ul>		Nil	Nil	Nil	

Sl. No.	Title	Organizations	Budget (Rs. In Million)			Source of Funding
			Existing	Additional	Total	
B)	Promotion & Facilitation for setting up of Solar Water Heating (SWH) systems in all Govt. establishments by undertaking pilot projects in – <ul style="list-style-type: none"> <li>• Primary Health Centre’s - 10 Nos.</li> <li>• Hospital - 10 Nos.</li> <li>• Govt. Higher Secondary School - 10 Nos.</li> <li>• District Collectorate Building and other govt. establishments -20 Nos.</li> </ul>		9.90	6.60	16.50	
4	Institutional development and strengthening of JAKEDA, LREDA and KREDA for promotion of Renewable Energy applications	JAKEDA, LREDA, KREDA, State Climate Change Cell, J&K				MNRE, Govt. of J&K, JAKEDA, LREDA, KREDA,
A)	Training of the working group members and their representatives from JAKEDA including LREDA and KREDA and other concerned departments and organizations on sector specific climate change issues and enhance the knowledge about the policy measures.		Nil	10.00	10.00	
B)	Introduction of e-governance system and enabling IT based operation in the JAKEDA, LREDA and KREDA and capacity building of all officers at district level.		1.30	3.70	5.00	
C)	Development of Programme Management Cell in S&T Dept.for identification of projects, development of Pre-Feasibility Report, Detailed Project Report, Arrangement of fund, Monitoring of project implementation and operation.		Nil	5.00	5.00	

Sl. No.	Title	Organizations	Budget (Rs. In Million)			Source of Funding
			Existing	Additional	Total	
5	<b>Harnessing renewable energy potential the state for power generation</b>	JAKEDA, Housing & Urban Development Dept. -J&K				MNRE, Govt. of J&K, Funding Agencies
A)	Assessment of Biomass potential and availability for energy generation in the state and demarcation of biomass potential sites in the map.		Nil	3.00	3.00	
B)	Assessment of Solar irradiation, temperature, wind speed at district level across the state for solar mapping.		Nil	5.00	5.00	
C)	Assessment of Wind Energy potential of the state, wind mapping and identification of wind project sites.		Nil	5.00	5.00	
D)	Detailed Assessment of Waste to Energy projects from Municipal Waste, Industrial and other wastes in the state.		Nil	5.00	5.00	
E)	Undertake R&D work to improve the performance of biogas plants in low temperature condition and with reduced livestock waste in high temperature zones.		Nil	5.00	5.00	
6	<b>Strengthening of technical competency of various stakeholders of renewable energy which includes O&amp;M persons, technicians, installers, manufacturers and other relevant service providers as per international standard.</b>	JAKEDA, Technical Education Dept. -J&K, Industry & Commerce Dept. -J&K				Govt. of J&K, Dept. of Higher Education, Dept. of Technical Education, MNRE
A)	Introduction of subject or paper on RE system installation, O&M, repair, etc. in all ITIs of the state to meet a local demand.		1.50	Nil	1.50	



Sl. No.	Title	Organizations	Budget (Rs. In Million)			Source of Funding
			Existing	Additional	Total	
B)	Introducing technical course on Renewable energy technology and Energy management at Poly-technic /Engineering colleges of the state to achieve increase in availability of technically qualified manpower.		1.50	Nil	1.50	
C)	Conducting certificate courses for strengthening of technical competency of the existing solar and other renewable energy technology service providers.		Nil	1.00	1.00	
D)	Supporting state level entrepreneurs to become RESCOs, Channel Partners under JNNSM scheme and renewable energy device manufacturers, distributors, installers, etc.		Nil	0.50	0.50	
7	Enhancing state's own power generation capacity through hydro power plant set up and provides support to private/public investors in project implementation and undertakes micro/mini hydro projects for remote area's to meet up local demand.	JAKEDA, JKSERC, JKSPDC, LREDA, KREDA, PHE, Irrigation & Flood Control Dept. -J&K				Govt. of J&K, Funding Agency, Govt. of India, Dept. of Water, MNRE
A)	Detailed reconnaissance study on water availability and hydrology data evaluation for identification of new hydro projects and demarcation of hydro power sites with specific capacity mapping.		Nil	10.00	10.00	
B)	Promotion & facilitation of hydro power project implementation by providing adequate support from the state government in terms of clearance, land acquisition, power transmission network development and funding. Encouragement of greener construction technologies in new Hydro power project implementation.		Nil	1.00	1.00	

Sl. No.	Title	Organizations	Budget (Rs. In Million)			Source of Funding
			Existing	Additional	Total	
C)	Declaration of water policy and mandate siltation and pollution control in water bodies of hydro power projects.		0.50	Nil	0.50	
D)	Implementation of 10 MW mini, micro hydro project in already identified project sites by next 5 years through PPP mode and 50 MW through IPP mode.		Nil	1000.00	1000.00	
8	<b>Promotion of grid connected Rooftop and Small Solar Power projects in the state of J&amp;K</b>	JAKEDA, JKSERC, JKSPDC, LREDA, KREDA				MNRE, Private or Public Agency, Govt. of J&K, Funding or Donor Agency
A)	Implementation of 25 MW grid connected Rooftop and small solar power plant up to 2 MW capacities across the state within 2017-18 by Independent Power Producers (IPP) and also through PPP mode.		Nil	2000.00	2000.00	
B)	Declaration of policy measures for proper decommissioning and recycling of all solar panels installed across the state.		Nil	2.50	2.50	
9	<b>Promotion of green buildings in the state</b>	JAKEDA, LREDA, KREDA, PHE, Irrigation & Flood Control Dept. - J&K, Housing & Urban Development Dept. - J&K, Public Works (R&B) Department				MNRE, Govt. of J&K, Govt. of India, BEE, Private or Public Agency, JNNURM
A)	Development of policy framework on green building considering state geographical location, prevailing climatic condition.		1.50	Nil	1.50	
B)	Introducing mandatory norms for Undertaking green building measures in all new govt. buildings and residential buildings of more than 1500 sq. ft. in cities of Jammu & Srinagar. Mandatory compliance of energy efficiency measures, rain water harvesting measures, recycling measures of water and wastes in all big hotels.		Nil	20.00	20.00	

Sl. No.	Title	Organizations	Budget (Rs. In Million)			Source of Funding
			Existing	Additional	Total	
C)	Capacity Building of authorities (Housing & Urban Development Department, PHE, Irrigation & Flood Control Department, Public Works (R&B) Department, JAKEDA) on green building policy and its requirement.		Nil	3.50	3.50	
<b>Total</b>			<b>1470.10</b>	<b>3970.40</b>	<b>5440.50</b>	







## 5 Enhanced Energy Efficiency

### 5.1 Introduction

Jammu & Kashmir is the northernmost state of India. It is situated mostly in the Himalayan mountains. Jammu and Kashmir shares border with the states of Himachal Pradesh and Punjab to the south and internationally with the People’s Republic of China to the north and east and Pakistan to the west. The State has a population of 1,25,48,926 with 20,15,088 households (14,97,920 rural and 5,17,168 urban) as per the 2011 Census.

The state is traversed by three main rivers i.e. Indus, Jhelum and Chenab. The Indus traverses through Ladakh, while the Jhelum and Chenab flows through Kashmir & Jammu respectively. The average rainfall is about 100 cm. Existence of huge glaciers

in the state and existence of high mountains with glacial cover and heavy rainfall makes it haven for hydro power generation.

As per preliminary survey an estimated potential of only 16,480 MW of power has been identified, much less than the actual potential. The state of Jammu and Kashmir was the second, next to Mysore to use Hydro Power much back in the 1<sup>st</sup> decade of this century.



Figure 8: Location of Hydro Power Project

## 5.2 Key trends in the sector

Power sector plays a major role in any developmental effort. A sustained growth in power sector is crucial to ensure economic growth. The gradual increase in demand of power is a sign of improvement in human development as well as industrialization. Hydro power is recognized as an ecofriendly, economical and green renewable source of energy. State of Jammu and Kashmir has huge hydel potential which if utilized fully would provide a strong impetus to the growth of the State's economy. The tapping of hydro power potential calls for huge resources, technical expertise, administrative reforms, congenial environment, proper regulation and management besides competitive marketing, policy formation and private participation. Optimal exploitation of the

available hydel resources would also suffice for power supply to Northern grid along with meeting the state's internal demands.

Total estimated potential for hydro power generation in the state is 20,000 MW out of which 16,480 MW (excluding 251 Projects up-to 25 MW generation potential identified totaling to 986 MW Capacity) has been identified as the actual generation potential. Out of the identified potential only 2,457.96 MW or 15% has been harnessed so far.

### 5.2.1 Electric Power Installed Capacity<sup>6</sup>

The power generation in the state is mainly governed by hydro power with a little share of fossil fuel based grid interactive power plant. The list of hydro power generating station in the state is as follows:

*Table 14: Capacity wise installed hydro power project State Sector*

Under Power Development Corporation	
Hydro	759.96 MW
Total No. Of Hydel Projects	20
Thermal	175.00 MW
Total No. Of Thermal Projects(Operated only in case of emergency in view of high per unit generation cost)	2
Under Power Development Department	
Diesel	33.146 MW

*Table 15: Capacity wise installed hydro power project Central Sector*

Hydro	1,680.00 MW
Total No. Of Hydel Projects	4

<sup>6</sup>Year book 2011-12\_PDD J&K\_12th Oct'12 & Economic survey J & K 2012-13-Power

Table 16: Capacity wise installed hydro power project Independent Power Producers

Hydro	17.50 MW
Total No. Of Hydel Projects	4

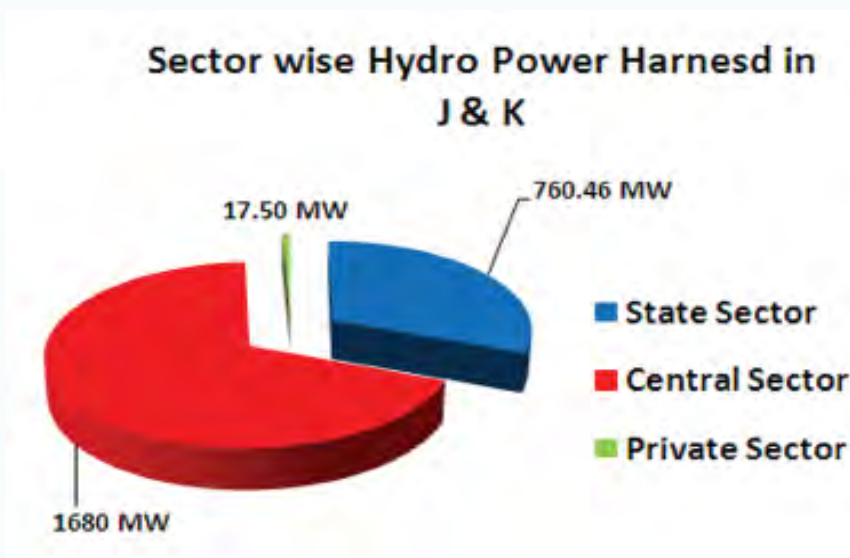
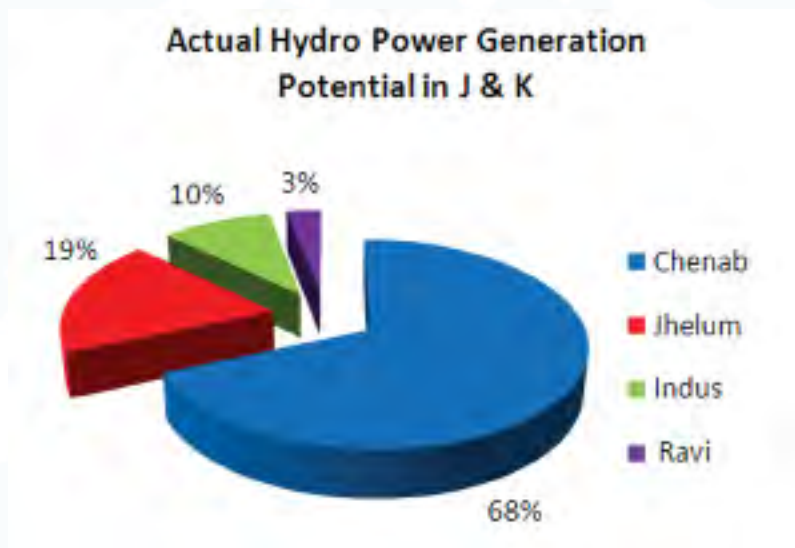


Figure 9: Source wise hydro power potential and sector wise hydro power resource harnessed

Table 17: List of Key Hydro Power Project and their capacity

Sl. No.	Name of Project	Basin	Capacity in MW	Configuration (MW)
1	Lower Jhelum	Jhelum	105.00	3 x 35
2	Upper Sindh-II	Jhelum	105.00	3x35
3	Upper Sindh-I	Jhelum	22.60	2 x 11.3
4	Ganderbal	Jhelum	15.00	2x3+2x4.5
5	Pahalgam	Jhelum	3.00	2 X 1.5
6	Karnah	Jhelum	2.00	2 x 1
7	Baglihar Stage I	Chenab	450.00	3x150
8	Chenani-I	Chenab	23.30	5 x 4.66
9	Chenani-II	Chenab	2.00	2 x 1
10	Chenani-III	Chenab	7.50	3 x 2.5
11	Bhaderwah	Chenab	1.50	3 X 0.5
12	Iqbal	Indus	3.75	3 x 1.25
13	Sumoor	Indus	0.10	2 x 0.50
14	Hunder	Indus	0.40	2 x 0.20
15	Bazgoo	Indus	0.30	2 x0.15
16	Igo- Marcelloung	Indus	3.00	2x1.5
17	Marpachoo	Indus	0.75	3x0.25
18	Haftal	Indus	1.00	2x0.5
19	Satakna	Indus	4.00	2 X 2
20	Sewa-III	Ravi	9.00	3 x 3
21	Sanjak	Indus	1.26	3 x 0.42
Sub Total State Sector(in MW)			760.46	
1	Salal	Chenab	690.00	6x115
2	Dulhasti	Chenab	390.00	3 x130
3	Uri-I	Jhelum	480.00	4x120
4	Sewa-II	Ravi	120.00	3x40
Sub Total Central Sector(in MW)			1,680.00	
Private Sector				
1	Athwato	Jhelum	10.00	2x5
2	Brenwar	Jhelum	7.50	3 X2.50
Sub Total Private Sector(in MW)			17.50	
Total potential in operation(in MW)			2,457.96	



## 5.2.2 Sector Wise Energy Consumption

Domestic consumers as a whole are the major electricity consuming sector in the state with cumulative consumption in tune of 34%. The category-wise energy consumption is given in the table below.

*Table 18: Category wise Electrical Energy Consumption*

Sl. No.	Customer category	2009-10		2010-11		2011-12	
		Energy Consumption (In MU)	%age	Energy Consumption (In MU)	%age	Energy Consumption (In MU)	%age
1	Domestic	1,380.00	36.00	1,255.93	31.08	1,431.98	33.56
2	Non-Domestic/ Commercial	295.00	7.70	349.10	8.64	333.26	7.81
3	Industrial	856.00	22.33	816.54	20.21	849.53	19.91
4	Govt.						
4.a	Irrigation/ Agriculture	295.00	7.70	198.10	4.90	140.67	3.30
4.b	Public Lighting	14.00	0.37	29.07	0.72	35.66	0.84
4.c	Public Water Works	383.00	9.99	586.04	14.50	636.14	14.91
4.d	State Central Dept.	532.00	13.88	711.20	17.60	695.65	16.30
4.e	General Purpose Bulk supply	78.00	2.03	95.10	2.35	144.10	3.38
Grand Total		3,833.00	100.00	4,041.08	100.00	4,266.99	100.00





From above statistics it is evident that although the demand of electricity across public utility is low but the demand is increasing. However this increasing demand can also be met without increasing the load by introducing energy efficiency measures. A huge potential of energy saving lies with the domestic sector that accounts for the major share of energy in the state. With a saving potential of 20-25% in the domestic sector, introduction of energy conservation measures can result in substantial energy saving which can provide for unmet demand and energy shortage in the state.

### 5.2.3 Demand Supply Scenario Analysis

The energy demand has seen a gradual

increase during 11<sup>th</sup> Plan period at an annual rate of 5 to 6%. To bridge the widened gap between demand and supply, the State Power Department has enforced power cuts of the order of 8 hours a day in summer and 10 hours a day in winter (under most critical scenario). Even with scheduled load shedding activity, the restricted demand turns out in tune of 11,091.26 MUs in 2011-12, which necessitated banking of power during summer with other state utilities and using of the same during winter.

The total availability of power in J & K from all the sources was just around 64% of the total requirement in FY 2011-12. The State is forced to purchase power from various sources besides drawing from Northern grid.

*Table 19: Peak and Power Availability Scenario in the State*

Energy Scenario (in MW)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13 (E)
Peak Demand	1,706	1,800	1,925	2,020	2,120	2,290	2,369	2,500	2,600
Peak Met	1,350	1,242	1,306	1,350	1,340	1,407	1,490	1,788	1,900
Peak Deficit	356	558	619	670	780	883	877	711	700
Peak Deficit (%)	20.87	31.00	32.16	33.17	36.79	38.56	37.02	28.44	26.92

*Table 20: Energy Demand and Availability*

Energy Scenario (in MU)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13 (E)
Energy Requirement	9,604	10,503	11,343	14,037	14,750	15,656	16,544	17,323	17,842.69
Restricted Energy	7,306	7,916.38	8,236.53	8,743.96	9,147.21	10,370	10,667	11,115.41	11,560.03
Energy Deficit	2,334	2,586.62	3,106.47	5,293.04	5,602.79	5,286	5,877	6,207.59	6,282.66
Energy Deficit (%)	24.21	24.63	27.39	37.71	37.99	33.76	35.52	35.83	35.21

## Per Capita Power Consumption (kWh)

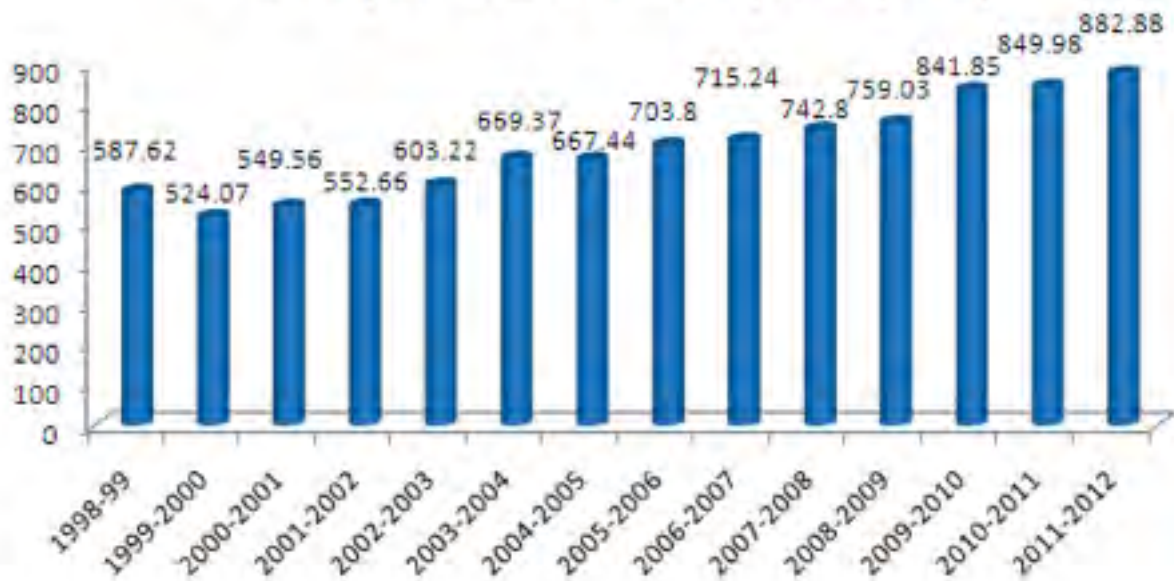


Figure 10: Gross Per capita Electricity (kWh) consumption in J & K<sup>7</sup>

## 5.3 Key issues in the sector

### 5.3.1 AT & C Losses

Once electric energy is generated, it is transmitted to areas where it will be used. Transmission refers to delivering electric energy from point of generation to distribution network. Distribution encompasses the substations and feeder lines takes power from the high voltage grid and progressively step down the voltage before it finally reaches the premises of different categories of consumers. The entire process of transmission from generating station to users results in technical losses of energy known as Transmission and Distribution (T&D) losses. Over and above the T&D losses,

losses are also accounted on commercial ground due to low metering efficiency, theft, pilferages, non-metering or non-recovery of payments. The transmission and distribution losses coupled with commercial losses are collectively known as Aggregate Technical and Commercial (AT&C) loss. The AT&C losses in the State are very high of the order of 61% as recorded in FY 2011-12. Technical losses pertain to outdated and old electrical device in the network. To minimize such losses, the system needs up-gradation and improvements. Commercial losses include power theft, unaccounted and uncontrolled consumption beyond agreement load, unregistered consumers, lesser contract demand, etc.

<sup>7</sup>Year Book 2011-12\_PDD\_12th Oct'12

Table 21: T&D and AT&C Losses (from 2006-07 to 2011-12)

Sl. No.	Particulars	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
1	Energy Input (MU)	8,236.53	8,743.96	9,148.07	10,370.65	10,667.20	11,091.26
2	Energy Billed (MU)	4,030.84	3,331.64	3,538.71	3,833.00	4041.10	4,267.00
3	T&D Losses (MU)	4,205.69	5,412.32	5,609.36	6,537.65	6,626.10	6,824.26
4	%age T&D Losses	51.06	61.90	61.31	63.04	62.12	61.61
5	Collection Efficiency (%age)	66.59	69.74	75.70	75.67	68.00	70.99
6	Energy realized (MUs)	2,676.26	2,416.20	2,633.12	2,902.07	2,749.38	3,029.14
7	AT&C Losses (MUs)	5,560.27	6,327.76	6,586.85	6,537.65	7,917.82	8,062.12
8	%age AT&C Losses	67.51	72.37	70.69	72.03	74.23	72.68

### 5.3.2 Sector specific energy conservation and saving potential

The energy consumption patterns are changing with invention of new technology and initiation of energy conservation measures by State Government. Efforts have been made to collect data on electricity conservation measures in agriculture, commercial, municipalities, SMEs, etc. Irrespective of the initiatives being taken up, a considerable potential of energy saving lies in each sector. "State-wise Electricity Consumption & Conservation Potential in India" carried out by National Productivity Council (NPC) in 2009 provides the following estimation of possible saving in energy consumption in J & K.

The possibility of energy savings is high in

the following sectors of the State.

- **Energy saving potential in Agricultural Sector**

A large numbers of Agricultural pump sets and Agricultural machineries consume significant quantum of fossil fuels and electricity. Inefficient agricultural pumps may be replaced by star rated efficient ones. Based on several studies on agricultural pump set efficiency, it has been found that the efficiency varies from 25-35% due to various factors. With a BEE star labeled agricultural pump set, the efficiency can be enhanced upto 50-52%<sup>8</sup>.

- **Energy saving potential in Power distribution system**

Jammu & Kashmir Power Development Department has an important role to play in making the state level Electricity grid

more climate-friendly. The transmission and distribution loss in Jammu & Kashmir is more than 61% and this can be reduced up to 28.6% on a time bound programme, say by the financial year 2018-19. Appropriate strategic actions are required to reduce the T&D Loss of the State.

- ***Energy saving potential in Lighting & Domestic Sector<sup>9</sup>***

30% of the power is consumed for lighting purposes. Thus use of efficient light could be made mandatory particularly for commercial organizations. Star rated home appliances should be encouraged in domestic sector. Usage of Compact Fluorescent Lamps (CFL) and Bureau of Energy Efficiency (BEE) star rated products can save up-to 40-50% of power in rural sector and 15-20% in urban areas. On the whole, the energy saving potential in domestic sector is estimated 20-25%.

- ***Energy saving potential in Building sector***

Energy Conservation Act, 2001 empowers the Government to prescribe the ECBC (Energy Conservation Building Code) for efficient use of energy and its conservation in buildings or

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<sup>9</sup>Combined Summary Report\_ NPC 2009

building complexes. The ECBC sets minimum energy performance standards for design and construction of non-residential buildings. Studies conducted by NPC reveal that energy savings potential in commercial buildings varies from 20-30%.

- ***Energy saving potential in Industrial Sector***

The annual electricity sale to the industry sector including low & medium voltage consumers (SME) and high voltage consumers (large industries) is 953 MU which is 23.62% of the total electricity sold. The larger industry segment is covered under the mandates of EC Act as designated consumers for energy efficiency, while SME segment is being addressed through cluster based initiatives by BEE. Based on several studies & energy audits by NPC, the electrical energy saving potential in industrial sector varies from 7-10%.

- ***Energy saving potential in municipalities***

Based on sample studies by NPC, the energy saving potential for municipalities & corporations from street lighting is assessed to be 25% and that from water works & sewage is 20%.

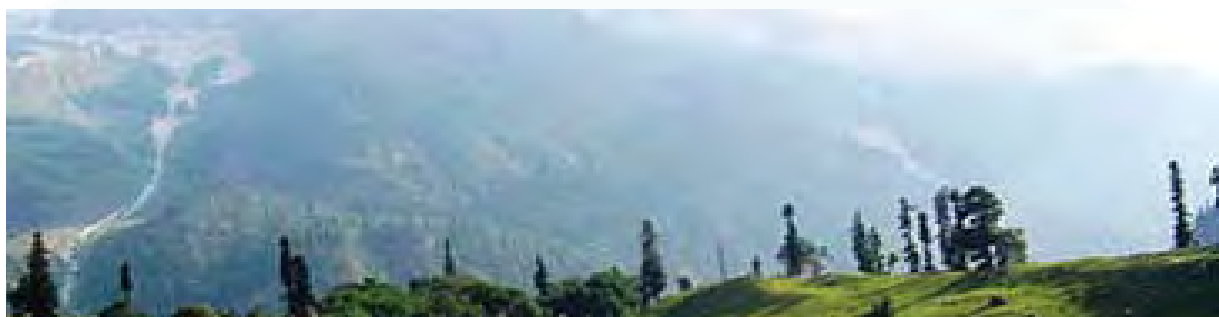




Table 22: Sector wise Energy Conservation Potential in Jammu & Kashmir (2007-2008)

Sl. No.	Sector Reference	Annual Energy Consumption		Estimated annual Energy Saving Potential	
		In MU	In TOE	In MU	IN TOE
1	Agricultural	271.00	-	58.8	-
2	Commercial	213.00	-	11.3	-
3	Municipalities	472.00	-	70.0	-
4	SME Clusters <sup>10</sup>	15.31	-	0.0	-
5	Domestic	1399.00	-	280.0	-
6	Industries	953	-	67	339
Total		3323.31		487 MU	339

### 5.3.3 Grid electricity consumption and GHG emission

Greenhouse gases (GHG) are emitted mainly from burning of fossil fuels. Generation of electricity which is mostly from conventional power plant results in considerable amount

of GHG emission. An assessment is being made to account the contribution of GHG from consumption of electrical energy in the state. Since the state is interconnected to North East West North-East (NEWNE) grid the specific emission factor of the grid is being considered for estimation.

Table 23: Sector Specific Electricity consumption & GHG emission from electricity consumption

Consumption Categories	In MU	In MWh	Emission Factor <sup>11</sup> (NEWNE Grid)	tCO <sub>2</sub>	%
Domestic	1,431.98	14,31,980.00	0.94	13,46,061.00	12.91
Non-Domestic/ Commercial	333.26	3,33,260.00	0.94	3,13,264.40	3.00
Industrial	849.53	8,49,530.00	0.94	7,98,558.20	7.66
Irrigation/Agriculture	140.67	1,40,670.00	0.94	1,32,229.80	1.27
Public Lighting	35.66	35,660.00	0.94	33,520.40	0.32
Public Waterworks	636.14	6,36,140.00	0.94	5,97,971.60	5.74
State Central Dept.	695.65	6,95,650.00	0.94	6,53,911.00	6.27
General Purpose Bulk supply	144.10	1,44,100.00	0.94	1,35,454.00	1.30
T & D losses-MU	6,824.26	68,24,260.00	0.94	64,14,804.00	61.53
Total GHG Emission (tCO <sub>2</sub> )				1,04,25,775.00	

<sup>10</sup>SME clusters electrical energy savings potential is already included in Industrial Sector.

<sup>11</sup>CO<sub>2</sub> Baseline Database for the Indian Power Sector, User Guide, Version 8.0\_January 2013

## GHG Emission in J & K in FY 2011-12

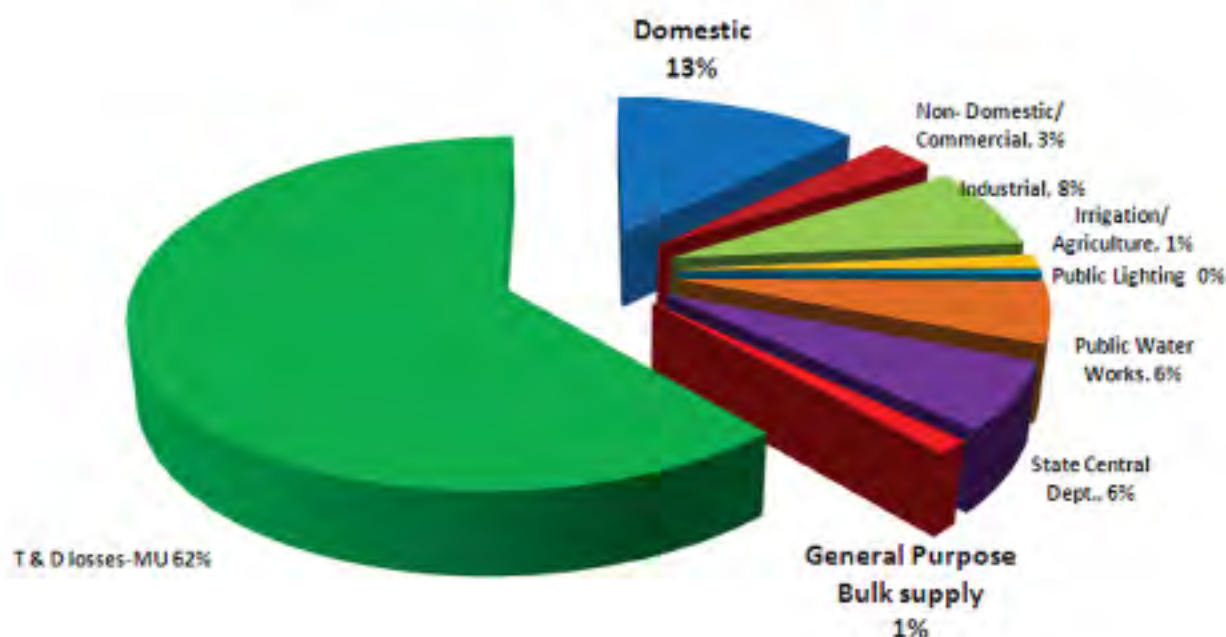


Figure 11: Sector specific GHG emission from electricity consumption

## 5.4 Programmes and Policies in the sector

### 5.4.1 National Mission on Enhanced Energy Efficiency (NMEEE)

The National Mission for Enhanced Energy Efficiency is one of the eight missions of National Action Plan on Climate Change configured towards improvising cost effective strategies for end-use demand side management. The Mission, by 2014-15, is likely to achieve about 23 million tons oil-equivalent of fuel savings- in coal, gas, and petroleum products, along with an expected avoided capacity addition of over 19,000 MW. The carbon dioxide emission reduction is estimated to be 98.55 million tons annually.

In addition to the policies and programmes for energy efficiency implemented by BEE, NMEEE would enforce the following four initiatives. These initiatives are as follows:

- Perform Achieve and Trade (PAT), a market-based mechanism to make improvements in energy efficiency in energy-intensive large industries and facilities more cost-effective by certification of energy savings that could be traded.
- Market transformation for energy efficiency (MTEE) with a shift to energy-efficient appliances in designated sectors through innovative measures that make the products more affordable.

- Energy efficiency financing platform (EEFP), a mechanism to finance DSM programmes in all sectors by capturing future energy savings.
- Framework for energy efficient economic development (FEEED), or developing fiscal instruments to promote energy efficiency.

The NMEEE set out a comprehensive strategy, which comprises the following components;

- Create demand for energy-efficient products, goods, and services by creating awareness about the efficacy of these products and services, amending government policies and programmes to integrate energy efficiency, preparing bankable projects to stimulate the process, and offering right incentives for cost-effective improvements in energy efficiency in energy-intensive industries and facilities through certification of energy savings that could be traded.
- Ensure adequate supply of energy-efficient products, goods, and services. This is being done by creating a cadre of certified energy professionals; promoting energy service companies (ESCOs), standards, and labeling of end-use equipment and appliances and preparing structured programmes to leverage international financing instruments including the Clean Development Mechanism (CDM) to reduce transaction costs to attract private investment etc.
- Create and promote energy efficiency

financing platform, set up partial risk guarantee funds, and develop innovative financial derivatives of performance contracts and fiscal and tax incentives for investment in this sector.

- Create and adopt robust and credible monitoring and verification protocols to capture energy savings from all energy-efficient activities in a transparent manner.
- Take necessary steps to overcome market failures with appropriate regulatory and policy framework to support the measures mentioned above.

#### 5.4.2 Restructured- Accelerated Power Development and Reforms Programme (R-APDRP)

The Govt. of India has proposed to continue R-APDRP as a Central Sector Scheme in the XI Plan with revised terms and conditions. The focus of the programme would be on actual, demonstrable performance in terms of sustained loss reduction. Establishment of reliable and automated systems for collection of accurate base line data, and adoption of Information Technology in the areas of energy accounting would be essential before taking up the regular distribution strengthening projects.

- R- APDRP is a scheme to bring down T&D losses to 15% within project period of 5 years with minimum target Of 3% per annum.

- The scheme is divided in two parts, PART-A and PART-B. Part-A is to cover Ring Fencing, Feeder Metering, Distribution Transformer (DT) Metering, application of Information Technology and Supervisory Control and Data Acquisition / Distribution Management System (DMS) in Distribution Sub Sector. Part-B is aimed to strengthen Distribution System in the identified project areas.
- The Power Finance Corporation (PFC) will be the Nodal Agency for the operationalization and implementation of the RAPDRP programme under the overall guidance of the Ministry of Power (MoP).
- Govt. of India will provide 100% loan for part A of the R-APDRP schemes and 90% loan for part B of the R-APDRP.
- Under R-APDRP scheme 30 towns have been identified as project areas in J&K State. Out of which 11 towns are in Jammu region including Jammu City and 19 towns in Kashmir region including Srinagar City. These towns are as under: Akhnoor, Anantnag, Budgam, Bandipore, Baramulla, Bhaderwah, Bijbehara, Doda, Duru-Verinag, Ganderbal, Handwara, Jammu, Kargil, Kathua, Kishtwar, Kulgam, Kupwara, Leh, Pattan, Pulwama, Punch, Rajouri, Ranbir-Singhpora, Samba, Shopian, Sopore, Srinagar, Sumbal, Tral and Udhampur. Gol has sanctioned INR 191.25 Crore for part-A and INR 1665.27 Crore for part-B of R-APDRP scheme.

The DPR for Supervisory Control and data Acquisition (SCADA) / Distribution management System (DMS) for Jammu and Srinagar cities have been approved by Gol at an estimated cost of INR 52.89 Crore.

### 5.4.3 Power Sector Reforms

To support reform initiatives in power sector, three tripartite MOUs have been signed so far between Jammu and Kashmir Power Development Department (J&KPDD), Planning Commission, GOI and Ministry of Finance, Gol to avail Central assistance for the years 2006-07, 2007-08 and 2008-09. The State Government needs to prepare and submit a Blue Print for the turnaround of T&D power sector. Some of the key recommendations are given below;

- Projected reduction of T&D losses from 62.9% in 2009-10 to 28.6% in 2018-19.
- Legislative requirement i.e. enactment of J&K Electricity Act and J&K Conservation Act on the pattern of the Central Acts.
- Making State Electricity Regulatory Commission (SERC) fully functional and Administrative Reforms for ensuring accountability.
- Establishment of base line data and undertaking T&D loss studies.
- Unbundling of T&D sectors.
- Tariff revision through SERC.
- Technical intervention like metering by 2012-13.



- Strengthening / upgrading computerized bills / collection system.
- Introduction of High Voltage Distribution System (HVDS)/ Aerial Bunched Cabling (ABC) in power theft prone areas.
- Power factor correction - Installation of shunt capacitors.
- Energy saving incentive like Time of Day tariff, Power factor incentives, seasonal tariff and subsidy on energy savers etc.
- Strengthening training/capacity building.
- Augmentation of system network at various stages etc.

#### 5.4.4 Hon'ble Prime Ministers Reconstruction Programme

The Hon'ble Prime Minister of India during his visit to J&K in November, 2004 announced a Re-construction Plan in infrastructure for the state. The objective of the scheme under the program is to develop infrastructure at 220KV and 132KV level by way of construction/ Augmentation of Grid Stations, new lines and thickening of conductors in existing lines. Originally the project was estimated to cost around INR 707.00 Crore based on cost data 2003. The project was scrutinized by CEA and the project cost was revised to INR 1,006.51 Crore subsequently. Accordingly, the revised project amount of INR 1,351.00 Crore was furnished to CEA for approval and the Project Report was approved for INR 1,350.00 Crore. Out of this cost, an amount of INR 1,048.56

Crore was spent till March 2011.

#### 5.4.5 Rural Electrification Programme

Under the rural electrification programme in J&K a total number of villages/ hamlets electrified rose to 14,229 by 31-03-2011. Under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) schemes target was to electrify 283 un-electrified/ de-electrified villages, out of which 169 villages were successfully electrified by Oct-2012.

- RGGVY is a scheme for 100% Rural Electrification.
- 14 Schemes covering whole of J&K were submitted to Rural Electrification Corporation (REC) at a total estimated DPR (Detailed Project Report) cost of INR 1,051.73 Crore. All these schemes have been sanctioned by REC at a cost of INR 917.02 crore and INR 741.36 Crore was released. An amount of INR 568.57 Crore has been spent by end of March 2012.
- RGGVY Schemes aims at envisage electrifying 365 no. un-electrified villages and de-electrified villages, which are financially viable for electrification within the Grid System.
- 3,03,682 no. Rural Household connections are proposed under the RGGVY schemes.
- 1,10,337 no. BPL households are earmarked for free electrification and 5,889 no. already electrified villages to be covered for intensive electrification under the scheme.

- As per guidelines of RGGVY, National Hydroelectric Power Corporation (NHPC) and Jammu and Kashmir State Power Development Corporation (J&KSPDC) have been entrusted with the execution in each of the 7 districts, as under;
  - NHPC: Udhampur, Kathua, Jammu, Srinagar, Budgam, Leh and Kargil.
  - J&KSPDC: Kupwara, Anantnag, Doda, Baramullah, Pulwama, Rajouri and Poonch.
- Projects upto 10 MW are reserved for state subjects with relaxed technical criteria.
- 15% free power + 1% Local Area Development Fund (LADF) has to be provided to State.
- Projects are to be allotted on Build Own Operate and Transfer (BOOT) basis to be returned to State after 35 years.
- Upfront Premiums ranging from 4.0 lakh to 8.0 lakh / MW as per the capacity of the projects.

#### 5.4.6 State Hydro Policy

State Hydrel policy 2011, notified by the Govt. of Jammu & Kashmir for any new hydro projects of generation capacity from 2 to 100 MW is to be implemented by Jammu & Kashmir State Power Development Corporation Ltd. Projects upto 2 MW have to be implemented by Science and Technology Department. The main features are;

- Tariff based bidding for project above 25 MWs.
- Terminal value for return of project should not be more than 10% of the cost of the project at the time of bidding.
- 30% power (excluding 15% free power + 1% LADF) has to be procured by the State with first right refusal for the

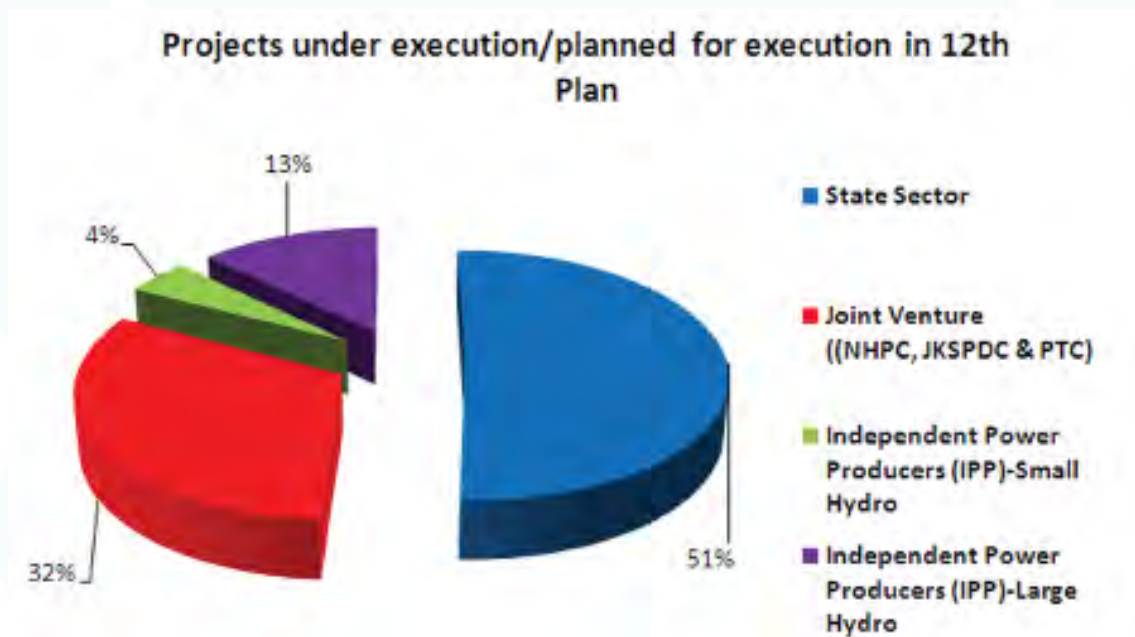


Figure 12: Projects under execution/planned for execution in 12th Plan

remaining Allotment of project through transparent competitive bidding.

- Jammu & Kashmir State Power Development Corporation Ltd. should be the Nodal Agency and responsible for Land acquisition, IWT clearance, Forest clearance etc.
- Incentive should be procured by way of non imposition of water usage charges for 1st ten years, exemption from Entry Tax / Income Tax available to IPPs, besides incentive available from Ministry of New and Renewable Energy (MNRE), GoI.
- Model Implementation Agreement and Power Purchase Agreement (PPA) are integral parts of the reserved Hydel Policy 2011. Timelines / mile stone have been fixed as part of the agreement.

#### 5.4.7 Jammu and Kashmir Energy Conservation Act, 2011

The Jammu & Kashmir Energy Conservation Act, 2011 as passed by the Jammu and Kashmir State Legislature was approved by the Governor on 23<sup>rd</sup> April, 2011. Salient features of the state EC act, 2011 are given below:

- Establishment and incorporation of Bureau of Energy Efficiency.
- The head office of the Bureau shall be at Jammu/ Srinagar.
- Management of Bureau: The general superintendence, direction and management of the affairs of the Bureau shall be under the Governing

Council's purview. The Governor council would consist of ten to fifteen members appointed by the Government.

- The Bureau shall effectively co-ordinate with designated consumers, designated agencies and other agencies, recognize and utilize the existing resources and infrastructure, in performing the functions assigned to it under the Act.
- Bureau shall recommend amendments or modifications in the norms for processes and energy consumption standards to the Government to suit the regional and local climatic conditions of the State Bureau shall recommend on the energy conservation building codes to the Government with respect to use of energy in the buildings.
- Prescribe guidelines for energy conservation building codes specified by the Government.
- The bureau shall support the Government for issuing energy savings certificates.
- Strengthening of consultancy services in the field of energy conservation.
- Promote research and development in the field of energy conservation.
- Develop testing and certification procedure and promote testing facilities for certification and energy consumption of equipment and appliances.
- Formulate and facilitate implementation of pilot projects and demonstration projects for promotion of efficient use

of energy and its conservation.

- Promote use of energy efficient processes, equipment, devices and systems.
- Promote innovative financing of energy efficient projects.
- Support financial assistance to institutions for promoting efficient use of energy and its conservation.

## 5.5 Key Priorities

The following key priorities for the sector were identified after detailed deliberation with the working groups. The priorities are in line with the concerns raised due to the negative effect of the climate change and the state's response.

### 1. Establishment and incorporation of Bureau of Energy Efficiency, J & K EC act 2011

As per The Jammu and Kashmir Energy Conservation Act (J & K EC Act), 2011 a Bureau has to be formed. The Bureau shall be a body recognized by the name, "Bureau of Energy Efficiency". The bureau would have perpetual succession and a common seal, with powers subjected to the provisions of the Act. Under the Bureau, a statutory body/nodal agency need to be formed by the state to implement energy conservation measures at state level. The main objective of the scheme should be to build capacity of the nodal agency to enable them to discharge regulatory, facilitative and enforcement functions under the J&K

EC Act 2011. The scheme would develop and implement Energy Conservation Action Plan (ECAP) based on a uniform template prepared to take necessary measures to build institutional and human capacity, enable the nodal agency to implement energy efficiency programmes and undertake evaluation and monitoring of the Energy conservation activities implemented in the state.

Newly formed statutory body/nodal agency have limited experience in energy efficiency / conservation activities. This has led to the need for capacity building, enhancing the understanding and knowledge about energy efficiency, having a common action plan to implement measures to reduce energy intensity of the State etc. The proposed scheme of the BEE, J&K therefore enables statutory body/nodal agency to:

- a) Prepare a five year ECAP
- b) Implementation of ECAP with yearly deliverables
- c) Enhance capacity to undertake regulatory duties that they are required to perform under the Act.

The Bureau should provide financial support to the statutory body/nodal agency for strengthening their institutional capacity and carry out the following activities:

- Creation of IT infrastructure
- Creation of database for Energy Managers / Energy Auditors and Designated Consumers and other stakeholders.



- Organizing workshops / training programmes.
- Creating awareness through electronic media / print media.
- Preparation of Detailed Project Reports of Govt. Buildings under IGEA.
- Implementation of Energy Efficiency Demonstration Projects in the area of energy efficient street lighting, revamping of drinking water pumping system and energy efficiency in SMEs clusters.
- To replace the existing Incandescent Light Bulbs (ILBs) in the households and the street lights of one village with LEDs.

## 2. Promoting Energy Efficiency in Small and Medium Enterprises (SMEs)

Energy use & technology gap study and cluster specific manual on energy conservation opportunities need to be prepared for better understanding of EE in SME sector in J & K. Small Industries Development bank of India (SIDBI)/IndiaSME Technology Services Limited (ISTSL) are already involved in preparation of DPRs on energy efficient technologies in SME clusters in different states. BEE also initiated the Small Group Activities (SGA) and Total Energy Management (TEM) programme to introduce the energy efficiency practices in SMEs with support of experts from Japan.

## 3. Promoting Energy Conservation Building Code (ECBC)

The Energy Conservation Building Code (ECBC) was launched by the Government of India on 27<sup>th</sup> May, 2007. The ECBC sets minimum energy standards for new commercial buildings having a connected load of 100 kW or contract demand of 120 kVA in terms of Energy Conservation (Amendment) Act, 2010.

Labeling programme for 3 categories of buildings (day use office buildings/BPOs/ Shopping malls) have been developed and put in public domain. Till now 136 buildings have been found eligible for issue of label. The ESCO model has been promoted for carrying out energy efficiency measures in existing buildings through performance contracting.

## 4. Renovation and Modernization of Hydro-power Projects

Hydro power stations are generally designed with a projected operational life of about 35 years, though equipment start wearing out from commencement of regular operation. As a result, the performance of the plants gradually declines over time. This necessitates Renovation & Modernization work of older power stations. Before the plants complete their productive lifecycle, they should be renovated and modernized to revamp their performance. The Renovation, Modernization and Upgrading (RM & U) involves sizeable capital investment.

***The main objectives of undertaking RM&U are as follows:***

- (i) To protect against deterioration of performance.

- (ii) To improve availability, reliability, efficiency and safety of the equipment.
- (iii) To regain lost capacity.
- (iv) To extend the productive life.
- (v) To save investments on new equipment

Following projects are under RMU in the State:

on the states without sacrificing the service obligation. It can also help in creating access to subsidies for beneficiary farmers for electricity conservation (estimated 30-40%) with replacement of inefficient pump sets with energy efficient ones. Implementation of the action plan is planned through following sub activities:

- (i) Preparation of scheme to provide with financial incentive to farmers on use of

Table 24: List of Hydro Power project (with capacity) under renovation and modernization

S. No.	Name of the Project	Capacity in MW
1.	LJHP	105.00
2.	Chenani-I	23.30
3.	USHP-I	22.60
4.	Karnah	12.00
5.	Mohra	9.00
6.	Satkna	4.00
7.	Iqbal	3.75
8.	Haftal	1.00
9.	Hunder	0.40
10.	Bazgo	0.30
11.	Sumoor	0.10
<b>Total</b>		<b>181.45</b>

## 5. Development of comprehensive scheme for promotion of energy efficient pumps in agriculture sector

Jammu & Kashmir's Agricultural sector accounts for around 3.5% of the power requirement of the State. Promotion of energy efficient agricultural pump sets would reduce the overall power consumption, improving performance for ground water extraction and reducing the subsidy burden

energy efficient agricultural pumps.

- (ii) Replacement of inefficient agricultural pumps with energy one.

## 6. Reducing Transmission and Distribution (T & D) Losses

Reduction of T&D losses is a prime focus in the energy sector as that would directly result in greenhouse gas emission reduction and ensure energy security. Implementation of

the action plan is planned through following sub activities:

- (i) To assess the current T&D loss pattern and plan measures to reduce losses through increasing of energy efficiency and reducing pilferage.
- (ii) Renovation of existing transmission and distribution network.
- (iii) Replacement of Existing Transformer with star rated transformer.
- (iv) 100% consumer metering to reduce AT&C Losses - Involving Installation of SCADA system and metering arrangement for on-line remote monitoring system right from grid sub-station till the consumer end having a connected load of 20 kW and above.
- (v) Implementation of feeder level metering at distribution level.
- (vi) Consumer level metering through a cell to formulate and carry out vigilance activities.
- (vii) To introduce franchise model for distribution to reduce commercial losses and better management of the distribution system;
  - a. Formulation of Project management unit to facilitate for franchisee for 3 years
  - b. Impart training
  - c. Training and providing support to prospective entrepreneurs.

## 7. Promoting Demand Side

## Management (DSM) and energy efficiency

DSM and energy efficiency would reduce the demand for energy and therefore reduce carbon emissions. Under this initiative, a comprehensive policy and plan to save energy in order to reduce the demand–supply gap and contribute towards abatement of climate change effects would be undertaken. This would include the following activities: (i) Implementation of utility level DSM measures, (ii) Awareness generation for Energy Conservation, (iii) Promotion and implementation of the National Bureau of Energy Efficiency’s ECBC norms in the state to limit the energy consumption in buildings and (iv) For proper energy monitoring, capacity building of energy auditors, strengthening the existing Energy Conservation Cell under the Energy Department supporting with manpower and infrastructure.

## 8. Decentralized power generation

The power sector of the state suffers from lack of proper transmission network. Transmission, Sub-Transmission and Distribution lines are very old and owing to the brittle conductors, energy loss during transmission is high. Promotion of evacuation of power from decentralized renewable energy power projects including micro hydro, run off the river, Solar (PV & Thermal both), IPP, CPP and high voltage transmission infrastructure for power evacuation and import of power from regional grid is planned through evacuation corridors. The fulfillment of the overall objective is planned through the following sub activities:

Encouragement for Decentralized generation of power to reduce the T&D Losses by introducing schemes and policies

- a. Carrying capacity study and resource mapping of each of the districts for setting up possible power project.
- b. Preparation of techno economic feasibility report for the requirement of transmission network.
- c. Applying budgetary provision through international funding and private sector investment.

## 9. Harnessing the biomass potential

Promoting on-grid and off-grid biomass power projects would reduce the carbon emission through reduced use of grid power. Under this initiative, the following would be done to harness the biomass potential to its maximum: (i) Study the existing policy and develop investment friendly policy to promote additional biomass application (ii) Conducting a detailed feasibility study for scoping biomass-based project (iii) Developing a biomass supply chain involving agro, agro industrial and other biomass resources including dedicated energy plantation (iv) Promoting biomass based gasifier project in agro based industries (v) Raising awareness (vi) Creating a conducive scenario for investment and (vii) Implement demonstration/pilot projects if required.

## 10. Development of policy for mandatory use of efficient light particularly for commercial

## organizations in the state

Most of the energy is consumed for lighting purposes. The demand is on a rise with construction boom especially in state like Jammu & Kashmir. This means regulations in energy usage for lighting purposes can make a major contribution in containing the issue of climate change and energy efficiency. There are three key elements to achieve progress:

- (i) Use less energy
- (ii) Replacement of all inefficient lighting system with energy efficient systems.
- (iii) Use of renewable energy (e.g. Solar PV, lantern, etc).

State Govt. should develop a policy framework on using energy efficient lights in domestic & commercial buildings, Govt. & private offices, education institutes, hospitals, colonies, etc.

## 11. Expansion Conversion of conventional street lights to solar LED/CFL street lights

Energy from the light of the sun (photovoltaic) can be used to produce electricity. Though the equipment is expensive, maintenance requirements minimal and there is no fuel cost. They are far less expensive than building new power plants and grid distribution systems for rural areas not covered by grid electricity. Energy from the heat of the sun (solar thermal) can be used economically for water and room heating purposes. Conventional street lights can be replaced by solar LED/CFL based street lighting system.

- (i) Preparation of pre-feasibility study.
- (ii) Fund identification.
- (iii) Implementation strategy

## 12. Maximizing solar power usage and Encouraging use of Solar Gadgets (especially in Industries):

The use of fossil fuel based power and therefore carbon emissions can be reduced with use of solar gadgets. Hence adequate incentives should be provided for the same. Under this initiative, the state would promote both solar photovoltaic as well as solar thermal. An increase in market penetration of stand-alone solar systems for use by institutions, communities and individuals is being proposed. A range of activities –promotional policy initiatives, survey, feasibility reports, demonstration projects, awareness creation and capacity building, and strengthening the manufacturing base would be undertaken. All of these would lead to increased use of solar gadgets in the state. Industrial energy measures should strengthen the business case for investing in higher efficiency equipment and solar gadgets. Compliance of the action plan is planned through following sub activities:

- (i) State level policy framework for use of solar gadgets.
- (ii) Using solar PV for outdoor lighting.
- (iii) Using solar water heating system.
- (iv) Carrying out awareness campaign for more solar system installation and use of star rated devices.

## 13. State energy audit policy and Implementation of pilot Energy efficiency project and IGEA

The objective of the pilot initiative is to demonstrate the scope of energy efficiency through implementation of energy efficiency measures. Such action would enhance the capacity of the state nodal agency to undertake similar initiative in the future and also promote such activities amongst the sector. Compliance of the action plan is planned through following sub activities:

- (i) Conducting energy audit by the empanelled organization.
- (ii) Undertaking IGEA in Govt. Buildings, Hospital, Universities, Banks, Hotels etc.
- (iii) Implementation of Pilot energy Efficiency one of the identified pumping Station.
- (iv) Implementation of Pilot Energy Efficiency Street lighting Project in one of the Urban Local Bodies (ULB) area.
- (v) Identifying and empanelling ESCOs (Energy Services Company).
- (vi) Taking up joint pilot project with ESCOs.

## 14. Promoting Energy Efficiency Practices in the State

The objective is to create awareness among the sectors (domestic, commercial and industrial) about the benefit and necessity of taking up energy efficiency measures and



also the pathway of achieving the same including promotion of use of star rated gadget. Complying of the action plan is planned through following sub activities:

- (i) Identification of Agencies for the activities.
- (ii) Undertaking sectoral and scoping study of the possibility of energy efficiency in each sector and barriers in taking up the energy efficiency initiatives.
- (iii) Undertaking Training Need Analysis Study for the department, preparation of manual and carrying out pilot workshop.
- (iv) Carrying out awareness campaign towards adopting energy efficiency measures and use of star rated devices.

#### 15. Awareness and implementation for use of CFL and replacing incandescent lamp under Bachat Lamp Yojna, and Umbrella program of BEE

Bachat Lamp Yojana (BLY) promotes energy efficient and high quality CFLs as replacements for incandescent bulbs in households at the price of an incandescent bulb, i.e. INR 15. This would remove barrier of high CFL price (which is currently selling at INR 80 - INR 100 per CFL) and is negating its penetration into households. It targets replacement of about 400 million incandescent bulbs in use in the country, leading to a possible reduction of 4,000 MW of electricity demand, and a reduction of about 24 million tonnes of CO<sub>2</sub> emissions

every year. The price differential would be borne by project implementer through carbon credits earned which could be traded in the international market under Clean Development Mechanism (CDM) under the UNFCCC Kyoto protocol. BEE has developed the umbrella framework for BLY-Programme of Activities (PoA) which has been registered under UNFCCC-EB on 29<sup>th</sup> April, 2010. The PoA would define key CDM requirements, including the project baseline, additionality, monitoring protocols through which CO<sub>2</sub> emission reductions would be assessed. The PoA approach reduces time and transaction costs for registering the projects since the key CDM requirements does not need to be addressed by area-specific projects within the PoA.

#### 16. Standards And Labeling Programme

Standards and labelling (S&L) programme has been identified as one of the key activities for energy efficiency improvement. A key objective of this scheme is to provide the consumer an informed choice about energy saving and thereby the cost saving potential of the relevant marketed product. The scheme was launched by the Hon'ble Minister of Power on 18<sup>th</sup> May 2006 and is currently invoked for 12 equipments/appliances, i.e. ACs, Tube lights, Frost Free Refrigerators, Distribution Transformers, Induction Motors, Direct Cool Refrigerator, Geysers, Ceiling fans, Colour TVs, Agricultural pump sets, Liquefied Petroleum Gas (LPG) stoves and washing machines, of which the first 4 have been notified under mandatory labelling from 7<sup>th</sup> January, 2010. The other

appliances are presently under voluntary labelling phase. The energy efficiency labelling programs under BEE are intended to reduce the energy consumption of appliance without compromising with the services it provides to consumers. The scheme aims at providing information on energy performance of appliances based on the standards issued by BEE so that the consumers can make judicious decisions while purchasing appliances. The STAR rating ranges from 1 to 5 in the increasing order of

energy efficiency. In addition to the objective of informed choices to consumers, this program leads to huge energy savings and thereby cost savings. It also reduces capital investment in energy supply infrastructure, enhances the product quality, strengthens the competitive markets, builds position for domestic industries to compete in such markets where norms for energy efficiency are mandatory, removes indirect barriers to trade, reduces carbon emission and helps meet climate change goals.



## 5.6 List of Key Priority Action

Table 25: List of Key Priority Action Mission on Enhanced Energy Efficiency

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Policy development for mandatory Energy Audit in Govt. Building: 1. Identification of Agencies for taking up activity. 2. Scoping study of the possibility of energy efficiency in Govt. buildings (e.g. Civil Secretariat, Hospitals, Irrigation pumping system, Universities, etc). 3. Barrier identification of taking up the energy efficiency initiatives. 4. Undertaking Training Need Analysis Study for the department, preparation of manual and carrying out pilot workshop.	PDD, PWD, Dept of Industry, Department of Irrigation, Health Department, Universities.	Nil	2.50	2.50	GOI
2	Development of comprehensive scheme for promotion of energy efficient pumps in agriculture sector. Replacement of Inefficient agricultural pumps by efficient pumps	PDD, Irrigation Dept., Agriculture Dept.	Nil	0.40	0.40	GOI, EFA
3	Conversion of conventional street lights to solar LED/CFL street lights. 1. Preparation of pre-feasibility study 2. Fund identification. 3. Implementation strategy	UDD, Municipality, PDD	1.00	100.00	101.00	Govt. of J & K, GOI
4	Encourage use of Solar Gadgets in Industries 1. Industrial Energy Efficiency Auditing and Benchmarking 2. State level policy framework for solar gadgets use 3. Using solar PV for outdoor lighting. 4. Using solar water heating system. 5. Carrying out awareness campaign towards taking up solar system installation and use of star rated devices.	Dept. of Industry, PDD, Science & Technology Department	Nil	2.50	2.50	GOI, EFA

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
5	<p>T &amp; D Loss reduction -</p> <ul style="list-style-type: none"> <li>o To assess the current T&amp;D loss pattern, plan &amp; implement measures to reduce losses through increase of energy efficiency in DTs and reducing pilferages through pilfer-proof Boxes, Service Cables and ABC cables for LT lines.</li> <li>o Renovation of Existing transmission and distribution network.</li> <li>o Replacement of Existing Transformer with star rated transformer.</li> <li>o 100% consumer metering to reduce AT&amp;C Losses - Involving Installation of SCADA system and metering arrangement for on-line remote monitoring system right from grid sub-station up to the consumer end having a connected load of 20 kW and above (Bulk &amp; other such categories).</li> <li>o Implementation of feeder level metering at distribution level</li> <li>o Consumer level metering a cell should be formulated and carry out Vigilance activity.</li> <li>o To introduce franchise model in distribution to reduce commercial losses and better management of the distribution system.</li> <li>o Formulation of Project management unit to facilitate for franchisee for 3 years</li> <li>o Impart training Training and imparting support to prospective entrepreneurs.</li> </ul>	JKSERC & JKPDD	1.00	1,000.00	1,001.00	Govt. of J &K, GOI



Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
6	<p>Encouragement for Decentralized generation of power to reduce the T&amp;D Losses by introducing schemes and policy</p> <ul style="list-style-type: none"> <li>• Pugah Geothermal Project (will replace Diesel generation in Ladakh)</li> <li>• Achoora small hydel Gurez (will replace Diesel generation in Gurez)</li> <li>• Preparation of DPRs/PFRs of Micro Mini &amp; Small Hydel Projects. (100 Projects @ INR 10 lakhs per project)</li> <li>• Incentive to Developers for Small Hydel Projects @ 5% of estimated cost.</li> </ul>	JKSERC, PDD, Science & Technology Department, IPPs,	Nil	3,600.00	3,600.00	GoI, APDRP, RGGVY Funding from R&M resources /EFA
7	<p>Development of policy for mandatory use of efficient light particularly for commercial organizations in the state.</p> <p>1. State Govt. policy framework on using energy efficient lights in domestic, commercial building, offices, education institute, hospitals, etc.</p>	JKPDD, PWD, Dept. of Industry	Nil	2.00	2.00	GOI,
8	Awareness and implementation for use of CFL and replacing incandescent lamp under Bachat Lamp Yojana, and Umbrella program of BEE.	JKPDD, UDD, Municipality, PWD.	Nil	200.00	200.00	GOI
9	Promoting efficient brick manufacturing process leading to fossil fuel conservation, preventing denudation of top soil and GHG emission reduction by mandatory use of efficient brick heating/burning.	Dept. of Industries	Nil	2.50	2.50	GOI, EFA
10	<p>Promotion of use of star rated domestic appliances may be encouraged. The shops selling TV, Refrigerators or Washing Machines, Fans etc. may be asked to keep only star rated products.</p> <p>1. Incentivizing local equipment supplier (10% on MRP) for first 3 months from the launching of the scheme.</p>	PDD, Dept of Industries	Nil	1.00	1.00	GOI, EFA



Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
11	Development of policy to mandate ECBC adoption in state.	PDD, S&T Department, PWD, Industry, UDD	Nil	3.00	3.00	GOI
12	Formulation of DSM project for JKSERC 1. Implementation of utility level DSM measures 2. Awareness generation for energy conservation. 3. For proper monitoring, capacity building of energy auditors, strengthening of energy conservation cell under the Energy department supported manpower and infrastructure.	PDD, JKSERC, Dept. Of Science & Technology.	Nil	2.50	2.50	GOI/ EFA
13	Replacement of electric boiler with solar & grid connected hybrid boiler in industrial units	PDD, UDD, Department of Industries.	Nil	2.00	2.00	GOI
14	Energy Audit of Generation Stations & Renovation and modernization of the existing hydro power station	JKSPDD, JKSERC	1570.00	280.00	1,850.00	Govt. of J & K, GOI
15	Transport 1. Promotion of low emission vehicles, electric vehicles 2. Introduction to concept of mass rapid transit	Department of Transport, Department of Urban Development Department	Nil	300.00	300.00	GOI
16	Maximize harnessing biomass potential in the state through cogeneration/thermal/ power plant/ gasification to feed in the grid as green power. Increase in application of CPP both in grid and stand alone mode	PDD, JAKEDA, Dept. of Industries	Nil	50.00	50.00	CFA- MNRE/ IREDA / CDM revenue/ EFA
	<b>Total</b>		<b>1,572.00</b>	<b>5,548.40</b>	<b>7,120.40</b>	













## 6 Mission on Sustainable Habitat

### 6.1 Introduction

Urban sector faces significant impacts of climate change. These impacts potentially have serious consequences on human health, livelihood and socio-economic assets, especially for the urban poor, informal settlements and other vulnerable groups. Climate change impacts range from increase in extreme weather events, flooding to high temperatures leading to public health concerns. As the urban regions of the state are dynamic systems that face unique climate impacts, their adaptation must be location specific and tailored to local circumstances.

The importance of infrastructure and improvement of living standards of population is crucial to sustained economic development. A detailed analysis of the development process over last four decades shows that one of the major reasons for slow economic and social development is the unplanned population growth. The capital cities and other district towns of the state are challenged with problems of

rapid urbanization, expansion of informal settlements, substantial poverty, inadequate infrastructure and environmental degradation. These and other concerns plague cities' ability to grow and prosper. Many of these conditions also limit resilience to current climate variability.

The state government is thus planning to mainstream climate change adaptation in urban infrastructure development. Creating this new possibility of adaptive resilience would support a new future in the face of climate change. The concerned departments prepared the action plan prioritizing actions in line with National Climate Change Action Plan for the sustainable habitat sector.

### 6.2 Key trends in the sector

The state is situated at high altitude and has a mountainous terrain with unfavorable climatic conditions. Most of the urban population of the state is usually concentrated in towns and cities. More than 60% of the urban population of the state is concentrated in class I towns, also the net addition to the

population of these towns has been the highest (SDR, J&K 2003).The population size, growth, composition and quality play an important role in the development process.

*Table 26: Urban Population*

Description	2001	2011
Total Population	1,01,43,700	1,25,48,926
Male	53,60,926	66,65,561
Female	47,82,774	58,83,365
Rural	76,27,062	91,34,820
Urban	25,16,638	34,14,106
Urban population as percentage of total population	24.81	27.21

*Source: Digest of Statistics, J&K, 2010-11*



*Figure 13: District Map of J&K*

The main developmental issues in the context of urban areas of the state are being taken care of by two main Municipal Corporations -Jammu Municipal Corporation and Srinagar Municipal Corporation. There are about 83

Municipality/ Municipal councils all over the state. The urban population is spread across all the districts of the state, with Srinagar, Jammu, Leh, Baramulla and Udhampur having high population concentration. All



these districts have major cities and divisional administrative headquarters. The capital cities of Srinagar and Jammu have always been the traditional growth centres. Most of the small and medium towns are extending due to uncontrolled population growth.

The existing urban infrastructure along with the core urban public services such as water supply, sanitation and sewerage, urban roads and solid waste management do not suffice for the growing urban population. The Sanitation facilities in urban areas lack sewerage systems in urban areas resulting in pollution of the nearby water bodies due to release of untreated effluents. Poverty and lack of livelihood amenities in rural areas has led to migration of population to urban areas. This has posed threat to the availability of proper human habitat. Lack of sewerage system, indiscriminate developmental activities have led to contamination of the water bodies, drain and obstruction in the rainwater outlets.

Overcrowding and expansion of slums, increasing scarcity of water supply, inadequacies of public health facilities and sanitation system, and mismanagement of waste materials are the major problems dogging the urban areas. Moreover, rampant growth of private housing colonies, which in most cases are not well planned, leads to issues for urban local bodies to ensure basic amenities to these colonies. Most of these colonies have turned into slums adding to the problems in the Srinagar city.

### 6.2.1 Solid waste

Solid waste management is emerging as an essential urban and industrial issue. The Municipal Solid Waste (MSW) generated in Srinagar city in 2010 was around 394 MT/day of which around 220 MT/day was disposed as landfill at SyedporaAchan(SOE report 2012). Majority of slaughter houses in Srinagar city have the slaughtering areas within their premises. The waste is released into the surface and underground drainage system. In Jammu, the MSW generation is estimated to 350 – 400 MT/day, out of which 300 MT/day solid wastes are collected and sent to Dumping Site at Bhagwati Nagar.

### 6.2.2 Transport

The transport sector contributes majorly to the Green House Gas (GHG) emission in the state. It is estimated that the number of vehicles in the State would be multiplied two times every five years adding significantly to the quantum of emission of GHG. Roads are the primary mode of transport available in Jammu and Kashmir. Therefore, along with the road length, the number of vehicles has risen significantly. The State Government regulates road transport facilities under the provisions of Motor Vehicles Act, 1988. The number of registered vehicles has reached to 8.1 lakh as on 31<sup>st</sup> March 2009 which accounts for 47,000 extra vehicles than the last year. This figure corresponds to an annual percentage growth of figure 7.63%. Details of public and private transport are given in table blow:

Table 27: Types of vehicles registered in the State

Sl. No.	Type of vehicle	Total Registration
1	Buses	10,360
2	Mini buses	15,411
3	Trucks/ tankers/ MGVLGV	48,190
4	Cars	1,92,793
5	Jeeps	11,791
6	Taxis	25,308
7	Motor cycle/ Scooter	4,30,844
8	Auto rickshaws	39,753
9	Tractors	20,296
10	Trailers	667
11	Other (Ambulance, Record rollers dozers etc)	15,081
	<b>Total</b>	<b>8,10,494</b>

Source: J&K Transport Department, 2009-10

## 6.3 Vulnerability of the sector

Cities and towns of Jammu & Kashmir have always been vulnerable to natural hazards such as earthquakes, cloudbursts, snow storms, floods, droughts, avalanches and landslides. In some situations, cities experienced increase in the frequency of existing climate-related hazards, such as flooding. Due to the peculiar topography, rugged terrain, extreme weather conditions and underdeveloped economy, the state has always been prone to natural disasters and its after effects. Jammu and Kashmir has witnessed many cases of natural disaster in the 19th and early 20th centuries.

Such events not only disrupt economic activity but also lead to immense hardship for the affected population. The signs of

changing climate has already manifested through extreme weather conditions which have been further aggravated by many ill-practices resulting in deforestation and environmental degradation.

Within the cities of Jammu & Kashmir, the poor are typically the most vulnerable. They tend to live in slum/informal settlements, often located in areas most exposed to the effects of global climate change, steep slopes and ravines. Little or no infrastructure exists to provide protection from storm events or to ensure mobility. Reflecting the low and unstable incomes of the residents, but exacerbated by poor land tenure characteristics, little or no building regulation, and lack of housing finance, low housing quality results poor resistance to natural disasters. The inherent vulnerability of these settlements within the urban areas of the

state is amplified as the effects of climate change become more pronounced.

The signs of climate change at present are mainly visible through rise in temperature or increase or decrease in rainfall. Also frequent rainfall makes urban living highly vulnerable to floods and landslides. Indian Meteorological Department (IMD) monitoring reveals that temperature is increasing in both the regions of Jammu & Kashmir with significant increase in Maximum temperature by 0.05°C per year in Kashmir Valley and minimum temperature in Jammu region by 0.08°C per year (Jaiswal&Rao, IMD Pune, 2007).

### 6.3.1 Flashfloods and Landslides

Cloudbursts and flash floods are common features in different parts of the state which are usually responsible for loss of life and property. Flash floods are mainly caused due to glacial melting as a result of glacial melting. Suru basin and Kolhai are the prominent examples. They have lost about 16% and 18% of the total volume respectively. It is observed that flash floods cause tremendous loss in catchment of Jhelum, Chenab and Tawi rivers. Low-lying areas of the Kashmir Valley, especially Sonawari, Awantipora, Srinagar, along with parts of Jammu are prone to flood. Upper catchments of all tributaries of Jhelum, Indus, Chenab and Tawi rivers are also prone to flash floods.

Landslides are common phenomenon across the state. Large and small landslide occurs every year in all three region of the State. These are complex disaster phenomenon caused by heavy rainfall, snowfall and

earthquakes. Also, downhill creep causes landslips and landslides. The area between Batote and Banihal on National Highway is prone to landslides.

## 6.4 Key issues in the sector

The issues related to the people's habitat are considered the vital indicators for assessment of the living condition in an identified geographical area.

Solid Waste generated from urban household is normally collected and dumped in an unscientific manner to nearby dumping grounds. Absence of proper segregation system and scientific treatment and disposal procedure leads to unhygienic condition near the urban areas across the state. Different wastes and waste management activities have varied impacts on energy consumption, methane emissions and carbon storage. Recycling reduces Green House Gas (GHG) emissions by reducing methane emissions from landfills. If energy is generated from the waste the consumption of energy from fossil sources would reduce. Inadequate collection and improper disposal system currently lead to spillage and contamination of soil and surface as well as groundwater streams. Integrated Solid waste Management facility is still not implemented within the state. Moreover, the solid and liquid waste generated from the slaughter house has a detrimental effect on the nearby water bodies and also the aesthetic environment.

Sanitation possesses major problems in the absence of any sewerage system in urban areas resulting in release of domestic

effluent into nearby rivers and streams leading to contamination of water sources. Indiscriminate developmental activities also add to the problem by jamming drains and encroaching on rainwater flow paths.

The urban transport sector has been largely neglected in the State, characterized by heavy traffic congestion due to narrow roads, rapid growth in number of vehicles along with highly concentric development. Often

there are days when some areas remain inaccessible due to landslides, snowfalls or other damages caused by heavy rains. Public transport is limited due to inadequate road network, poor infrastructure and scattered demand.

In order to combat these odds through a sustainable strategy for climate resilience, the state has envisaged some key priorities in the urban sector.

*Table 28: Adaptation Pathways with respect to climate change in State*

Issues	Impact	Pathways
Warm and Humid summer and cold winters	Increased demand for cooling	Create awareness to retrofit building with green design; policy incentive for usage star rated HVAC products
Energy Usage	Higher concentration and higher use	Utility DSM measures in street lighting, solar water heating
Increase in natural hazard like earthquake, flashflood, Cloudbursts, landslides etc.	Increase loss of human settlement and loss of lives	Policy formulation on hazard resistant settlements within populated urban areas and awareness for hazard preparedness to minimize loss of property and lives.
Heavy and aberrant precipitation	Increased storm-water runoff	Development of storm water management plan and investment in sewerage; re-assessment of master plans/land use plans of urban agglomerations, policy incentive use of permeable surfaces and incorporation in the PWD codes
Enhanced waste generation due to urban agglomeration by population influx	Health hazards, soil contamination through leaching, odour pollution	Awareness for waste segregation and policies for land filling of waste
Decline in the forest cover	Decrease in bio-sequestration of atmospheric carbon dioxide, incur significant adverse soil erosion and frequently degrade into wasteland.	Planting heat tolerant trees, city wide programmes for tree watering and maintenance, roadside plantation programme, development of parks
Transport system congestion and ageing	Congestion and higher GHG emission	Phase out of old vehicles, integrated traffic study, congestion reduction plan and implementation of intelligent transport system



## 6.5 Programme and Policies in the sector

The following key policies are in place that would be able to address the impacts of climate change and also reduce the sectoral contribution to climate change. The Housing and Urban Department is responsible for implementation of these schemes/ programs.

### 1. Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

The State government has adopted several urban development schemes such as the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). JNNURM was launched by Government of India on 3rd December, 2005 and it started its implementation in the State in 2007. It is a reform driven fast track programme to ensure planned development of identified cities. It focuses on efficiency in urban infrastructure/service delivery mechanism, community participation and on enhancing accountability of the Urban Local Bodies. The main thrust areas of JNNURM are Water Supply Including Sanitation, Sewerage, Solid Waste Management, Road Network, Urban Transport, Integrated Development of slums, Re-Development of Inner (Old) City.

### 2. Capital City Development Programme (CCDP)

The scheme is being implemented in two capital cities of Srinagar and Jammu to provide basic civic amenities primarily in Construction of lanes/ drains/ culverts, construction of bath rooms/ lavatory

blocks, development of Parks/ play grounds/ graveyards, development of roads, etc.

### 3. Integrated Development of Medium Towns

The scheme is implemented by the Urban Local Bodies in all towns other than Srinagar and Jammu Cities for providing basic civic amenities. The scheme is implemented through the Municipal Councils/Committees and the funds are routed through the Directors of Urban Local Bodies Jammu and Kashmir. The other scheme with same objectives known as Urban Development Scheme (UDS) is a District Sector scheme and administrated by the District Development Commissioners.

### 4. Urban Transport

The funds under this scheme were provided to Srinagar Development and Jammu Development Authorities for construction and up-gradation of Bus Terminals and other Mini Bus stands to resolve the transport related problems of Srinagar and Jammu Cities till 2009-10. During the previous financial year the scheme was extended for other towns of the State and the funds were released to two Directors of Urban Local Bodies for Urban Transport.

### 5. Drainage Sector

The Department contemplates to provide proper drainage network in the State. Accordingly various schemes/works under this sector have been taken up to be executed through Srinagar/Jammu Municipal Corporations and Directorate of Urban Local

Bodies, Kashmir/ Jammu. An allocation of INR 2,000.00 lakh were provided during the year 2011-12 and have been proposed to retain the same for the current financial year under this sector.

## 6. Integrated Low Cost Sanitation Scheme

This is a centrally sponsored scheme aiming to convert /construct low cost sanitation units through sanitary two pit pour flush latrines and new latrines for EWS households without latrines. About 56 projects for conversion/ construction of 5,901 units have been sanctioned by Government of India (GoI).

## 7. Dal Development

The Dal Development Programme has two components - Conservation/ Management Plan of the Lake and Rehabilitation / Re-Settlement of Dal Dwellers & Lateral Sewer lines/ house connectivity. The Conservation

Management Plan of the Lake is funded 100% by GOI and the Rehabilitation has to be borne by the State Government. The rehabilitation plan has been worked out and land at Rakh-i-Arth, measuring about 3,000 canals is being developed in the first phase. There are other components for establishing the Housing colony at Rakh-I-Arth to be funded through State Plan besides funds for construction of secondary sewers and laterals of the Sewerage System.

## 8. Sewerage Sector

Three sewerage schemes viz Sewerage Project TalabTiloo at Jammu, Sewerage Project in Brari Numbalat Srinagar and Sewerage Project in Khushalsarat Srinagar are under execution under this sector. The pilot Project TalabTillo has been commissioned. The amount shall be utilized to provide house connections through chambers in major portion of the area covered under the project. The STP of 10 MLD capacity is ready



to be commissioned provided the house connections are made.

## 6.6 Key Priorities

Jammu & Kashmir is characterized by an increasing altitude as one moves towards north, thereby decreasing temperature. Thus, Jammu is 366 m above the mean sea level with annual mean temperature of 24.5°C and sub-tropical climate. Kashmir is at an altitude of 1,585 m above mean sea level with a mean annual temperature of 13.3°C and comes under temperate climate, while Ladakh is at a height of 3,505 m above the mean sea level and experience sub-arctic climate. The state has a hilly topography and one of the most vulnerable states to the effects of climate change such as warmer temperatures, unusual rainfall, landslides. At the same time, better urban planning and policies can reduce energy use and Green House Gas (GHG) emissions and improve the resilience of urban infrastructure to climate change, thereby shaping future trends. Lack of suitable livelihood and employment facilities added to uncontrolled exploitation of natural resources. Moreover, the state is situated adjacent to three other countries which are equally vulnerable to natural disasters. This necessitates special attention for initiatives on mitigation and adaptation under sustainable habitat mission.

The state has identified key priorities with high importance and out of that five actions are adaptation activities and eight are mitigation activities. The high priorities identified are based on the basis of cost effectiveness, cost-benefit, feasibility, ease of implementation

and overall sustainability. Within the Sustainable Habitat sector, six key priorities are put under the transport infrastructure sector and seven priority actions are under sustainable urban development sector. The total budget proposed for the thirteen key priorities along with sub activities is INR 96885 Lakh or INR 968.85 Crore.

Under a policy scenario with implementation of national emission reduction strategies, aggregated mitigation costs can be reduced if economy-wise environmental policies are complemented by urban policies, such as congestion charges or increasing spatial density. This is due to complementarities with other policy objectives, such as lower local pollution and health benefits, and enhancement of city attractiveness and competitiveness through lower local pollution levels. The identified key priorities consist of multiple opportunities for the mitigation activities to explore the carbon markets with several mechanisms like **Clean Development Mechanism (CDM), Voluntary Carbon Standards, Nationally Appropriate Mitigation Action (NAMA) etc.** The revenue generated from the mitigation activities can be used for their effective operation. Involvement of State Government through **“climate sensitive”** urban planning and management can help achieve national climate goals and minimise tradeoffs between environmental and economic priorities at local levels. While local authorities can help to achieve national climate goals through urban policies to reduce energy demand and improve resilience to climate change, national governments can help to create a sound



institutional foundation and knowledge base to support local decision makers engage with stakeholders to identify and carry out cost-effective actions.

State governments are acting on climate change issues, even without national policies through local regulations, urban services,

and programme administration. The two capital cities can stimulate green jobs by raising consumer awareness, raising the eco-efficiency of local business, facilitating clean-tech start-ups and supporting training programmes. The following action points have emerged out of several rounds of discussions among the working group members.

### Key Priorities: Sustainable Habitat

1. Promotion of battery operated (charged from solar power) transport systems in tourist places, battery driven motor boats instead of diesel engine boats (battery charged from solar module mounted on the boat) and use of alternative fuel instead of diesel to drive Barges and other diesel driven equipment used for maintenance purpose in the lake
2. Capacity building of all levels of stakeholders to make them understand their role on their regards and maintain proper environment management system
3. GHG accounting study on emission by transport vehicles
4. Establishment of intelligent transport system
5. Policy framework in transport sector
6. Promotion of public transport and mass transport & Promotion of water transport
7. Establishment of end-to-end solid waste management system
8. Reallocation of the hotels or application of STP near Dal lake & DPR preparation on STP
9. Base line study on solid waste and industrial waste generation and DPR preparation & four pilot project implementation
10. Capacity Building/ Awareness Generation Program on segregation of solid waste at household level
11. Establishment of segregation mechanism of bio-medical waste in urban hospitals and in rural PHCs
12. Application of methane capture technology and preparation of fertilizer from weeds generated in Dal lake



1. Promotion of battery operated (charged from solar power) transport vehicles for tourist zones, battery driven motor boats instead of diesel engine boats (battery charged from solar module mounted on the boat) and use of alternative fuel instead of diesel to drive Barges and other diesel driven equipment used for cleaning the lake

State Government has planned to promote research, development and demonstration projects in the field of Battery Operated Vehicles (BOVs) under the Alternative Fuel for Water Transportation primarily in tourist places. The objective of the programme is to promote non-polluting Battery Operated Vehicles (BOVs) in the state, which would help in conserving diesel oil and curb environmental pollutions.

Dachigam National Park is kept out of bounds for the daily tourists by the Forest Department, only few tourists are given entry with special permission from the Tourism Department. This is to prevent the sound and noise pollution caused by the tourist vehicles that enter the sanctuary boundaries. Green or Eco – Friendly Vehicles such as Battery or Fuel cell operated vehicles including solar/battery operated vehicles with low sound pollution could be the effective. Similarly, for water transportation which is a primary transportation system throughout the Dal lake, Battery Operated Vehicles (charged from solar power) should be introduced. These

measures would reduce the Green House Gas (GHG) emission from the diesel operated motor boats as well as the consumption of fossil fuel.

2. Capacity building of all levels of stakeholders for better understanding of their role and maintain proper environment management system

The state government has emphasized on the need for capacity building of the officials and other stakeholders on climate change related issues, implications and possible adaptive and mitigating measures. This would enable them to include climatic considerations and proper environmental management strategies in their departmental planning as well as day to day operation and monitoring activities. The process should begin with a training needs assessment for all relevant departments and agencies. This might be followed with training modules especially on overall climate change issues, environment management, solid waste management, water management and urban management would be conducted and subsequent training would be imparted. Capacity building would also be extended to awareness generation on good practices such as source segregation of waste and energy efficiency.

The identified key priorities are based on the cost effectiveness, feasible options, sustainability and ease of implementing with respect to the present condition. New or reformed institutions are needed to enable state governments to facilitate capacity building and decision-making on climate

change at the local levels. A comprehensive capacity building programme on climate change is necessary which would help to generate awareness and increase the knowledge base of responsible stakeholders, officials, policy makers for better climate change adaptability. The action is necessary before implementation of any climate change mitigation initiatives for a comprehensive knowledge base for better understanding and better implementation of the initiatives. Department of Urban Development would be primarily responsible for this key priority action.

### 3. GHG accounting study on emission by transport vehicles

Measures to reduce GHG emissions from all sectors must be immediately taken to minimize climate impacts. Transportation sector contributes largely to overall GHG emissions throughout the state and is rapidly growing. The state government would undertake GHG emission estimation from the transport sector (both surface and water transport sector) so that proper mitigation action could be planned. Based on the outcome of the result state government would also formulate new transport policies throughout the state.

### 4. Establishment of intelligent transport system

Road traffic congestion is a regular problem within the state of Jammu & Kashmir. Due to its unique geographical characteristics and adverse climatic conditions road networks are affected severely. The problem is mainly

felt in the state capitals as well as district headquarters. This is primarily because infrastructure growth is slow compared to growth in number of vehicles, space and cost constraints. Better traffic management would limit the CO<sub>2</sub> emission, reducing stop-go traffic and discouraging excessive speed. Intelligent Transport System (ITS) techniques have to undergo adaptation and innovation to suit the traffic characteristics of the hilly terrain and narrow roadways in J&K. Apart from adopting traditional sensors to chaotic traffic conditions, efforts can be made to design new sensing solutions for chaotic traffic. There is scope for evaluating existing ideas for the challenging traffic scenarios, innovate new solutions and empirically evaluate ideas in collaboration with public and private sectors.

State Government is planning to adopt the ITS for better management of increasing traffic congestion leading to higher GHG emission. Adopting ITS can reduce the GHG emission and more efficient transport system which would also contribute to the overall economic growth of the state.

### 5. Policy framework in transport sector

Climate Change poses two fundamental challenges to the transport sector; the sector would have to significantly reduce Green House Gas (GHG) emissions which needs investment for adaptation to impacts of climate change. The scale and scope of emission reductions sought by policy makers is a challenging task but there is much that can still be achieved within the sector at

low cost while the cost of energy prices are increasing rapidly.

The state government is planning to formulate cost effective mitigation policies that can minimize the GHG emissions from the transport sector. Regional circumstances within the state would play an important role in determining the allocation of effort. The new transport policy would focus to curb GHG emissions resulting from the transport sector throughout the state.

## 6. Promotion of public transport and mass transport & Promotion of water transport

Transport is the fastest growing source of Green House Gas (GHG). A shift towards sustainable transport and urban development would reduce environmental costs and reliance on fossil fuels. Vehicular emissions have two negative impacts on environment: one is global climate change through increase in GHG emissions and the other is air pollution and its negative health repercussions. The total number of registered motor vehicles has increased in the two wheeler segment comprising of motorcycles, scooters and mopeds. The number of two wheelers has grown rapidly amongst personalized modes of transportation emitting the maximum Carbon Dioxide (CO<sub>2</sub>) and Carbon Monoxide (CO) than the other vehicles. Out of all the pollutants, CO<sub>2</sub> is a potent GHG and CO is considered as the major air pollutant.

General public transportation falls into the category of Mass Rapid Transit (MRT), or

modes of urban transportation that carry large volumes of passengers quickly. State Government is planning and prioritizing their budgets to allocate more funds in order to build new public transportation systems and expand or improve upon old ones. The improved public transportation systems would encourage use of public transport in place of personal vehicles. This would require employers to subsidize mass transit fees for their employees. Water transport is a major transportation system within the state and contributes significantly to the economy of J&K. Water transport system can also be encouraged for Mass transit using cleaner fuels instead of diesel. This would also significantly reduce GHG emissions throughout the state. The state government is encouraging the usage of water transportation system through introduction of Battery Operated Vehicles (BOVs) and motor boats run by solar charged batteries instead of diesel oil to reduce GHG emission.

## 7. Reallocation of the hotels or application of STP near Dal lake & DPR preparation on STP

Dal Lake is located on the eastern part of Srinagar city on the right bank of Jhelum. 15 major drains of the city open into the Dal Lake, polluting its waters on a daily basis. The untreated sewerage brings with it nitrogen and phosphorus which has changed physical and chemical properties of Dal waters. The sewage generated from entire Srinagar city discharged into Dal lake pollutes the water body significantly. Moreover, increasing

sewage discharged from the nearby hotels and resorts around Dal lake result in a synergistic effect.

Thus state government is planning to implement several sewage treatment plants which would treat the sewage wastes produced from the city and hotels situated near Dal lake before discharging it into the water body. This would reduce the pollution load as well as methane generation resulting from anaerobic degradation of the high organic load of the city sewage. Also the potent GHG emission would be reduced along with restoration of the Dal lake.

## 8. Establishment of end-to-end solid waste management system

The MSW management decisions taken by mayors, county executives, and city and county councils and boards can influence the rate of greenhouse gas (GHG) emissions. Emissions of CH<sub>4</sub> results from the decomposition of biodegradable components in the waste stream such as paper, food scraps, and yard trimmings. The potential of GHGs to cause global climate change is being debated both nationally and internationally. Solid waste management subprojects include construction and upgrading of landfill sites, transfer station, storage and parking facilities for the collection vehicles and procurement of collection and disposal equipments, as eligible under the subproject selection criteria for the Investment Program. The activity is proposed to establish an Integrated Waste Management Plan for cities including measures to improve efficiency of existing solid waste and sewerage management

systems, and incorporate a plan for management of Construction and Demolition (C&D) waste, biomedical waste, and domestic hazardous waste.

Collection and dumping of the solid waste in urban areas is one of the basic responsibilities of the Department. However, the Department does not have sufficient machineries and equipment's for collection and disposal of Municipal Solid Waste. In order to deal with the issue the Department has introduced a scheme in the Annual Plan 2010-11 with proposed 6 SWM projects for the district of Reasi (Katra), Udhampur, Khour (Jammu) Budgam, Pulwama and Kulgam. The SWM is an ever increasing challenge due to constant migration of people towards towns/cities. There are several issues which should be addressed before venturing into a solution for handling huge amount of garbage.

The Urban Development Department might draw comprehensive plan for power generation from Municipal Solid Waste (MSW) and manure production from Municipal Solid Waste. The project could be implemented either through public/private partnership or fund made available through JNNURM sources. MSW projects are also highly suitable to attract CDM benefits. Measures to reduce Green House Gas emission and adapt to expected climate change impacts would put additional pressure on city budgets and increase the need for additional public resources. These mitigation activities would reduce significant amount of GHG emissions and the revenue flow from the sale of emission reductions would help in sustaining the project. The



problem of littering can be well managed with development of suitable linkage or setting up of appropriate infrastructure for recycling of plastics, glass, paper etc. With active participation of people, this can be a sustainable source of livelihood for a larger section of urban population.

#### 9. Base line study on solid waste and industrial waste generation and DPR preparation & four pilot project implementation

There is an urgent need for detailed analysis of the sources of solid wastes from urban and industrial sectors for proper management plan to be formulated. The urban department of J&K is thus planning for a detailed baseline study and preparation of Detailed Project Report (DPR) for the solid waste management activities. The Department is exploring the possibility of engaging consultants for a typical cost effective design accommodating the latest technologies in the area. Subsequent allocations would be made. Thus the study shall contribute to a scientific product such as the development of a methodological approach which can be used by municipalities or research institutions or consultants with similar tasks.

#### 10. Capacity Building/ Awareness Generation Program on segregation of solid waste at household level

The Municipal Solid Wastes (Management and Handling) Rules 2000 are not the only policy documents targeting the issue. The National Environment Policy 2006, lays down the action plan for soil pollution comprising

actions for strengthening the capacities of ULBs for segregation, recycling, and reuse of municipal solid wastes and setting up and operating sanitary landfills, in particular through competitive outsourcing of SWM services. The garbage collection services are often not available to many households. They often fail to dump their garbage on time when the collection vans arrive at their doorstep. Also many have to walk to the municipal containers. The surroundings of the container collection points are often filthy due to littering by residents, animal activities, or lack of site maintenance by the responsible authorities. Indiscriminate dumping into open drains, down banks on the road side and down into gullies, is a major problem within the city area. This other than leading to a visually filthy environment leads to increased health risk by physical contact, vector proliferation and infrastructure damage by flooding.

The Urban development department of the state is planning to provide mass awareness programme with capacity building at household level for proper waste sequestration at source. The wastes can be categorized into biodegradable (wet) and non-biodegradable (dry) wastes. The non-biodegradable (dry) waste would thereafter be segregated into recyclables, non-recyclables and domestic hazardous waste. Each household would be provided two buckets in different colors free of charge for the wet and the dry waste respectively. This would reduce the segregation cost of the SWM projects and enhance the efficiency of environmental friendly disposal of the solid waste.

### 11. Establishment of segregation mechanism of bio-medical waste in urban hospitals and in rural PHCs

As per a survey report of J&K Pollution Control Board, the lack of coordination between various government departments and the departments within the health care institutions is causing issues for implementation of bio-medical waste management rules. The report says that the management of bio-medical waste should be a priority while allocation funds for health care institution. Tons of bio-medical waste has accumulated in associated hospital of the Government Medical College Srinagar in absence of proper collection mechanism. The state hospitals are littered with used syringes, needles, plastic items, bandages and empty medicine and saline bottles.

State Urban department needs to establish an effective mechanism for proper segregation of biomedical wastes in urban hospitals and rural public health centres. This would reduce the environmental degradation as well as harmful effects to public health within the state. The mechanism would significantly help in establishment of proper disposal of the generated biomedical waste from the hospitals of urban area as well as rural PHCs.

### 12. Application of methane capture technology and preparation of fertilizer from weeds generated in Dal lake

Weed control methods with use of chemicals or mechanical mowers address the problem less harmfully than using enzymes and dispersal equipment. The excess nutrients have the same harmful effects as those that come from the surrounding watershed. Fertilizers, animal droppings, septic tank seepage and nutrients recycled from the sediment reduce the dissolved oxygen level in a lake thereby increasing the organic load. This leads to the habitat destruction and eutrophication in the Dal Lake and destruction of the major water source of Srinagar city. Government is planning to implement five Sewage Treatment Plants (STPs) with the combined capacity of 36 Million Litres per Day for treatment of sewage generated by households, commercial establishments and the hotels.

However the weeds harvested from the lake can be utilized for the extraction of methane through controlled anaerobic digestion system which can be utilized for power generation or any other energy sources. The digested sludge will be rich in nutrients and can be utilized as organic manure. Thus the process would restore the oxygenation characteristics of the Dal Lake, promoting healthy aquatic habitat while reducing undesirable weed growth, snails and blood suckers like leech etc along with the associated scum and algae population.









## 6.7 List of Key Priority Action

Table 29: List of Key Priority Action Mission on Sustainable Habitat

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Promotion of battery operated (charged from solar power) transport systems in tourist places, battery driven motor boats instead of diesel engine boats (battery charged from solar module mounted on the boat) and use of alternative fuel instead of diesel to drive Barges and other diesel driven equipments used for maintenance purpose in the lake	Housing & Urban Development (H&UD) Department	Nil	1.00	1.00	GoI, EFA
2	Capacity building of all levels of stakeholders to make them understand their role on their regards and maintain proper environment management system	H&UD Dept.	Nil	2.50	2.50	GoI, EFA
3	GHG accounting study on emission by transport vehicles	H&UD Dept.	Nil	2.50	2.50	GoI, EFA
4	Establishment of intelligent transport system	H&UD Dept.	Nil	50.00	50.00	GoI, EFA
5	Policy framework in transport sector	H&UD Dept.	Nil	2.50	2.50	GoI, EFA
6	Promotion of public transport and mass transport & Promotion of water transport	H&UD Dept.	Nil	800.00	800.00	GoI, EFA
7	Reallocation of the hotels or application of STP near Dal lake & DPR preparation on STP	H&UD Dept.	Nil	800.00	800.00	GoI, EFA
8	Establishment of end-to-end solid waste management system	H&UD Dept.	Nil	400.00	400.00	GoI, EFA
9	Base line study on solid waste and industrial waste generation and DPR preparation & four pilot project implementation	H&UD Dept.	Nil	50.00	50.00	GoI, EFA

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
10	Capacity Building/ Awareness Generation Program on segregation of solid waste at household level	H&UD Dept.	Nil	10.00	10.00	Gol, EFA
11	Establishment of segregation mechanism of bio-medical waste in urban hospitals and in rural PHCs	H&UD Dept.	Nil	10.00	10.00	Gol, EFA
12	Application of methane capture technology and preparation of fertilizer from weeds generated in Dal lake	H&UD Dept.	Nil	60.00	60.00	Gol, EFA
<b>Total Budget (INR in Million)</b>			<b>Nil</b>	<b>2,188.50</b>	<b>2,188.50</b>	

*N.B: The cost estimates are indicative and may change after preparation of Detailed Project Reports (DPRs)*





## 7 Green India Mission

### 7.1 Introduction

Forests and climate change are inherently linked. When kept healthy, forests play a key role in our national climate change strategy. Over geologic time, changes in disturbance regimes are a natural part of all ecosystems. However, loss of forest's ability to mitigate the effects of climate change will mean losing many important ecosystem goods and services. Development, climate change, invasive species, unsustainable forestry practices, diseases and insects, all of these factors and more, endanger the forests that we rely on for so much. The variety and severity of the threats to our forests means that simply planting trees for sheer numbers is not enough. We have to develop detailed restoration plans that take every factor into account - from the needs of local wildlife to the changing climate in the region. Even if changes cannot always be predicted, it is important to consider ways in which impacts to forest systems can be mitigated under likely changes in disturbance regimes. The task for

the next decade is to understand better how climate affects disturbances and how forests respond to them. Improved monitoring programs and analytic tools are needed to develop this understanding. Ultimately, this knowledge should lead to better ways to predict and cope with disturbance-induced changes in forest.

#### 7.1.1 Current Status of Forest and Forest Cover Change

According to the interpretation of satellite data of October-December 2008, the forest cover of Jammu and Kashmir is spread over 22,539 sq. km (including area outside the LoC) accounting for 10.14% of the State's geographical area (Source: India State of Forest Report, 2011). In terms of forest density parameters fixed by Forest Survey of India, a total of 4,140 sq. km area is presently covered under very dense forest, 8,760 sq. km under moderately dense forest and 9,639 sq. km under open forest; distribution of which is depicted in the figure below.



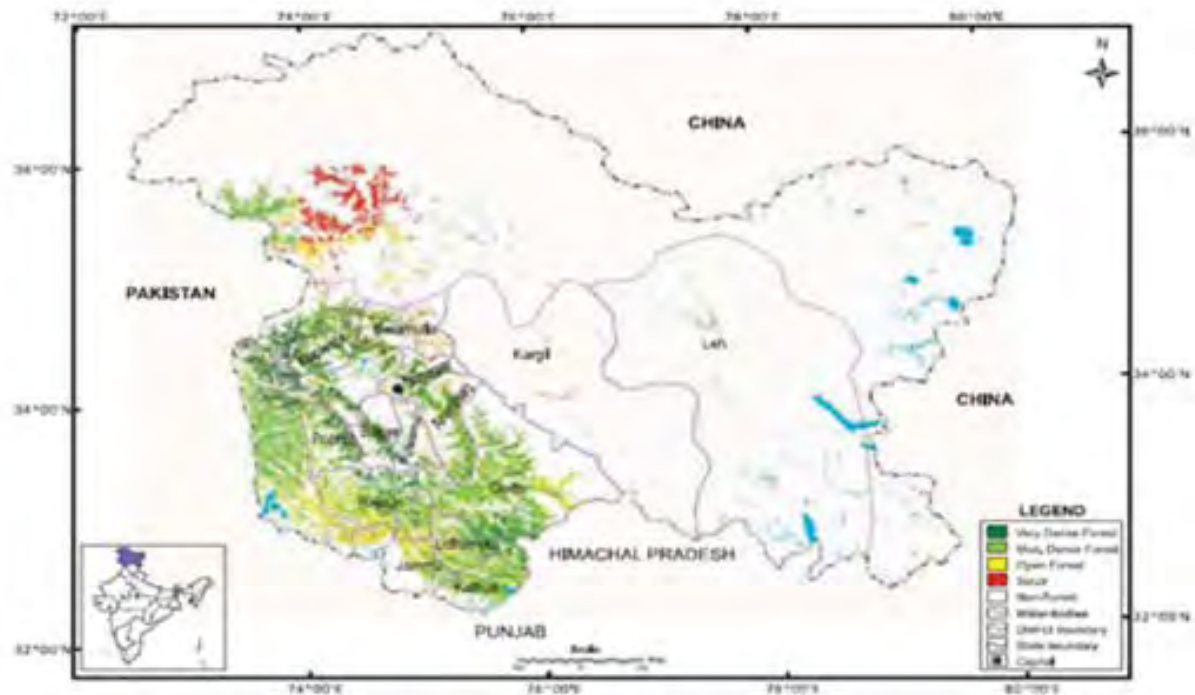


Figure 14: Forest cover in the State<sup>12</sup>

Jammu and Kashmir has 4 National Parks, 15 Wildlife Sanctuaries and 34 Conservation Reserves, spread across an area of 11,774.50 sq. km. The Dachigam National Park is famous for Hangul. The Wular Lake in Baramulla

district, having a spread of 8,900 hectares, has been designated as a Ramsar site. The district-wise forest cover in different canopy density classes is given in the following table:

<sup>12</sup>India State of Forest Report 2011, Forest Survey of India, Dehradun





Table 30: Assessment of variation in forest cover (Area in sq. km)

District	Geo. Area (GA)	2011 Assessment				Percent of GA	Change* over 2009 assessment	Scrub
		Very Dense forest	Moderately Dense Forest	Open Forest	Total			
Anantag	3,984	196	664	578	1,438	36.09	0	23
Baramulla	4,588	425	286	446	1,157	25.22	0	86
Budgam	1,371	99	69	52	220	16.05	0	8
Doda	11,691	619	1,689	1,659	3,967	33.93	0	5
Jammu	3,097	0	210	672	882	28.48	0	43
Kargil	14,037	0	3	21	24	0.17	0	19
Kathua	2,651	112	673	614	1,399	52.77	1	12
Kupwara	2,379	472	366	322	1,160	48.76	0	3
Leh	45,110	0	48	57	105	0.23	0	6
Outside LOC	1,20,848	1,326	2,471	2,686	6,483	5.36	1	1,810
Poonch	1,674	187	300	242	729	43.55	0	9
Pulwama	1,398	110	106	78	294	21.03	0	10
Rajouri	2,630	49	439	752	1,240	47.15	0	8
Srinagar	2,228	196	307	249	752	33.75	0	16
Udhampur	4,550	349	1,129	1,211	2,689	59.10	0	47
Grand total	2,22,236	4,140	8,760	9,639	22,539	10.14	2	2,105

Source: India State of Forest Report 2011, Forest Survey of India, Dehradun

According to the 2011 assessment of FSI, it is observed that the area under forest cover has increased by 2 sq. kms in Jammu and Kashmir State. However, there is a net decrease of 147 sq. km from the reported area in the ISFR

2009. This is due to interpretational changes on account of refinement of methodology as well as availability of improved satellite data in appropriate seasons (Source: ISFR 2011).

Table 31: Forest Cover Change Matrix (Area in sq. km)

	2011 Assessment					2009 assessment
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	4,140	0	0	0	0	4,140
Moderately Dense Forest		8,760	0	0	0	8,760
Open Forest	0	0	9,637	0	0	9,637
Scrub	0	0	0	2,101	0	2,101
Non-Forest			2	4	1,97,592	1,97,598
Total 2011	4,140	8,760	9,639	2,105	1,97,592	2,22,236
Net Charge	0	0	2	4	-6	

Source: ISFR 2011

### 7.1.2 Forest cover under different forest type

Forest Survey of India has undertaken forest type mapping using satellite data with reference to Champion & Seth Classification. The assessment has identified 38 forest types belonging to eight forest type groups, viz. Tropical Dry Deciduous, Subtropical Pine, Subtropical Dry Evergreen, Himalayan Moist Temperate, Himalayan Dry Temperate and Sub Alpine Scrub. Percentage-wise distribution of forest cover in various forest types is given in the chart below.

actions for enhanced ecosystem (like carbon sequestration and storage in forest & other ecosystems), hydrological and biodiversity conservation along with provisioning services like fuel, fodder, timber and NTFPs. The “greening” in the context of climate change aims at a combination of adaptation and mitigation measures, which helps in:

- Enhancing carbon sinks in sustainably managed forests and other ecosystems.
- Adaptation of vulnerable species/ ecosystems to the changing climate.

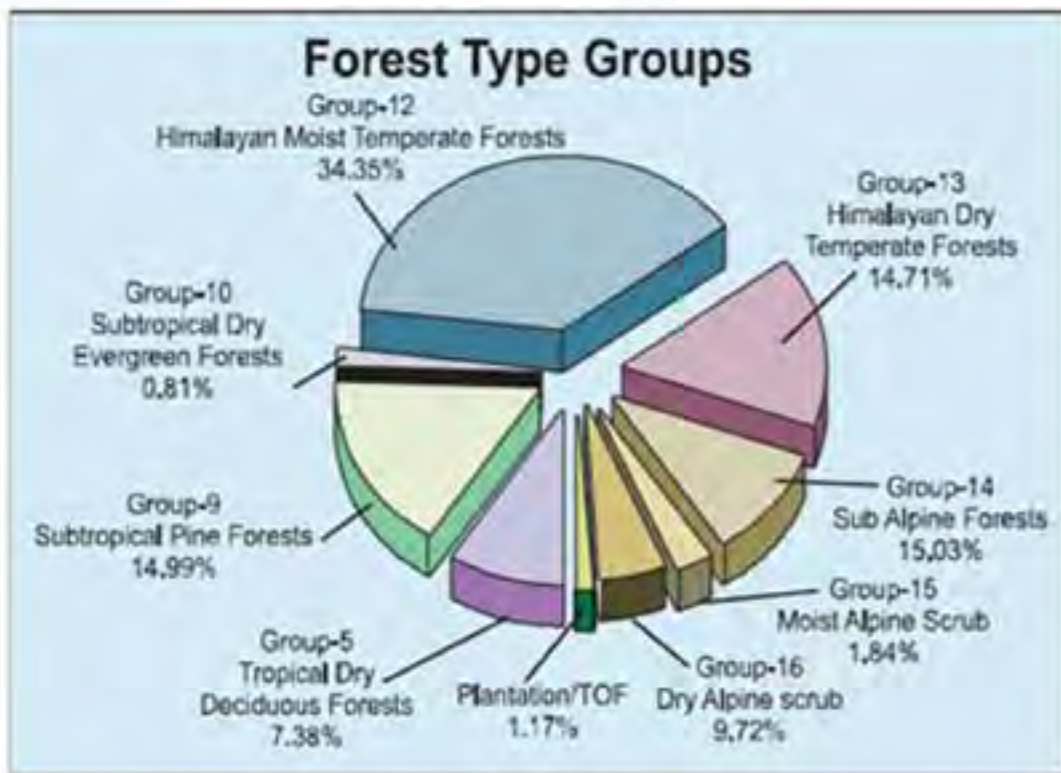


Figure 15: Different Forest Types in States<sup>13</sup>

The Green India Mission (GIM) under the National Action Plan on Climate Change (NAPCC) aims at adaptation and mitigation

- Inculcating resilience in the existing forests by various silvi-cultural and forest management interventions

<sup>13</sup>India State of Forest Report 2011, Forest Survey of India, Dehradun

- Adaptation of forest-dependent communities

The objective of the State Mission on Forest & Biodiversity sector is to achieve the national goal of GIM under NAPCC & to respond to the possible climate change impacts in the State.

Climate change impacts can be reduced by way of conservation and protection of forests and biodiversity resources. Revised policies for the protection and management of the forest should be integrated with conservation of the catchment areas in the hills.

The Green Mission of Jammu and Kashmir is prepared in compliance to the guidelines of National Climate Change Action Plan-Green Mission with a series of discussions with the

Officers of the Forest Department and the Principal Chief Conservator of Forests.

### 7.1.3 Role of Forest in State

The State of Jammu and Kashmir has rich diverse forest resources that plays an important role to preserve the fragile ecosystem of the State and serves as catchments for Himalayan Rivers. In Jammu and Kashmir, the perennial water supply including groundwater recharge, and health of soils, primarily depends upon the area and quality of forest cover. A healthy forest cover is essential for long term operation of hydroelectric projects. In the State, forest also provides some environmental services like carbon sequestration, pollution abatement, amelioration of climate, in-situ conservation of biodiversity and maintenance of ecological





balance. Since there is unique aesthetic value of forest landscape and huge potential for tourism in the State, the forests play a pivotal role to make the State an ideal tourist destination.

Forests are also essential for soil conservation, water security, and for meeting the daily necessities of local population with regards to timber, firewood, fodder and other forest produce. As per the State specific demarcation rules, the forests of the State were constituted along with the initial revenue settlement. As forest are the largest land based resource in Jammu and Kashmir, they have an important role in supporting livelihoods and poverty alleviation. Forests also have some economic value and play an important role in supporting economic activities and human well being. As per the expert estimation (Down to Earth, issue of July 2005) the net present environmental value of forests of Jammu and Kashmir was Rs.1,92,000 crores.

## 7.2 Key trends in the sector

The varied and distinctive geo-climatic conditions across the three regions of the state, viz, Jammu, Kashmir and Ladakh is responsible for the diversified forest cover ranging from sub-tropical to temperate and alpine. The three regions have witnessed exponential growth in human and livestock population, rapid industrialization and spurt in developmental activities, especially in past few decades. These developmental processes have resulted in depletion of forest cover accompanied by an overall degradation and forest soil. Earlier, forests

mainly served the purpose of timber production. Although, commercial felling of green trees has been discontinued, but drying of trees due to natural reasons is unavoidable. Further, due to continuous and unrestricted grazing, most of the forests in the State are deficient in regeneration. Other factors like forest fires, invasive weeds, unregulated tourist movement and lack of timely silvicultural operations prohibit the regeneration. Similarly, a marked reduction in population of other productive species especially medicinal plants, has been observed. Over exploitation of forests has not only degraded them but also impaired their ability to provide environmental benefits. The effects of forests degradation are visible through drying up of perennial water sources, accelerated soil erosion, flash floods, silting of reservoirs loss of biodiversity and reduced forest productivity.

## 7.3 Vulnerability of the sector

### 7.3.1 Climate Variability in J&K

Climate variability refers to shorter term like daily, seasonal, annual, inter-annual, several years' variations in climate, including the fluctuations associated with El Niño (dry) or La Niña (wet) events. The overall effects of climate variability are puzzling in Jammu and Kashmir. Based on Percent of Normal, majority of the districts in the northwest part of the country consisting of Rajasthan, Gujarat, Jammu & Kashmir, Punjab, and Haryana have drought probabilities of  $\geq 20\%$ . Severe drought produces massive tree mortality, but there is also evidence of



periodic tree staffing during extreme rainy years. As per INCCA Report 2010 the whole Himalayan region is exhibiting an increase in the precipitation in the 2030s scenario. The increase varies between 5% and 20% in most areas, with some areas of Jammu and Kashmir showing an increase of up to 50%. As per INCCA Report 2010 due to climate variability in the State, food production deficit is growing in recent times. Due to low rainfall, the rain-fed agriculture will suffer the most. Horticultural crops like apple are also showing decline in production and areal coverage particularly due to decline in snowfall.

### 7.3.2 Impact of climate change on forest ecosystems in Jammu and Kashmir

Indian Institute of Science has conducted an assessment of the impact of climate change on forest ecosystems in India. A dynamic vegetation model IBIS (Integrated Biosphere Simulator) was used to assess the impacts of climate change on forests in India. The

study indicates that about 39% and 34% of the forested grids are likely to undergo shifts in vegetation type under A2 and B2 climate scenarios, respectively with a trend towards increased occurrence of the wetter forest types.

Approximately 47% and 42% of tropical dry deciduous grids are projected to undergo shifts under A2 and B2 scenarios respectively, as opposed to less than 16% grids comprising of tropical wet evergreen forests. Similarly, the tropical thorny scrub forest is projected to undergo shifts in majority of forested grids under A2 (more than 80%) as well as B2 scenarios (50% of grids). According to another study projected impacts of climate change, using a moderate A1B scenario and IBIS vegetation model for the period of 2030s and 2080s, are projected in figure below, which show the impacts on current forested locations in India. The figure shows that Jammu and Kashmir is projected to undergo vegetation change in both A1B (2035 and 2085) scenarios.



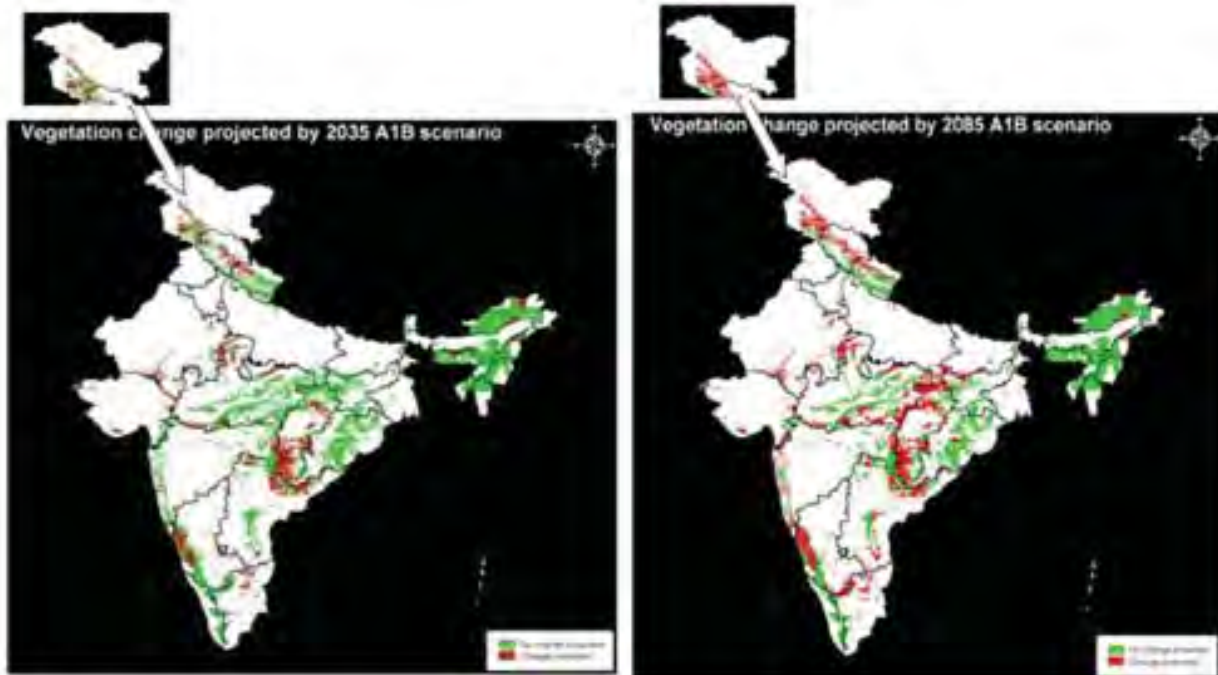


Figure 16: Forest Grids in India

All forested grids in India are shown in color (red or green): red indicates that a change in vegetation is projected at that grid in the time-period of 2021-2050, and green indicates that no change in vegetation is projected by that period.

The model simulated vegetation as well as grids that undergo vegetation change for the Himalayan region is shown in above Figure 18. The entire Himalayan region is covered by 98 IBIS grids, out of which 55 (56%) are projected to undergo change. Thus, over half of the forests are likely to be adversely impacted in the Himalayan region by 2030's<sup>14</sup>.

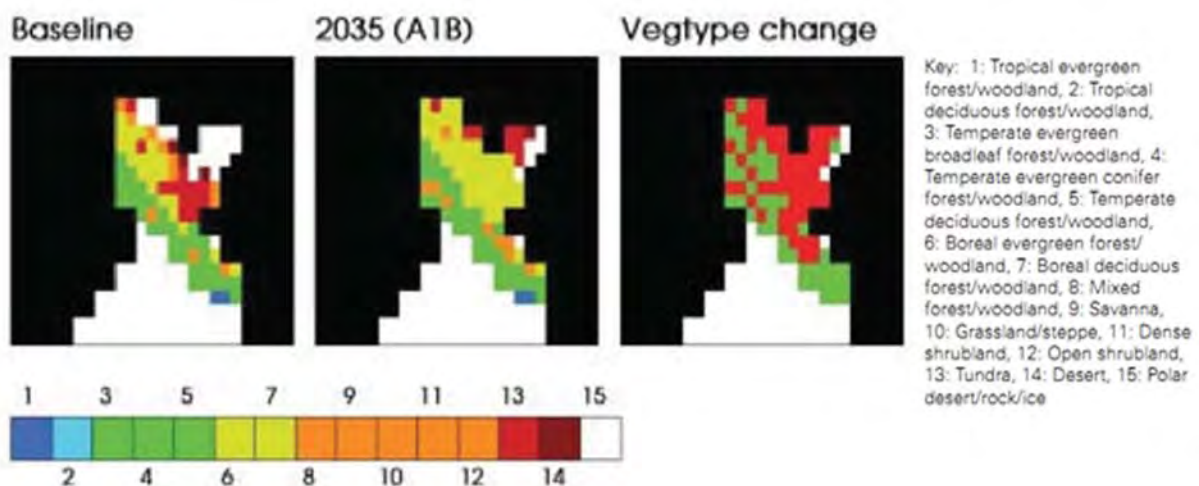


Figure 17: Simulated dominant vegetation in the Himalayan region for the baseline (left panel) and 2035 (middle panel). The grids where a change in vegetation is projected are shown in red in the right panel

<sup>14</sup>CLIMATE CHANGE AND INDIA: A 4X4 ASSESSMENT A SECTORAL AND REGIONAL ANALYSIS FOR 2030S, Ministry of Environment & Forests Government of India (November 2010)

### 7.3.3 Vulnerability to the sector

Severe Human pressure on forest is responsible for deforestation and degradation in Jammu and Kashmir. Due to high dependency on forest for timber and fuel wood, deforestation is an ongoing process. On the other hand the livestock population in the State is 9.90 million resulting in huge demand for fodder. In addition most of this livestock graze in forests. Grazing and trampling of saplings by livestock is the biggest threat to regeneration of vegetation in all forested areas of the State. Low tree density, low bio-diversity status as well as higher levels of fragmentation contribute to the vulnerability of these forests. As per Chatuvedi, (2010), most of the mountainous forests (sub-alpine and alpine forest, the Himalayan dry temperate forest and the Himalayan moist temperate forests) are susceptible to the adverse effects of climate change. This is because climate change is predicted to be larger for regions that have higher elevations. There is a need to explore win-win adaptation practices in such regions such as anticipatory plantations, sanitary harvest, and pest and fire management.

It is also seen that a significant part of the Himalayan bio-diversity hotspot that stretches along the northwestern part of India along the States of Punjab, Jammu and Kashmir and Himachal Pradesh is projected to be highly vulnerable. This may be mostly attributed to the higher elevation of these regions. The study has shown that these regions will experience higher levels of warming.

According to the estimated vulnerability index suggests that upper Himalayas, northern and central parts of Western Ghats and parts of central India are most vulnerable to projected impacts of climate change. The forests in the central part of India, especially the north-western part of India are highly vulnerable.

Due to changes in precipitation and temperature in Jammu and Kashmir the probable vulnerability of the forestry sector is as follows:

- Climate change would increase many existing stress on forest ecosystems through increase in invasive species, insect pests and pathogens, and disturbance regimes. Climate change would result in ecosystem shifts and conversions.
- Many tree species would have insufficient adaptation rates to keep pace with climate change.
- Forests would not be able to provide a consistent supply of forest products.
- Climate change impacts on forests would impair the ability of many forested watersheds to produce reliable supplies of clean water.
- Climate change would result in a widespread decline in carbon storage in forest ecosystems across the region.
- Many contemporary and iconic forms of recreation dependent on forest ecosystems would change in extent and timing due to climate change.

- Climate change would alter many traditional and modern cultural connections to forest ecosystems.

## 7.4 Key issues in the sector

### **Loss of forest cover and habitat destruction:**

Many species are threatened due to habitat destruction, forest fragmentation and loss of forest cover. Developmental activities (road construction, transmission lines, power projects, etc.), encroachments, illicit felling of trees, uprooting of trees due to natural calamities like heavy snowfall, and wind storms are some of the reasons responsible for loss of forest cover.

**Spread of Alien species:** In some of the sub-tropical forests areas of the State, spread of alien species like *Lantana camara* and *Partheniumhysterphorus*, has posed an increasing threat on forest productivity and native biodiversity. Few species of fish like mirror carp have caused decline in the population of native fish species like the *Schizothorax*. Other species of trout in several hill streams have adapted well but their impacts on local biota unknown.

### **Unregulated grazing by domestic livestock:**

Rapid increase in the livestock population of the State has resulted in a huge gap between demand and supply of fodder. Consequently, the forests and pastures of the State are subjected to heavy grazing, much beyond their carrying capacity. This problem has remained largely unaddressed, resulting in severe degradation of forests and pasture lands which has further reduced the fodder availability. The palatable grass and shrub

species have been replaced by un-palatable species. To meet the fodder demand, more and more areas are subjected to overgrazing, further compounding the problem. This is a vicious cycle which often results in many conflicts between different stakeholders for use of scarce grazing resources. Over-grazing of forest areas by livestock has also seriously impaired the ability of natural forests to regenerate.

**Encroachments:** Human encroachments into biologically rich forest areas have increased alarmingly resulting in loss of forest cover and honeycombing of forests. Encroachments into water bodies like lakes are common and have reduced the expanse of lake bed.

### **Anthropogenic pressure on forest areas:**

Both protected and unprotected forest areas and grazing lands are under tremendous biotic pressure for timber and firewood extraction/ collection. Indiscriminate collection of many native species having commercial value or medicinal importance continues despite protection accorded under different laws (Wildlife Act, Forest Act, and Biodiversity Act).

Jammu and Kashmir is endowed with rich biodiversity and gene pool resources, such as dense lush green forests, alpine pastures, snow bound peaks, glaciers, rivers, streams and fascinating wetlands like Wullar, Dal, Hokersar, Hygametc offering conducive breeding grounds for the migratory birds. In the sub-tropical forests of the State, Chir (*Pinus roxburghii*), which occurs between 600 m to 1,500 m, is the predominant species. The common tree associates of this species



are *Quercus leucotrichophora*, *Quercus ilex*, *Olea cuspidata*, *Pistacia integerrima*, *Lyonia ovalifolia*, *Pyrus pashia*, *Alnus nepalensis*, *Acacia modesta*, *Celtis australis*, *Rhus spp* and *Corylus colurna*. Shrubs commonly found in this zone are *Myrsine africana*, *Dabregeasia hypoleuca*, *Berberis spp*, *Nerium indicum*, *Plectranthus rugosus*, *Daphne cannabina*, *Zizyphus spp*, *Spiraea sorbifolia*, *Prinsepia utilis*, *Rubus ellipticus*, *Woodfordia floribunda*, *Rosa moschata* and *Punica granatum*. These shrubs constitute the under growth in Chir forests. The intensity of under growth in Chir forests varies from light to heavy. The ground flora generally comprises *Fragaria vesca*, *Viola canescens*, *Polygonum spp*, *Girardinia heterophylla*, *Ainsliaea aptera*, *Impatiens glandulifera*, and a variety of grasses and ferns. The common climbers of this zone are *Clematis spp*, *Jasminum humile*, *Vitis spp*, *Rosa moschata*.

The temperate forests occur at altitudes between 1,600 m and 3,200 m. These temperate forests are dominated by Blue pine (*Pinus wallichiana*), Spruce (*Picea smithiana*), Deodar (*Cedrus deodara*) and Silver fir (*Abies pindrow*). The common broad leaved tree associates of Deodar, Kail and Fir are *Aesculus indica*, *Alnus nepalensis*, *Ulmus wallichiana*, *Prunus padus*, *Quercus dilatata*, *Quercus semecarpifolia*, *Q. leucotrichophora*, *Fraxinus excelsior*, *Betula utilis*, *Rhododendron spp*, *Celtis australis*, *Pyrus pashia*, *Corylus colurna*, *Toona ciliata*, *Toona serrata*, *Populus spp*. The incidence of the under growth in these forests varies in intensity from scant to moderate and the commonly found species are *Viburnum*

*foetens*, *Viburnum nervosum*, *Skimmia laureola*, *Podophyllum hexandrum*, *Parrotia jacquemontiana*, *Desmodium spp*, *Sarcococca saligna*, *Indigofera pulchella*, *Prinsepia utilis*, *Rubus spp*, *Rosa spp*, *Berberis spp*, *Daphne cannabina*, *Acer pictum*, *Cotoneaster spp* etc.

The herbaceous ground flora includes *Viola canescens*, *Fragaria vesca*, *Rumex hastatus*, *Anemone spp*, *Polygonum spp*, *Girardinia heterophylla*, *Impatiens glandulifera*, *Atropa belladonna*, *Podophyllum hexandrum*, and a variety of miscellaneous grasses and ferns.

Alpine pastures immediately follow the temperate tree line from 3,200 to 3,600 m, the alpine vegetation is scarce between 3,600-4,100 m and largely comprises of trees like *Junipers*, *Rhododendrons*, *Betula etc sprinkled with multiple herbs and shrubs*.

The fauna of Jammu and Kashmir includes wild goats like *Markhor* and *Ibex*, antelopes like *Chhiru*, deer's like *Hangul or Kashmir Stag*, *Musk Deer*, *Spotted Deer*, *Shapoo*, *Black Bears*, *Leopards*, *Wolf*, *Fox*, *Monkeys* and birds like *Western Tragopan*, *Himalayan Monal Pheasant* etc. Though the man vs wild conflict has always existed in the past, it has certainly escalated in the past two decades. Asiatic black bear (*Ursus thibetanus*) and common leopard (*Panthera pardus fusca*) frequently attack humans and livestock resulting in death/ serious injuries, besides causing loss to property. The obvious reasons are the loss of wild habitat as a result of human activities such as deforestation causing loss of forest cover, change in land use pattern, human interference, stone

quarrying and mine blasting near the forest areas, forest fires, and natural factors like increase in wild life populations, decline in the natural prey base, change in the predator behavior due to easy availability of prey like stray dogs, etc.

## 7.5 Programme and Policies in the sector

The following are the major schemes and Programmes implemented in the forestry sector of the State under State/District/Centrally Sponsored schemes:

- Consolidation and Demarcation
- Development of Minor Forest Produce including Medicinal Plants
- Eco Task Force
- Urban Forestry
- Pasture and Fodder Development
- CM's participatory Afforestation Scheme
- Forest Protection
- Participatory Grazing Land Development Programme
- Eco-restoration of Degraded catchments
- Integrated Forest Protection Scheme
- CAMPA

It is seen that majority of the above schemes are related to afforestation and reforestation. Afforestation on the degraded forests has yielded good results. The initiative has been recognized and awarded by the government of India for the year 2009 and 2010. To

maintain ecological balance, the felling of trees has also been limited. As a result, the out turn of forest produce has declined. The out turn of timber which was 102.48 thousand cubic meters in 2000-01, declined to 69.70 thousand cubic meters in 2009-10, and has further come down to 37.14 thousand cubic meters during the current financial year 2012-13 (ending Nov)<sup>15</sup>. Therefore, the continuous ecological restoration activity in Jammu and Kashmir would certainly have climate change mitigation effects besides addressing biodiversity issues. Forests have to be conserved and managed in a sustainable manner with active participation of local communities so as to ensure a continuous flow of benefits to all stakeholders.

At the same time, the Government has adopted the J&K State Forest Policy in January 2011 for effective conservation and management of forest ecosystems. The State Forest Policy addresses need for conservation of forest resources, meeting needs of people, and poverty alleviation through developmental activities. Strategies for protection, conservation and management of forests are fully defined and documented in the State Forest Policy which has been formulated through series of consultation with different stakeholders.

### ***Salient features of Forest Policy 2010:***

Being the largest land based resource in the State; forests have immense potential for supporting livelihoods and alleviating poverty. State forest policy was launched in the year 2010.

<sup>15</sup>[http://www.jandkplanning.com/images/Economic\\_Survey/19-env.forests.pdf](http://www.jandkplanning.com/images/Economic_Survey/19-env.forests.pdf)

***The basic objectives of the Jammu and Kashmir State Forest Policy are as follows:***

- Conservation of biodiversity and natural habitat through preservation of natural forests with the vast variety of flora and fauna.
- Rehabilitation of degraded forests so as to optimize their productivity and restore their potential to provide ecosystem goods and services on sustainable basis.
- Poverty alleviation by meeting livelihood needs of forest dependent communities through sustainable supply of forest produce by improving productivity of existing forests, and through forestry activities, schemes and programmes.
- Extending tree cover outside forests to reduce pressure on natural forest for supply of forest produce.

## 7.6 Key Priority

Trees utilize carbon dioxide in the atmosphere for biomass production, and provide mitigation and adaptation services. In order to tap the potential of forests for climate change mitigation and adaptation, following strategy will be adopted:

- Conservation, sustainable management of forests and enhancement of forest carbon stocks will be encouraged to offset emissions from core sectors of energy, industry and transport.
- Forest carbon stocks will be conserved and enhanced by reforestation of

regeneration deficient and open forest areas.

- Unutilized areas suitable for tree growth will be afforested by planting fast growing species to meet the energy requirements of local population in order to offset use of fossil fuels.
- Technologies for efficient conversion of energy from biomass will also be developed and popularized.

In order to benefit from international incentives towards conservation, maintenance and enhancement of forest carbon stocks, institutional framework will be established to synergize actions of individuals, organizations and Government Departments. Cent percent incentives will flow to the local community wherever such incentives accrue because of involvement of the community in protection, afforestation and reforestation activities.

The key priority actions for climate change adaptation and mitigation adopted by the State would aim at maintaining a healthy forest resource, reduce the continuous depletion and degradation of forest and, and also recognize the close association between climate change and forests.

### 1. Implementation of J&K State Forest Policy :

The Jammu and Kashmir State Forest Policy-2011, provides a comprehensive roadmap for conservation of existing forests and restoration of the forests that have degraded.

Implementation of strategies provided in the State Forest Policy will address the climate change issues related to forestry sector in a significant manner. The policy provides that the Forest Department will prepare an implementation schedule for realizing the objectives of this Policy, and, a high powered institutional mechanism will be put in place to monitor and review the implementation of the Policy. Therefore, the first and foremost priority for the Forest Department is to implement the State Forest Policy in letter and spirit.

## 2. Capacity building and awareness for all levels of stakeholders

Capacity building of forest department personnel would be undertaken to improve their skills and professional competence to enable them to recognize the impacts of climate change on forest resources. They should be trained on the legal aspects of forest and environmental issues. Infrastructural requirement and professional needs are to be identified for proper guidance on climate change issues to meet the requirements at all levels of Forest officers & staff.

## 3. Gene bank development for climate adaptable species

Forests have to cope with new environmental stresses, both biotic and abiotic. These include habitat shifting and alteration, fragmentation, drought, temperature extremes, flooding, wildfire, and novel insects and diseases. To maintain the healthy ecosystems in the State vulnerable species and habitats should be identified. Therefore,

genetic conservation is the key to preserving vulnerable species. At the same time, species having wider adaptability over larger geographical and climatic regimes also need to be identified and conserved as a part of adaptation strategy for climate change.

## 4. Eco-restoration through afforestation and Climate oriented eco-restoration plan

Ecological restoration helps in recovery of degraded, damaged, or destroyed ecosystem. The State government wants to take Ecological restoration activity particularly in terms of afforestation to respond to climate change in the State. These activities would help influence the State's carbon budget in a positive way. The State would prepare an eco-restoration plan for climate change mitigation.

## 5. Study on identification of tree phenology" with "Phenological studies of Forestry and other tree species"

Climate change may cause deviation in timing, duration and synchronization of phenological events in forest species. Changes in rainfall, precipitation and temperature would alter tree phenology since they differ widely with respect to adaptations to seasonal drought and indications for bud break of vegetative and flower buds. Erratic precipitation and increasing temperature are likely to alter the span of the growing season of trees. The impact of climate change can be better assessed at the level of functional types based on the duration of deciduousness and



timing of onset of the reproductive phase (first-visible-flower). The State government would take a study to see the significant variation (advanced or delayed) in onset dates of flowering and fruiting responses in tree species as a result of climatic change.

## 6. Flora and Fauna vulnerability study

Fauna and flora though can gradually adapt to changes in temperatures but they fail to adapt to sudden weather variability. Reduced snowfall in the mountains of the State may cause habitat shift for mountainous plant and bird communities to higher elevations for survival. Species having physiological limitations to adapt to sudden weather changes might become extinct. Since horticulture is one of the major sources of livelihood and revenue, the State Government wants to do a study to see the floral and faunal changes in the State.

## 7. Studies of carbon influxes/ out fluxes of various forest types / trees and their role in carbon sequestration

The goal of carbon sequestration study is to identify potential approaches for enhancing terrestrial carbon sequestration as a partial mitigation of CO<sub>2</sub> induced climate change. The primary objective of the State Government is to provide data to determine carbon stocks and sequestration rates spanning the entire life cycle of the major forest species. The study would be designed to provide improved estimates based on micrometeorological and inventory methods,

litter, deadwood and soil carbon stocks and sequestration rates for different species.

## 8. Study on per capita firewood consumption and alternative livelihood

Firewood derived from forests is an important source of domestic energy in rural and urban areas of Jammu and Kashmir. Fuelwood is collected directly from forests and fields in the Himalayan region. Unrestricted grazing in forest areas has reduced the tree regeneration. This would affect future supply of fuelwood and carbon sinks. The per capita fuel wood consumption in the State needs to be quantified so that future plans can be formulated accordingly. This study would seek to document annual per capita fuelwood consumption, availability and production through case study research in all the districts of Jammu and Kashmir and associated fuelwood harvesting areas. It would help in the improvement of livelihood of the forest dependent communities and also encourage forest conservation which will ultimately result in GHG sequestration.

## 9. Study on soil organic carbon (SOC) of forest area

The soil represents the largest depository for fixing carbon. The forest soil is one of the major carbon sink due to high organic carbon content. A study would be conducted in Jammu and Kashmir to estimate the SOC pool under different forest covers. Due to wide variations in weather, soil types, topography and altitude the forest species vary from broad leaved to conifers and from deciduous

to evergreen. SOC pool also varies as per the forest species. Findings of this study would serve as benchmark for the future investigations to ascertain the changes in SOC pool over a period of time and to take climate change mitigation measures if required.

#### 10. Climate impact study in undisturbed/ protected forest areas

Most of the forests are subjected to disturbances on account of human activities. The forest degradation in these areas is primarily due to anthropogenic causes and it would be difficult to segregate the effects of climate change on forests in these areas. Therefore, climate impact studies should also be carried out in undisturbed/ protected forest areas where the climate change effects, if any, are not confounded with other disturbance effects.

#### 11. E-green portal with geo-reference

The State Government would do the field Survey with modern instruments / Standalone GPS with reasonable accuracy for collection of associated Master Data inclusive of Legacy Data as per Standard Operating Procedure (SOP) prescribed by FSI / Department. The E-green portal would provide accessibility to a variety of geospatial layers available including thematic information, topographic maps and satellite images. It would also provide access to important documents relevant to

the geospatial layers shown on the map. The e-portal would help to develop adaptation and mitigation strategy for forestry and other sectors in the Jammu and Kashmir.

#### 12. Nursery development for climate adaptable species

The State Government wants to run a programme for producing high quality climate adaptable seedlings by using advanced technology, which would be initiated under State Forest Department. Under this programme some root trainer and clonal nurseries would be established in different forest divisions. The seedlings produced would be utilized for plantations in the land under forest Department and the surplus seedlings would be sold to the public for better survival.

#### 13. REDD+ feasibility study for carbon sequestration

Forests are not only a major carbon sink, they are also a renewable source for imperishable forest products and a replacement for fossil fuels. This scoping study aims at exploring the feasibility for developing mechanism under the UN Framework Convention on Climate Change (UNFCCC) to Reduce Emission from Deforestation and forest Degradation (REDD). The State has become a huge resource and is especially interested in the opportunities of the most recent development REDD+, which would include financial award for conservation, sustainable management of forests and enhancement of carbon stock in the State.

#### 14. Study of climate change impact on wild life specie

Wildlife lifecycle (breeding, nesting, growing or feeding) depends on the climatic conditions of the area. Some species sensitive to climate change need to move to suitable climate conditions. Other species which are able to adapt to the new climate conditions would become more dominant. Biodiversity management strategies are essential for maintenance of biodiversity resources. The most important strategy would be to leverage our current system of nature conservation reserves by creating connectivity among the protected areas. To help animals to survive in the weather variability or climate change, the State government wants to do a study on climate change impact on wildlife species. A team of officers should be involved for wildlife conservation.

#### 15. Climate change impacts on undisturbed forest area like national parks

Climate change would affect the habitats and wildlife in National Parks though few habitats are capable of being effective carbon sinks. Rates of glacier melting would be noted and the impact on these areas needs to be assessed. Although maximum National Parks can be affected by impact of climate change

like flooding, droughts, changes in plant and animal feeding, reproductive and migration patterns. Since tourism is one of the major sources of revenue generation of the State, a detailed study on climate change impact on National Parks of the State is the need of the hour.

#### 16. Studies of impact of managed watershed under different management system on sustained water availability

Government of Jammu and Kashmir is looking forward to start Integrated Watershed Management Programme (IWMP) project in all the rain fed areas of the State in a phased manner. This would help in creating dependable infrastructure to make various farming in the area a profitable activity, arrest the groundwater decline, conserve surface water run-off during monsoon, and reduce soil erosion and to inculcate the culture of water conservation. This approach will incorporate new technologies and allow protecting important water resources, while at the same time addressing critical issues such as the current and future impacts of rapid growth and climate change. IWM is an approach that recognizes and operates based on the interconnectedness of ecology, economy and society.





## 7.7 List of Key Priority Action

Table 32: List of Key Priority Action Green India Mission

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Implementation of J&K State Forest Policy	Department of Forest	Nil	150.00	150.00	Gol, Govt. of J&K, EFA
2	Capacity building and awareness for all levels of stakeholders	Department of Forest and CAMPA Division	Nil	200.00	200.00	Gol, Govt. of J&K, EFA
3	Gene bank development for climate adaptable species	Department of Forest	Nil	50.00	50.00	Gol, Govt. of J&K, EFA
4	Eco-restoration through afforestation and Climate oriented eco-restoration plan	Department of Forest and CAMPA Division	Nil	450.00	450.00	Gol, Govt. of J&K, EFA
5	Phenological studies of Forestry and other tree Species	Department of Forest	Nil	10.00	10.00	Gol, Govt. of J&K, EFA
6	Flora and Fauna vulnerability study	Department of Forest	Nil	6.00	6.00	Gol, Govt. of J&K, EFA
7	Studies of carbon influxes/ out fluxes of various forest types / trees and their role in carbon sequestration	Department of Forest	Nil	10.00	10.00	Gol, Govt. of J&K, EFA
8	Study on per capita fuel wood consumption and alternative livelihood	Department of Forest	Nil	10.00	10.00	Gol, Govt. of J&K, EFA
9	Study on soil organic carbon of forest area	Department of Forest	Nil	5.00	5.00	Gol, Govt. of J&K, EFA
10	Climate impact study in undisturbed/protected forest areas.	Department of Forest	Nil	10.00	10.00	Gol, Govt. of J&K, EFA
11	E-green portal with geo-reference	Department of Forest	Nil	100.00	100.00	Gol, Govt. of J&K, EFA
12	Nursery development for climate adaptable species	Department of Forest	Nil	150.00	150.00	Gol, Govt. of J&K, EFA

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
13	REDD+ feasibility study for carbon sequestration.	Department of Forest	Nil	5.00	5.00	Gol, Govt. of J&K, EFA
14	Study of climate change impact on wild life species	Department of Forest and wildlife Division	Nil	10.00	10.00	Gol, Govt. of J&K, EFA
15	Climate change impacts on undisturbed forest area like national parks	Department of Forest and wildlife Division	Nil	10.00	10.00	Gol, Govt. of J&K, EFA
16	Studies of impact of managed watershed under different management system on sustained water availability	Department of Forest and wildlife Division	Nil	100.00	100.00	Gol, Govt. of J&K, EFA
<b>Total (INR in Million)</b>			<b>Nil</b>	<b>1,276.00</b>	<b>1,276.00</b>	







## 8 Water Mission

### 8.1 Introduction

Climate change is projected to influence the hydrological cycle of water bodies, water supply systems and exacerbate requirement of water in different regions. The disturbance of the hydrological cycle as projected due to the variability in the climatic conditions are likely to enhance the current stress on water resources from surging population, growing economic development and land use change including urbanization. Increase in ambient temperature and changes in rainfall pattern might influence the hydrological cycle to a large extent. Other consequences like increase in rates of evapotranspiration, decrease in fresh water availability, mass losses from glaciers and reductions in snow cover might severely impact the hydrological cycle. Change in the hydrological cycle may affect the spatial and temporal distribution of runoff, soil moisture, ground-water reserves and may increase the frequency of droughts and floods. Increased frequency of rainfall and variation in rainfall pattern including extreme events like flood poses challenge

to the society, physical infrastructure and quality.

Economy of the State relies heavily on water intensive sectors like agriculture, horticulture, energy generation, tourism, etc. Since most of the water-bodies in the State receive supply from mountain range therefore loss of glacier might reduce the water availability impacting hydro power potential and lower availability of water for irrigation impacting the agrarian economy in the State. Regions in the State that are already subjected to water stress are projected to be adversely affected with impacts on multiple sectors e.g. agriculture, domestic water supply and health.

It is therefore imperative that effective plan be strategized towards increasing the efficiency of water use, explore options to augment water supply in critical areas and ensure more effective management of water resources. Integrated water resources planning and basin management are strategized to cope up with the projected variability in rainfall and river flow. The Broad objectives of the mission addressed are:

- Promoting research studies on all aspect related to impact of Climate Change on Water Resources including quality aspects of water resources so as to address the growing concern of water and food security issue.
- Expeditious implementation of water resources projects- irrigation, Hydro power, domestic water supply, water transport, etc.
- Promotion of traditional and modern system of water conservation and preservation of water bodies –lakes.
- Planning on principles of integrated water resources development and management
- Ensuring convergence among various water resources programmes.
- Intensive capacity building and awareness programme including those for Panchayati Raj Institutions, Urban local bodies, Water User Associations and youths towards water use efficiency, water conservation and managing water related disaster like flood and drought.

## 8.2 Key trends in the sector

The State is endowed with ample amount of surface and ground water resources mostly of Himalayan origin. The three distinct physiographic division of the State are drained by three distinct river basins namely Chenab, Jhelum and Indus River. Apart from the rivers, the State is also gifted with numbers of water bodies including tributaries, lakes

and wetlands. The following section provides a brief of the existing water bodies in the State, the availability of water from various resources and its demand across different sector in the State.

### 8.2.1 River System

The water flowing in the Himalayan rivers receives water from rain, snow and glaciers. Water flow from snow and glaciers make these rivers perennial where heavy monsoon rainfall contribute to the bulk of water in these basins which are used for irrigation and Hydro-power generation.

#### 1. Indus River

The Indus river originates at the confluence of the Sind river and the Gar river which is Mansarovar lake in Tibet at an elevation of 518 meters, and enters India through South-eastern corner of J&K State. The Indus River is fed by massive Tibetan glacial waters to become a mighty river further fed from other glacial catchment areas in Karakoram and Zaskar ranges. The Indus river flows in between the Ladakh range and Zaskar range before crossing the international boundaries into Pakistan. The Indus traverses a distance of 1,800 miles (2,900 km) through Tibet, India, Pakistan occupied Kashmir (PoK), and Pakistan before draining into the Arabian Sea in south of Karachi. The main catchment area of the Indus river is in Kargil and Ladakh districts of J&K (about 59,146 sq. km). The catchment area up to Indo-Pak border is about 1,68,355 sq. km out of which 30,755 Sq. km is in Tibet and 1,37,000 Sq. km is in the international boundaries of India (out





of which 59,646 Sq. km within the line of control.

Indus has several tributaries major among them are Gilgit River, Gumal River and Kabul River. The western tributaries of the Indus that include the Swat, Kurram, Gomal,

Kohat, Zoab and Kabul are not discussed herein. The river has been variously known as the Sengge or Lion River by the Tibetans, Abbasseen or Father of Rivers by the Pathans of present North West Frontier province (NWFP) Pakistan, and Mitho Dariyo or Sweet River by the denizens of the arid Sindh.



Figure 18: Indus River and its tributaries with in Jammu and Kashmir



## 2. Jhelum River

Jhelum originates from Verinag spring in Anantnag and after passing through Srinagar it flows as into Wular lake and then passing through Baramulla and Uri it flows towards Pakistan. The total geographical area of Jhelum basin up to Indo-Pakistan border is about 34,755 sq. km. The total catchment area upto the ceasefire line of about 17,622 sq. km, spreads in seven districts namely Anantnag, Pulwama, Srinagar, Badgam, Baramulla, Kupwara, and Poonch. The Lidder River is the biggest tributary of Jhelum and is fed by a large number of glaciers. Jhelum is joined by many small streams like Vishow, Rambiar, Wanbran, Aripal, Romeshi, etc.

## 3. Chenab River

The merging of the two Himalayan River- Chandra River and Bhaga River at Tandi located in upper Himalayas forms the Chenab. It enters the plains of Jammu and then enters into Pakistan. The Salal, Dulhasiti, Sawalkot and Baglihar Hydel projects have been constructed over it.

## 4. Kishan Ganga River

Kishan Ganga is in Drass (Kargil) in the inner Himalayas. After passing through the mountain tracks of Gurez, Keran and Karnah it joins Jhelum at Doemel.



## 5. Tawi River

Originating from Kailashkund spring at Soej hills in Bhandarwath, Tawi passes through Jammu and joins Chenab in Ranbir Singh Pura and then enter Pakistan.

## 6. Ravi River

Ravi is a trans-boundary river flowing through

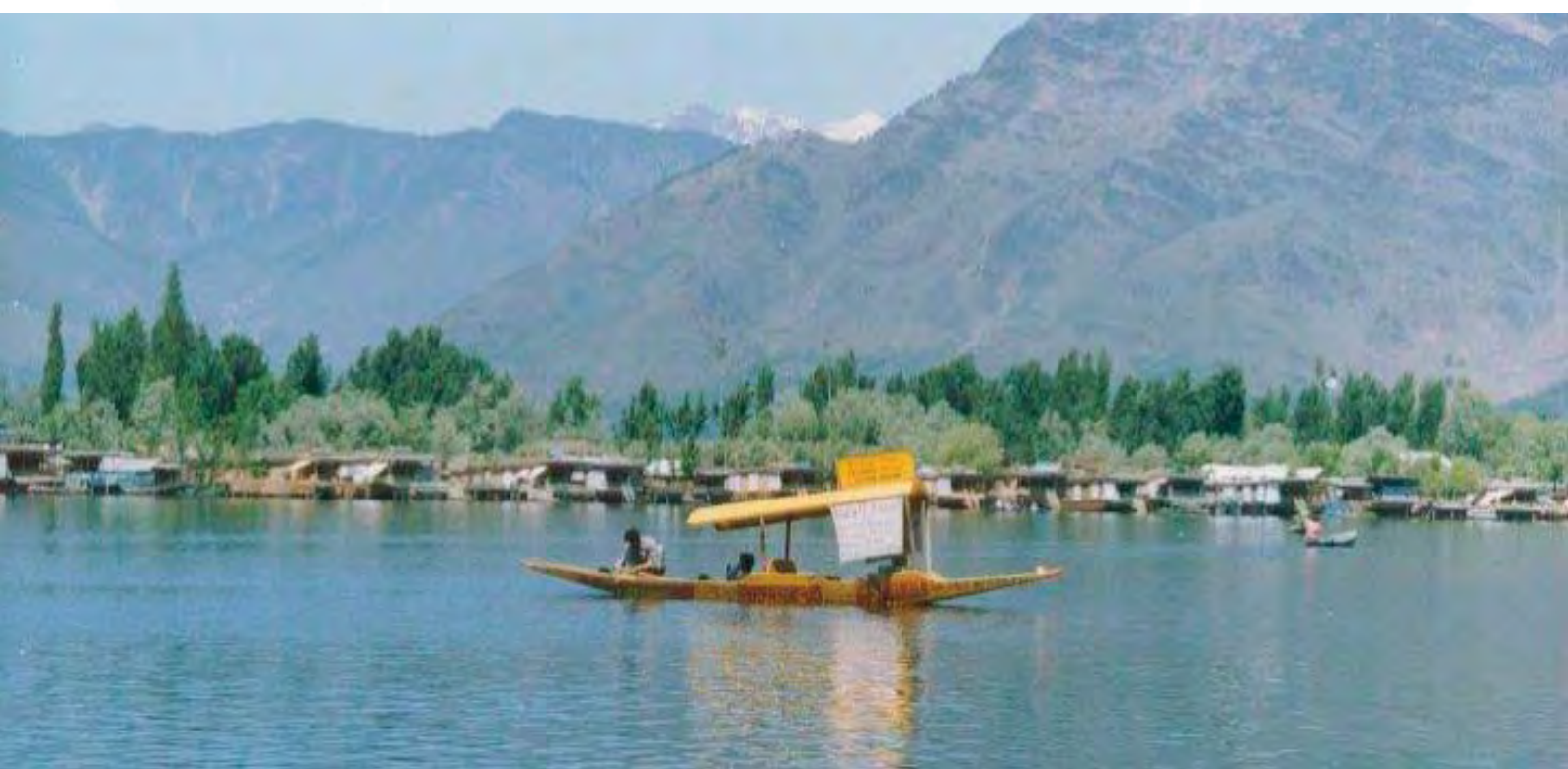
North-western India and North Eastern Pakistan. The river drains a total catchment area of 14,442 sq. km in India after flowing for a length of 720 km.

### 8.2.2 Lake

Number of lakes and water bodies in the State that acts as a source of surface water are represented as follows:

*Table 33: District wise number of lake and water bodies*

Sl. No	District	Number of Lakes and Water bodies	
		SOI Toposheet of 1967	LISS III Datasheet of 2012
1	Anantnag	88	98
2	Baramulla	119	124
3	Budgam	25	33
4	Doda	13	88
5	Jammu	15	15
6	Poonch&Rajouri	46	27
7	Pulwana	61	20
8	Kathua	1	1
9	Kupwara	111	66
10	Ladakh	637	665
11	Srinagar	52	74
12	Udhampur	36	19
	Total	1,248	1,230



### 8.2.3 Major supply of water in the State

#### 1. Precipitation

Precipitation is the major source of water resource in the State over and above surface water and replenishable groundwater. The precipitation is also one of the important

constituents of climate. The presence of the water vapors in the climate, which depends upon the feed of the moisture from evaporation, both from the seas and the land, and the movement of this moist water, its condensation and the precipitation are part of the climatic process. The regime of the precipitation in the hydrologic cycle, thus heavily depends on the climatic factors.

*Table 34: Availability of Water from precipitation across the administrative divisions of Jammu*

Sl. No.	Station	2004	2005	2006	2007	2008
		Total Rainfall in mm	Total Rainfall in mm	Total Rainfall in mm	Total Rainfall in mm	Total Rainfall in mm
1.	Jammu	1,098.9	1,112.4	1,235.8	1,294.1	1,339.4
2.	Banihal	982.8	1,553.2	1,865.4	1,038.4	1,180.7
3.	Batote	1,151.2	1,703.5	1,912.5	1,038.4	1,265.9
4.	Bhaderwah	1,193.5	1,597.4	1,407.9	918.8	1,075.5
5.	Katra	1,819.7	1,879.2	2,546.9	2,283.2	2,375.5
6.	Kathua	1,005.4	1,301.8	1,162.9	1,896.4	1,360.4







An analysis of availability of precipitation between 1980 and 2008 reveals a varied pattern. Analysis of the rainfall trends indicate that since 1980, the rainfall has shown declining trend in Mansar, Udampur, Kathua, Kishanpur, Mandi, Basoli, Rajouri, Akhnoor, Khorh, Poonch, Bilawar, Ramnagar & Barmeen stations while the number of rainy days has increased in Kishanpur, Mandi, Rajouri & Akhnoor. Rainfall started increasing from 2000 in Jammu, Banihal, Batote, Bhaderwah, Katra & Kathua along with increase in number of rainy days in Jammu, Banihal, Batore & Bhaderwah.

Analysis of pattern of precipitation in Kashmir division between 1990 to 2008 reveals that though rainfall in Srinagar, Pahalgam, Kukernag, Qazegund, Gulmarg & Kupwara showed significant variation, the number of days with rainfall has increased in the areas.

## 2. Glacial

The “frozen water” in the Himalayas is crucial for the people inhabiting the mountain areas as well as those inhabiting the downstream regions. The Indus basin has 7,997 glaciers with a total glacier cover of 33,679 sq. km

*Table 35: Availability of Water from precipitation across the administrative divisions of Kashmir*

Sl. No.	Station	2004	2005	2006	2007	2008
		Total Rainfall in mm	Total Rainfall in mm	Total Rainfall in mm	Total Rainfall in mm	Total Rainfall in mm
1.	Srinagar (IMD)	635.2	680.8	887.6	501.8	649.7
2.	Pahalgam	976.6	1,300.7	1,514.7	921.2	1,038.2
3.	Kukernag	671.8	1,107.2	967.1	713.0	1,215.3
4.	Qazigund	1,006.1	1,275.7	1,407.1	879.8	1,075.3
5.	Gulmarg	1,057.8	1,663.0	1,664.3	937.8	1,222.9
6.	Kupwara	868.8	970.0	1,196.8	654.2	989.5

and total ice volume of 363.10 cu. km. The contribution of snow to the runoff of major rivers in the eastern Himalayas is about 10% and more than 60% in the western Himalayas.

*Table 36: Major glaciers in the Indus basin of India*

Basin	No. of glaciers	Glacier covered Area (km <sup>2</sup> )	Ice volume (km <sup>3</sup> )
Ravi	172	193.00	8.04
Chenab	1,278	3,059.00	206.30
Jhelum	133	94.00	3.30
Beas	277	579.00	36.93
Satluj	926	635.00	34.95
Upper Indus	1,796	8,370.00	73.58
Shyok	2,454	10,810.00	NA
Nubra	204	1,536.00	NA
Gilgit	535	8,240.00	NA
Kishenganga	222	163.00	NA
Total	7,997	33,679.00	363.10

*Table 37: The characteristic of glacial coverage in State*

Glaciers (no.)	Area (km <sup>2</sup> )	Average Size (km <sup>2</sup> )	Glacier%
526	29163.00	10.24	61.80



### 3. Ground-water

The major areas of the State are occupied by high hills. Occurrence of the ground water is primarily confined to alluvial regions which have been classified into Piedmont deposits on outer plains of Jammu, Dune belt in the outer Himalayas, isolated valley fills in lesser Himalayas, fluvio-Lacustrine deposits in Kashmir valley and moraines and fluvio-glacial deposits in Laddakh. Dug well in Kashmir has limited yield. Ground water occurs in perched condition and give rise to springs in phreatic surfaces. The Annual Replenishable Ground water Resource of the State has been assessed as 2.70 bcm and the net ground water availability is 2.43 bcm. The annual ground water draft of the State is only 0.33 bcm. Ground Water is being used through dug wells, bore wells and tube wells for drinking and irrigation purposes.

Two main aquifer systems lie in this area- the hard rock or fissured aquifer and the soft sedimentary or porous aquifer. Occurrence and movement of ground water is mainly controlled by primary inter- granular porosity in the soft sedimentary alluvium and *Karewa* (elevated table-land in Kashmiri dialect) formations. The unconsolidated sedimentary deposits form multi-layer aquifer systems in the outer plains of Jammu and valley areas of Kashmir. In hard rock or fissured formation, the thick weathered zone and the fractured secondary porosity govern the occurrence and movement of ground water. There exists large scope for further ground water development, particularly in the valley area as well as Kandi areas by constructing suitable ground water structures. The groundwater resources have two components, viz. static and dynamic.

*Table 38: Basin-wise Replenishable Groundwater Resources (in bcm)*

Annual Replenishable Ground water Resources	Monsoon Season	Recharge from Rainfall	0.61
		Recharge from other sources	0.77
	Non-Monsoon Season	Recharge from Rainfall	1.00
		Recharge from other sources	0.32
Total			2.70
Natural Discharge during non-monsoon season			0.27
Net Annual Ground water Availability			2.43
Annual Ground water draft	Irrigation		0.10
	Domestic and industrial uses		0.24
	Total		0.33
Projected Demand for Domestic and Industrial uses upto 2025			0.42
Ground water availability for future irrigation			1.92
Stage of Ground water development			14.00

Table 39: Basin-wise Replenishable Groundwater Resources (in bcm)

Parameters			Anan- tnag	Bad- gan	Bara- mula	Jammu	Kathua	Kupw- ara	Pulw- ama	Srin- agar
Annual Replenishable Groundwater Resources	Monsoon Season	Recharge from Rainfall	3,038	1,969	4,689	31,424	13,748	1,921	3,544	1,158
		Recharge from other sources	12,237	8,229	9,885	21,921	8,747	4,074	7,877	4,175
	Non-Monsoon Season	Recharge from Rainfall	13,851	6,805	29,245	15,700	6,869	7,002	16,160	4,028
		Recharge from other sources	3,465	1,050	1,260	16,032	6,223	105	3,045	840
	Total			32,591	18,053	45,079	85,077	35,587	13,102	30,626
Natural Discharge during non-monsoon season			3,259	1,805	4,508	8,508	3,559	1,310	3,063	1,020
Net Annual Ground water Availability			29,332	16,248	40,571	76,569	32,028	11,792	27,563	9,181
Annual Ground water draft	Irrigation		40	36	236	6,636	2,193	14	53	295
	Domestic and industrial uses		1,377	2,285	3,488	6,854	1,786	1,981	2,256	3,903
	Total		1,417	2,321	3,724	13,490	3,979	1,995	2,309	4,198
Projected Demand for Domestic and Industrial uses upto 2025			2,534	4,017	6,257	11,721	2,676	3,948	3,691	6,694
Ground water availability for future irrigation			26,758	12,195	34,078	58,212	27,159	7,830	23,819	2,192
Stage of Ground water development			5	14	9	18	12	17	8	46

## 8.2.4 Major Usage of Water and its sourcing in the State

### 1. Irrigation

The total cultivable area of the State is 25.96 lakh<sup>16</sup> acres (10.51 lakh ha). Agriculture and its allied sector including horticulture and sericulture are highly dependent upon the availability of water. The irrigation potential of the State is 2.50 lakh hectares through

major/medium surface water scheme and about 4.00 lakh ha through surface water minor schemes. The ground water irrigation potential is estimated to be 7.08 lakh ha. 2 major and 16 medium and a large number of minor irrigation completed schemes provides irrigation facilities to about 2.877 lakh hectare area in the State through Indus, Jhelum, Chenab and Ravi rivers. Currently, 14 medium and 13 renovation projects are under construction in the State.



Table 40: Total area of irrigated land from different sources

Year	Net Area Irrigated by (000 ha)				
	Canals	Tanks	Well	Other	Total
1950-51	244.00	3.00	3.00	11.00	261.00
1955-56	277.00	1.00	3.00	9.00	290.00
1960-61	256.00	-	5.00	13.00	274.00
1965-66	270.00	-	1.00	7.00	278.00
1968-69	252.00	-	1.00	11.00	264.00
1974-75	279.00	-	3.00	13.00	295.00
1980-81	285.00	2.00	4.00	13.00	304.00
1985-86	288.69	2.67	4.12	14.13	309.61
1990-91	278.58	1.98	1.33	16.20	298.09
1995-96	284.86	2.57	1.42	17.73	306.58
1998-99	283.81	2.60	1.32	21.42	309.15
1999-00	278.35	2.57	1.37	20.80	303.09
2000-01	284.15	2.71	1.53	22.48	310.87
2001-02	284.42	2.79	1.61	21.35	310.17
2002-03	274.50	2.66	1.57	20.49	299.67
2003-04	282.41	3.87	1.06	19.19	306.53
2004-05	266.28	3.93	1.08	19.60	310.89
2005-06	289.28	4.21	1.05	17.57	312.11
2006-07	286.64	4.24	1.04	17.52	309.44
2007-08	285.78	4.22	0.99	17.05	308.04
2008-09	287.77	4.84	3.80	17.32	313.73
2009-10	287.80	5.11	4.33	20.03	317.27
2010-11	288.48	6.22	11.65	14.28	320.63

Source: Digest of Statistics 2010-11

The above statistics clearly reveals that majority of irrigation in the State is canal fed comprising about 90% of the total.

### ***Irrigation Development in Indus Basin***

Due to sub-zero temperatures during the winter the Ladakh terrain remains under snow cover. There is only one crop season available during summer which is highly dependent on irrigation due to very scanty rainfall in the area and arid climate condition. The irrigated area as on effective date of treaty was 42,179 acres (17,069 ha) which is now increased to 49,338 acres (19,967 ha). Therefore, another 62,837 acre (25,430 ha) area can be brought under irrigation under the provision of treaty. However, the total cultivable area in the Ladakh region is only 71,540 acre (28,953 ha). Therefore, almost all the cultivable area of Ladakh region can be brought under irrigation under the treaty, but the provisions cannot be fully utilized as the cultivable area is limited. In the Indus basin there is only one crop season available

during the summer time, the main crops in the two districts (Ladakh and Kargil) are wheat, gram and small millets. Major sources of irrigation are gravity canal or kulhs drawn from rivers or streams. Due to topography and availability of agriculture land in patches there is limited scope of major and medium irrigation projects. Minor irrigation schemes are well suited for the region; about 476 minor irrigation schemes are providing irrigation to about 16,000 ha area in the Ladakh region. One medium project namely Igo Phey canal project provides irrigation to about 4,000 ha of land. One Parkachik Khawas irrigation canal project for irrigation of 2,235 ha land in the Kargil is under construction. It is estimated that another 8,000 ha area can be brought under irrigation by minor irrigation schemes in the districts, leaving a scope of about 15,000 ha area without irrigation under the treaty.



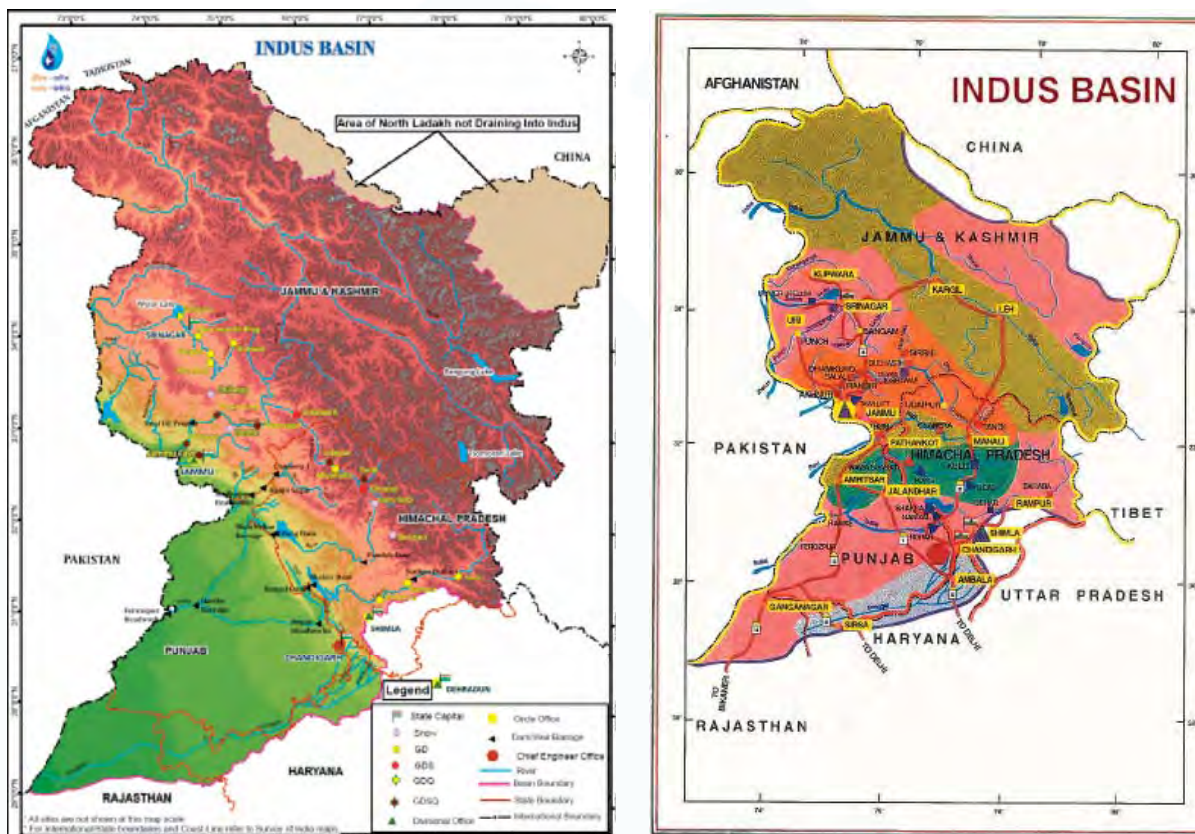


Figure 19: Indus Basin

### **Irrigation Development in Jhelum Basin**

Due to hilly terrain Jhelum basin has got limited scope of major and medium irrigation projects. Large numbers of Zamindari canals (kuhl) were constructed by people to supply irrigation water to the fields. A large number of government canal schemes like lift schemes, diversion schemes and storage schemes have been providing irrigation facilities to the large track of cultivated and horticulture area. As on effective date of Indus treaty, irrigated area in Jhelum was 5,17,909 acre (2,09,594 ha) and additional area permissible without any storage in the treaty, works out to be 6,67,909 acre (2,70,300 ha), out of which 6,51,500 acre

irrigation area (2,63,658 ha) has already been achieved. There is large number of surface flow minor irrigation schemes (3,540 no's) and surface water lift irrigation schemes (411) as per minor irrigation census (2000-2001). Dug wells, shallow tube wells as well as deep tube wells have also been developed to a limited extent. An area of about 15,000 acre (6,000 ha) is irrigated through ground water. During the survey and studies conducted by Central Water Commission, it was found that there were not many feasible storage schemes in the tributaries of Jhelum basin. Only feasible storage option found out was Drang site. The Irrigation and Flood Control Department, J&K has proposed 14 storage sites where storage is feasible and an area of about 80,000 acre



can be brought under irrigation from these storages. However, these sites have to be further surveyed and investigated as a small height of dam of about 20 m height, could relate to serious problems of submergence of forest, land and villages.

### ***Irrigation Development in Chenab Basin***

About 16% of the basin area is sown with mostly wheat, maize, rice, onion, fruits, vegetables and beans. The area in Chenab basin in Jammu region is mostly irrigated by gravity canals. Besides, irrigation from other sources like tube wells, tanks, well, springs, etc are also carried in much smaller magnitude. In Doda district, two medium irrigation schemes namely Shiva canal and Kashtigarh canal scheme have been constructed during Fifth Five Year Plan. In Udhampur district, two canals namely Udhampur and Duddar canal were constructed in II<sup>nd</sup> and V<sup>th</sup> plan respectively. Similarly, in Rajouri District also two medium irrigation projects namely Ans and Sajal have been functioning. In Jammu district, land is generally flat and two major canal systems, namely Ranbir canal and Pratap canal were constructed way back during 1903-04 to irrigate vast track of land on either side of river. As these are restrictions under the Indus Treaty for expanding the irrigation area, without creating storages,

there is urgent need to build storages as to exploit all the additional Irrigated Cropped Area (ICA) permissible under with storage.

Ground Water is being used through dug wells, bore wells and tube wells for drinking and irrigation purposes. Two main aquifer systems lies in the area, the hard rock or fissured aquifer and soft sedimentary or porous aquifer. Occurrence and movement of ground water is mainly controlled by primary inter- granular porosity in the soft sedimentary quaternary alluvium and Karewas formations. The unconsolidated sedimentary deposit form multi-layer aquifer system in Jammu, outer plain and in Kashmir, valley areas. In hard rock or fissured formation the thick weathered zone and the fractured secondary porosity govern the occurrence and movement of ground water. There exists large scope for further ground water development, particularly in the valley area as well as Kandi areas by constructing suitable ground water structures.

### ***Development of additional Irrigated Cropped Area within the provision of Indus Water Treaty***

As per provisions of Indus Water Treaty, additional ICA can be taken by India and is as follows:





Table 41: River basin wise irrigated crop area permitted under Indus Water Treaty

River Basin	ICA as on Effective Date (1-4-1960)	ICA permissible as per Treaty		Total ICA permissible		Total ICA 2010-11 (Actual)
		Without storage	With storage & releases (Addl)	Without storage	With storage & releases	
1	2	3	4	5	6	7
Indus	42179	70000	-	112179	112179	51175
Jhelum	517909	400000	150000	667909	917909	512575
Chenab	82389	231000	50000	132389	313389	48952
	-	-	150000			
<b>Total</b>	<b>642477</b>	<b>701000</b>	<b>350000</b>	<b>912477</b>	<b>1343477</b>	<b>612702</b>
# includes 6,000 acres outside drainage basin of Chenab						

## 2. Domestic Water

### *Jhelum basin*

The population of Jhelum basin in 2001 Census was about 40 lakh. The total domestic water demand is estimated to be 460 MLD. The areas falling in the basin are hilly and mountainous with inter mountain valleys. The valley areas are flat and mildly undulating topography. In such condition small surface water streams/ rivers and ground water is most suitable for domestic water supply. The ground water utilization in the valley has not much developed but 95% of development of ground water has been utilized for domestic and industrial use. As per State statistics, Jhelum valley has 1,485 tube wells and 5,216 dug well for the domestic water supply purposes. Given the relatively low stage of ground water development in each of these districts, it seems that increase in the water demand in the future decades can be taken care of through further development of ground water resources. Similarly, small industrial requirement of water can be taken

care of by exploiting ground water.

### *Chenab basin*

Total population in the Chenab basin district in J&K is 34.28 lakh as per 2001 census. The domestic water demand is roughly estimated to be 240 mgd. The stage of ground water development is quite low (Jammu 16% & Kathua 12%). These are about 600 tube wells and 331 dug wells in the Chenab districts, mostly in Jammu and Kathua districts. For meeting the domestic water requirement at the remote places not covered with the irrigation projects commands, ground water potential has to be tapped.

In the whole of the State of J&K 5,55,700 water taps have been installed out of which 1,52,400 are public stand post and rests are private pipe connections.

## 3. Drinking Water

Drinking water is widely available in the State. However, some villages/ habitations once covered under drinking water supply face

problematic scenario due to quantitative or qualitative deficiencies. Issues related to less service level, sources depletion, outlived design period of water supply schemes need to be addressed. The Govt. of J&K is facilitating availability of portable water to the extent of 135 ltr per person per day in urban areas and 70 ltr per person per day in rural areas through administrative departments. It is envisaged to provide deep tube wells/production wells to address the drinking water problem in extremely water scarcity zones and areas where water sources have completely depleted due to drought.

## 8.3 Vulnerability of the sector

### 8.3.1 Projected variation in the precipitation pattern

Overall Precipitation pattern: The PRECIS run for 2030's indicate that annual rainfall in the Himalayan region is likely to increase in 2030s with respect to 1970s range from 5% to 13% with some areas of Jammu and Kashmir showing an increase up to 50%. All seasons in the Himalayan regions indicate an increase in rainfall, with monsoon months of June, July, August and September showing the maximum increase in rainfall. The winter rain in the month of January and February are also projected to increase whereas minimum increase is indicated in October, November and December.

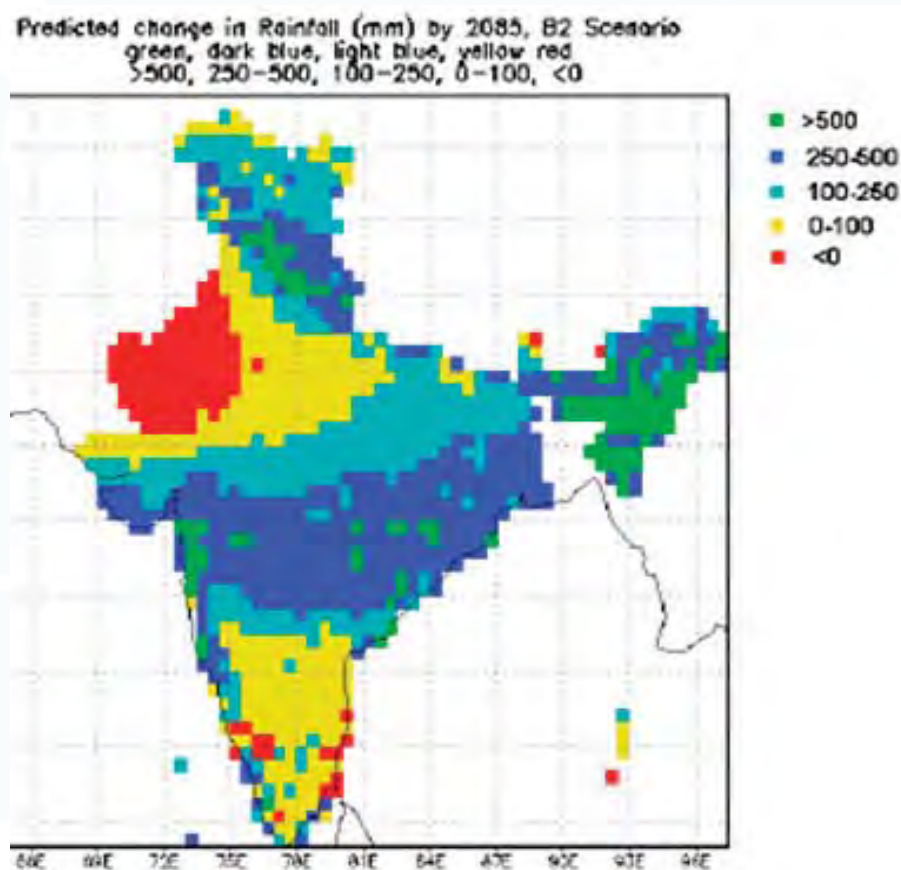


Figure 20: Predicted change in rainfall (mm) by 2085, (Source: Current Science)

Extreme precipitation: The number of rainy days in the Himalayan region in 2030s may increase by 5-10 days on an average, with an increase by more than 15 days in the eastern part of the Jammu and Kashmir region. The intensity of rain fall is likely to increase by 1-2 mm/ day.

Associated Vulnerability: Increase in the rainfall is likely to enhance the incidence of flood. It might also impact livelihood sectors like agriculture and tourism. The general impact of is reflected in the increase in sediment yield. The other major factors that govern sediment yield are the intensity of rainfall, land use and the soil type of the area. The increase in the sediment yield in the Himalayan region is up to 25%, which can be detrimental for the existing water resources projects and also cause considerable damage

to the environment.

### 8.3.2 Projected variation of the glacial reserve

The snowline and glacier boundary are sensitive to changes in climate conditions. Trend analysis of various glaciers from the past data gives some future projections. Glaciers are not well represented by PRECIS modeling. Warming is likely to rapidly increase the rate at which glaciers are melting, leading to greater ablation than accumulation. Almost all glaciers reportedly show negative mass balance according to SASE report.

The rate of recession of glaciers reportedly varies due to winter precipitation, climate warming and anthropogenic elements of landscape.

*Table 42: Recent retreat pattern of selected glaciers in Jammu and Kashmir*

Name of the Glacier	Retreat of snout (m)	Observation Period	Trend	Avg. retreat rate (m/year)
Drang-Drung	NIL	2004-2007	No Change	-
Kangriz	NIL	1913-2007	No Change	-
Siachin	NA	1862-1909	Advancing	15.42
	NA	1909-1929	Retreating	2.50
	NA	1929-1958	Retreating	14.00
	NIL	1958-1985	No Change	NIL
	NA	1985-2004	Retreating	3.00
	NA	2004-2005	No change	NIL

Associated Vulnerability: Glacial melt is expected to increase under change in climatic conditions, which would lead to increased summer flows in some rivers systems leading to enhanced flood scenario for few decades, followed by reduction in the flow as glaciers disappear resulting into drought conditions.

## 8.4 Key issues in the sector

### 8.4.1 Flood risk from water bodies in the State

Destructive floods of both large and small magnitudes, have been taking heavy toll on life and property in the State as seen from the historical records. The problem in Kashmir valley is basically due to inundation of banks of river Jhelum and its tributaries, land erosion in Jammu region around the Chenab and Tawi rivers.

#### ***Flood Problem in Jhelum Basin***

The flood problem in the valley is due to inadequate carrying capacity of the river Jhelum in its length from Sangam to Khandanyar. Just upstream of Srinagar a flood spill channel with capacity of 481 cu. m/s (17,000 cusecs) takes off to by-pass the city at Padshahibagh. However, in spite of the flood spill channel, floods can be caused from Jhelum in the Srinagar town, if the discharge of river through the town exceeds 991 cu. m/s (35,000 cusecs).

The outfall channel below Wular Lake is the only outlet for drainage of whole valley. The off take channel is only about 20,000 cusecs (570 cu. m/s). During high discharge in the river, the flood water gets accumulated in

the Wular Lake, which acts as an absorption basin. When the Wular lake level rises, the water from the river reaches above, almost up to Srinagar. Many times the rising water breaches the embankment at a number of places, mostly on the left side, submerging tracts of rich cultivated land, causing heavy damages to the crops. The problem is aggravated on account of the silt brought down by Pohru River entering into outfall channel and causing blockages.

The major risk is projected as the town is thickly populated along its bank and any widening of bank or raising embankments is not feasible.

#### ***Historical instances of flood are***

- During the year 1928, Jhelum caused heavy flood in the valley when the river carried a discharge of 2,265 cu. m/s (about 80,000 cusecs) against the capacity of 906 cu. m/s (32,000 cusecs).
- In 1950, flood flow was encountered due to discharge of about 1000 cu. m/s (35,000 cusecs).

#### ***Flood Problem in the Chenab basin***

The Chenab in the hilly area up to Akhnoor does not create any flood problem as it passes through the deep rocky steep gorges. In the plains, the slope of river is flat and it spreads to a width of 1 km to 8 km with many tributaries. The river channels erode the cultivable lands and the river inundates vast area causing devastation at higher discharges.



#### 8.4.2 Retreat of Glacial System

1. A study of snow cover monitoring by Negi et al, (2009) in the PirPanjal and Shamshawari ranges in Kashmir valley indicated spatial and temporal variability in the snow cover. Advance melting was observed in Banihal and Naugam/ Tangdhar regions than Gurej and Machhal regions.
  2. Shekher et al (2010) studied the snowfall patterns in the Western Himalayan range which indicated a decrease in total seasonal snowfall by 280 cm over the entire Western Himalaya between 1988 to 2008. The snowfall decreased by 280 cm over the PirPanjal, 80 cm over Shamshawari and 440 cm over the greater Himalaya ranges. Whereas over the Karakoram range, only 40 cm decreasing trend was noticed.
  3. Study by A V Kulkarni (2006) indicated significant glacial retreat. The study investigated 466 glaciers in Chenab, Parbati and Baspa basin since 1962. The investigation has shown an overall reduction in glaciers area from 2,077 sq. km to 1628 sq. km since 1962, an overall deglaciation of 21%. However, numbers of glaciers have increased due to fragmentation. MoEF report on Climate Change and India (A 4x4 Assessment report) in Nov 2010, gives an overall status as summarized below.
- A. Studies conducted during last three decades by the National Institute of

Hydrology (NIH) reveal that glaciers in Ladakh, Zaskar and the greater Himalayan ranges of Jammu and Kashmir are generally receding and the glacial volume changes range between 3.6% and 97%, with the majority of glaciers showing degradation of 17% - 25%. The studies however, do not reveal any significant retreat during 2004-07. Most of the glaciers in Western Himalayan are receding (except a few in Jammu & Kashmir which are not changing or rather are advancing).

- B. The Nubra valley of Jammu and Kashmir has 114 small-sized glaciers varying between less than 5 km and 10 km in length. The glaciers of the valley has not shown much change in their length and area during the period 1989–2001. However, variable decline in the glacial area of the Siachin glacier has been observed. The area has reduced from 994.99 sq. km in 1969 to 932.90 km<sup>2</sup> in 1989. However, small change in the area (932.90 sq. km to 930 sq. km) has been noticed during the decade of 1989–2001. Recession patterns of 466 glaciers in the Chenab, Parbati and Baspa basins of the western Himalayas have been studied for the period 1962–2008. An overall deglaciation of 21% has been observed.

Most of the glaciers in western Himalayas are receding (except a few in Jammu and Kashmir, which are either stagnant or advancing). The processes controlling the rate of retreat of glaciers

are complex and vary with location and topography of the area. However, the impact of rising temperature and reducing snowfall on glacier mass balance might require a sound long-term database for precise climate change assessment.

### 8.4.3 Deterioration of the Water bodies

The lakes are the worst hit by the human interference and rapid urbanization. Some of these water bodies have disappeared due to natural causes like glacial action, low precipitation or are on the verge of extinction. Lakes that are within the urban areas have deteriorated over the period of time. The reason for such shrinkage/deterioration is an outcome of massive habitations around the lakes and encroachment/choking of drainage system. Also massive erosion in the catchment area has resulted in siltation of these lakes thereby converting the water body into landmass. Dal lake which exists as a water body system with its adjoining lakes i.e. Gilsar, Khushalsar and Aanchar are almost nonexistent. The deterioration of water bodies is largely due to:

1. Indiscriminate cutting of surrounding vegetation thereby increasing silt and nutrient load in the lake bodies.
2. Disposal of Sewage and domestic waste.
3. Open Defecation.

4. Excessive use of pesticide and insecticide in the catchment.
5. Soil erosion in the catchment and siltation
6. Prolific plantation in Wular
7. Unchecked housing
8. Weed intensification and eutrophication

## 8.5 Programme and Policies in the sector

### 8.5.1 Indus water Treaty

Water utilization and hydro-power generation in the State is largely governed by the Indus Water Treaty. The Indus system comprises three eastern rivers namely the Sutlej, the Beas, the Ravi and three western rivers namely the Indus, the Jhelum and the Chenab. Under the Indus Water Treaty (IWT) of 1960, the waters of eastern rivers are allocated to India and those of western rivers to Pakistan except specified uses by India mostly in the State of J&K.

As on effective date of agreement on 1.4.1960, 6.42 lakh acres were being irrigated by India from the Western Rivers and is entitled to irrigate additional ICA of 7.01 lakh acres (total of 13.43 lakh acres) as per details below.

Table 43: Maximum area irrigated

Name of the river	The Indus	The Jhelum	The Chenab	Total
ICA in acres	70,000	4,00,000	2,31,000 <sup>17</sup>	7,01,000

As per Annex – E of the Indus Water Treaty, the aggregate storage capacity of all single purpose and Multi-purpose reservoirs which may be constructed by India after Effective Date shall not exceed the following table:

Table 44: Aggregate Storage Capacity

SI No.	River System	Conservation storage MAF		Flood Storage MAF
		General Storage	Power Storage	
(a)	The Indus	0.25	0.15	Nil
(b)	The Jhelum (excluding the Jhelum Main)	0.50	0.25	0.75
(c)	The Jhelum Main	Nil	Nil	As provided in Paragraph 9 of Annexure to the Treaty
(d)	The Chenab (excluding the Chenab Main) <sup>18</sup>	0.50	0.60	Nil
(e)	The Chenab Main <sup>19</sup>	Nil	0.60	Nil

### 8.5.2 Jammu and Kashmir Water Resources (Regulation and Management) Act, 2010

The State Act of 2010 provides the law relating to use of water, the measurement, construction, control and management of works with respect to water storage, conservation and protection, the irrigation water supply, drainage, flood control and prevention, the improvement in the flow of

water, the protection and improvement in the physical integrity of water sources, lakes and springs, the safety and surveillance of dams. The Act also provides for the establishment of State Water Resources Regulatory Authority for regulating water resources, ensuring judicious, equitable and sustainable management, allocation and utilization of water resources, fixing the rates for use of water and matters connected therewith and incidental there to.

<sup>17</sup>Includes 6000 Acres outside drainage basin of Chenab

<sup>18</sup>India shall have the option to increase the Power Storage Capacity specified against item (d) above by making a reduction by an equal amount in the Power Storage Capacity specified against items (b) or (e) above.

<sup>19</sup>Storage works to provide the power storage capacity on the Chenab main specified against item (e) above shall not be constructed at a point below Nangun (Latitude 33°19' N and Longitude 75°59' E)

The tariff fixation and revenue collection from different water usages particularly from Hydro power will provide huge revenue realization to the State which can be further reinvested in construction of Hydro and Irrigation Schemes in the State, proper operation and maintenance of the water system including water bodies. The Act covers all the aspects of proper regulation of surface and ground water in the State.

In the Jammu and Kashmir Water Resources (Regulation and Management) Act, 2010, prioritization of water allocation has been given in the following order, but subject to modification if so warranted by area/ situation specific consideration:-

- Drinking water including washing and bathing
- Irrigation
- Generation of electricity
- Ecology and
- Agro industries and non-agricultural industries.

The act has adopted policy for establishment of a network of water quality laboratories at district level to ensure the water quality and regular monitoring in terms of parameters laid down by Government of India so as to ensure that the good health of people. The Act provides for prevention of encroachment on existing water bodies and deterioration of water quality in such water bodies due to pollution. The Act also provides for treatment of effluents, solid/gaseous wastes which are discharged into the natural streams, water bodies and have the potentials of

contaminating the ground water through seepage.

## 8.6 Key Priorities

1. Generate baseline data with terrain analysis (contour/ slope/ gradient/aspect, etc.), including comprehensive land classification, catchment demarcation, river networks, lakes and water bodies, forest coverage, etc.

Assessment of the water resources is the first step in understanding the State of water resources. This is essential to assess all water resource related activities such as efficient management of the resources, planning of the water resource for future use, re-adjustment of water use plans considering the changed supplies and demands etc. Baseline assessment consists of

- A hydrological study to enhance natural water availability in the basin/region/ area;
- Monitoring of Ground water level and quality
- Estimation of surface runoff and Evapotranspiration
- Spatial Distribution and Seasonal Variability of precipitation and number of dry days
- Monitoring of stream level and flow
- An assessment of the resultant flows that would continue to be available in future



- Estimate available catchment areas and basin studies to evaluate the actual scenario of water availability
- Undertaking study on Glaciology, Snow Hydrology, River hydrology and sedimentation
- Deciding on the acceptability of the resultant flows from the environmental and cultural aspects, and changing the water use plans accordingly.

Such data information will help in ground water, surface water vulnerability mapping and framing plan for integrated water management.

## 2. Promoting and implementing water use efficiency measures

Implementing water use efficiency has been accorded with the highest priority under National Water Mission. Following are the measures proposed to be undertaken as a part of the priority action:

- Mandating water audit across industrial and commercial sector to benchmark unit wise water usage and enforcing adoption of water conservation measures.
- Introduction of water metering system across domestic, industrial and commercial sector to ensure judicious usage of water.
- Creating awareness among the farmer groups towards judicious use of water and promoting sprinkler/drip irrigation systems and lowering

evapotranspiration. Farmers should also be trained for computing water requirements of crops and build capacity towards applying just as much needed and not irrigate randomly. Promoting System of crop intensification and achieving water use efficiency across agriculture sector.

- Water recycling (including recycling of tail end water for irrigation)/reuse
- Canals should be ensuring canals are free from seepages.

### 3. Develop hydrological models for different seasons and calibration with the existing data

Planning adaptation or DRM measures requires consistent monitoring, archiving (including past weather data information) and analysis of the weather related parameters so as to assess the variation/trends in the meteorological cycle and project future climate scenario using Global Circulation Models (GCMs). On regional basis GCMs are down scaled to Regional Climate Models (RCMs). The study should also include data collection programme about the hydraulic parameters in the three sub-basins in the State. The Soil and Water Assessment Tool (SWAT) model usually used to predict the hydrological response of the basin catchment to the natural inputs (meteorology) as well as manmade interventions (irrigation etc).

The weather and basin level hydrological data parameters will be used to develop the hydrological model under short, medium and long term scenario. Hydrological models

give the hydrological and flood forecasting of stream flows. These models are also used for flood forecasting of stream flows. The projections of variability in the hydrological cycle will be used to develop the hazard risk vulnerability and plan adaptation measures. The hydrological model developed will be calibrated on time to time basis based on the continual monitored data parameters so to facilitate projection with lowest error.

#### 4. Comprehensive water budgeting in lieu of the current and future demand from domestic supply, irrigation, industry, tourism and for other sectors

The total water balance of the State, its basins, sub-basins, areas, etc. depicting the quantified hydraulic cycle is the main tool for understanding the water situation. Water budgeting should be based on this hydraulic cycle and interaction between rain water, surface water, ground water, evaporation etc. It is therefore essential that water budgeting be carried out to chalk out efficient planning.

#### 5. Monitoring river flows and mapping of flood and drought zones

Using the river geometry and the flood area maps, it is possible to judge the discharges at any point of the stream network. For this, the digital elevation model (DEM) would have to be linked to the flood flow model. After the model gets validated in the process, flood prone areas for a given flood frequency could be mapped from the model,

for the changed hydraulics. This would be an aid for planning or modifying the flood protection works. Again, the proposed flood management plan can be studied through the model. If, an unsteady flow model is linked to the topography, effects of these, on the upstream and downstream, can be studied.

#### 6. Formulate comprehensive rejuvenation plan for Dal Lake, Mansar Lake, Manasbal Lake, Pangong Lake and all other major lakes

Lakes are the essential sources of surface water which suffice for the domestic and drinking water requirement in the State. Moreover these lakes are also main areas of tourist attraction. Shrinkage and deterioration of the lakes and water qualities along with encroachment and choking of drainage system might be forced.

#### 7. Assessment and Implementation of rain water harvesting and artificial recharging of ground water

##### ***Artificial Recharging of Ground water***

The artificial recharge to ground water aims at augmentation of ground water reservoir by modifying the natural movement of surface water utilizing suitable civil construction techniques. Artificial recharging helps to enhance the sustainable yield in areas where over-development has depleted the Aquifer, Conservation and storage of excess surface water for future requirements improve the quality of existing ground water through

dilution, remove bacteriological and other impurities from sewage and waste water. To facilitate ground water recharging it is essential to identify

- Availability of non-committed surplus monsoon run off in space and time.
- Identification of suitable hydrogeological environment and sites for creating subsurface reservoir through cost effective artificial recharge techniques

As a first step towards identification of suitable sites following studies are proposed:

**(i) Identification of Areas :** identification of areas should be carried out in

- Areas where ground water levels are declining on regular basis
- Areas where substantial amount of aquifer has already been desaturated
- Areas where availability of ground water is inadequate in lean months
- Areas where salinity ingress is taking place

**(ii) Identifying site suitability through following studies**

- Hydrometeorological Studies to decipher the rainfall pattern, evaporation losses and climatological features
- Hydrological Studies should be undertaken to ascertain the availability of source water for the purpose of recharge ground water reservoir. Four

types of source water may be available for artificial recharge viz. In situ precipitation on the watershed, Surface (canal) supplies from large reservoirs located within basin, Surface supplies through trans basin water transfer, Treated municipal and industrial wastewaters.

- Soil infiltration studies
- Hydrogeological study of the area relating to rock units, their ground water potential and general pattern of ground water flow and chemical quality of water in different aquifers including aquifer geometry
- Geophysical studies
- Chemical quality of source water
- Assessment of Sub-Surface Potential For Ground Water Recharge

Based on the identification of the area that are water stressed and possessing lower ground water level ten locations would be selected based on the assessment of quality of the soil, hydrogeology and hydrology and the level of vulnerability.

### ***Rainwater Harvesting***

Rain water harvesting is the technique for collecting and storing rain water in surface or sub-surface aquifers, before it is lost as surface run-off.

*Following are the measures proposed as part of the action plan*

- (i) Developing policy and incentives

framework towards promoting rainwater harvesting in urban areas and new construction.

(ii) Training of architect, urban local bodies and builders over the technology of rain water harvesting.

(iii) Implementation of pilot and demonstration project in urban and rural areas

(iv) Undertaking study of the water stressed area with declining ground water level and substantial amount of aquifer being de-saturated and demarcating areas for undertaking rain water harvesting project. Following are the important aspects to be looked into for rain water harvesting:

- Hydrogeology of the area including nature and extent of aquifer, soil cover, topography, depth to water level and chemical quality of ground water
- The availability of source water, one of the primary requisite for ground water recharge, basically assessed in terms of non-committed surplus monsoon runoff
- Factors determining to area contributing to run off like area available, land use pattern, industrial, residential, green belt, paved areas, roof top area etc.
- Hydrometeorological characters like rainfall duration, general pattern and intensity of rainfall.

Following are the technologies proposed under the action plan in urban and rural areas subjected to suitable satisfaction of the ground condition:

#### **Urban Areas**

- Roof Top Rain Water /Storm run off harvesting through
  - o Recharge Pit
  - o Recharge Trench
  - o Tubewell
  - o Recharge Well

#### **Rural Areas**

- Rain Water Harvesting through
  - o Gully Plug
  - o Contour Bund
  - o Gabion Structure
  - o Percolation tank
  - o Check Dam/ Cement Plug/ Nala Bund
  - o Recharge shaft
  - o Dugwell Recharge
  - o Ground Water Dams/Subsurface Dyke

Emphasize on the awareness and capacity building for conservation, concern and co-management of water

Creating awareness for the need of water conservation and propagating benefits in terms of reducing water purification



and sewer cost, less electrical energy use for pumping, environmental and social benefits and preservation of ground water reserves are the essential steps towards water management and ensuring water use efficiency. In this context schools should promote a water conservation ethics among children and also engage civil society organizations in creating awareness.

## 8. Dealing with flood and Drought in the changing climate scenarios

Flood or Drought can derail the development trajectory currently in place in the State. Prolonged drought conditions can be harmful to the agriculture yield. State has to manage such conditions by development of irrigation system, ground water development, water harvesting, changing cropping pattern, adopting integrated farming systems. Studies in various regions with regard to climate change scenarios have indicated over increased frequency or probability of floods. Flood causes extreme damage to the human life and infrastructure. Thus it should be judiciously managed so as to lower the impact on livelihood.

To control or reduce the impact of extreme hydrological events like drought or flood it is essential that adaptation measures be planned to identify and reduce the impacts of climate variability.

1. Developing hydrological forecasting models for floods and lean period flows and fitting the models and calibration of the model with the existing data.
2. Linking digital elevation models for low

lying areas with hydrological models to understand flood situations under different scenarios

### ***Drought Related Measures***

3. Completion of on-going irrigation projects (major, medium minor schemes) with the help of centrally funding / assistance.
4. Renovation of existing irrigation Schemes
  - Major and medium schemes with Central Assistance
  - Minor irrigation schemes within State funding
5. Development of ground water/ irrigation and Drinking Water to cover all the area which is not reachable by surface water.
6. Rehabilitation of water bodies by desalting and raising the capacity of their reservoirs by gated arrangements. The stored water can be useful for drought management in the cropped areas.
7. Developing crop varieties considering the rise in air temperatures and intermittent drought conditions.

### ***Flood Related Measures***

8. Preparation/ revision of Master Plans for flood protection with changed flood scenarios due to climate change. Some efforts for preparation of master plans for flood control and management in the Jhelum and Chenab basins

have been carried out by the State government with the help of Central Water Commission. Considering the projections of enhanced magnitudes of floods due to Climate Change efforts, these master plan may be revised.

9. Urban storm water drainage improvement guidelines to be framed to facilitate implementation of various schemes under Jawaharlal Nehru National Urban Renewal Mission (JNNURM). Increased frequency of floods, urban drainage congestion may pose bigger problems. Studies should be carried out with the help of Central Water Commission (CWC) for improved drainage designs for urban areas. Strict measures for cleaning of drainage and waterways and removal of encroachments and acquisition of land/ properties for effecting proper drainage measures are enforced through legal and procedural changes.
10. Designing and planning of Implementation of nonstructural measures for flood management, and storage of water in numerous depressions and lakes.
11. Development of flash flood forecasting system based on the alerts from Automatic Rain gauges.

12. Dam Break or Embankment break studies to be conducted routinely with the help of CWC, NIH (National Institute of Hydrology and Central Water and Power research Stations (CWPRS).

## 9. Reducing impact of increased erosion and sedimentation

Whereas losses consequent to floods generally occur only in crop season, the losses due to sedimentation of fertile lands, bank erosion and changing course of river lead to loss of productive lands. The land erosion and deposition by sedimentation is likely to be accentuated in the climate change scenario because increasing flood frequencies will cause land erosions, and rainfall intensities may erode soil in the upper catchments. In the flood control & management master plan, river training and erosion control measures should also be studied and implemented. A master plan for soil conservation measures and catchment area treatment should be prepared for time bound implementation. It is also recommended to develop a universal soil loss model depicting erosion and sediment transport. It is also recommended to develop a master Plan for soil conservation measure and catchment area treatment and implementation.

## 8.7 List of Key Priority Action

Table 45: Key Priority Actions State Water Mission

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Generate baselinedata with terrain analysis (contour/ slope/ gradient/aspect, etc.), with comprehensive land classification with catchment demarcation, river networks, lakes and water bodies, forest coverage, etc	PHE, Irrigation and Flood control department	Nil	8.00	8.00	MOWR, CWC, CGWB, GoI, EFA
2	Promoting and implementing water use water use Efficiency measures	PHE, Irrigation and Flood control department , Housing and Urban Development Department, MOWR, CWC, CGWB , Agriculture	Nil	12.00	12.00	MOWR, CWC, CGWB, GoI, EFA
3	Develop hydrological models for different seasons and calibration with the existing data	PHE, Irrigation and Flood control department , MOWR, CWC, CGWB	Nil	8.00	8.00	MOWR, CWC, CGWB, GoI, EFA
4	Comprehensive water budgeting in lieu of the current and future demand from domestic supply, irrigation, industry, tourism and for other sectors	PHE, Irrigation and Flood control dept, Industry and Commerce dept	Nil	12.00	12.00	MOWR, CWC, CGWB, GoI, EFA
5	Monitoring river flows and mapping of flood and drought zones	PHE, Irrigation and Flood control dept	Nil	12.00	12.00	MOWR, CWC, CGWB, GoI, EFA

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
6	Formulate comprehensive rejuvenation plan for Dal Lake, Mansar Lake, Manasbal Lake, Pangong Lake and all other major lakes	Lake Development authority, Housing and Urban Development Department	Nil	56.00	56.00	MOWR, CWC, Gol, and other external agencies
7	Assessment and Implementation of rain water harvesting and artificial recharging of ground water	PHE, Housing and Urban Development Department, Rural dev. Dept.	Nil	208.00	208.00	MOWR, CWC, CGWB, Gol, EFA
8	Emphasize the awareness and capacity building for conservation, concern and co-management of water	PHE, Housing and Urban Dev. Dept	Nil	10.00	10.00	MOWR, CWC, CGWB, Gol, EFA
9	Dealing with flood in the changing climate scenarios.	PHE, Irrigation and Flood control dept, MOWR, CWC, CGWB, Revenue and Relief department	Nil	300.00	300.00	MOWR, CWC, Gol, EFA
10	Reducing impact of increased erosion and sedimentation	Irrigation and Flood control department, NIH, Agriculture Department	Nil	50.00	50.00	MOWR, MoAgri, Gol, EFA
11	Creation of Storage facilities on Distributaries of River Chenab and Jhelum As per Indus Water Treaty	Irrigation and Flood Control Department MOWR, NIH	Nil	45,000.00	45,000.00	Gol, MOWR
<b>Total (INR in Million)</b>			<b>Nil</b>	<b>45,676.00</b>	<b>45,676.00</b>	









## 9. Sustainable Agriculture Mission

### 9.1 Introduction

Like majority of Indian States, the agriculture and its allied sector is the mainstay of economy and livelihood across Jammu and Kashmir. Over 65% of the population are directly or indirectly engaged in agriculture and allied Sectors. The agriculture and its allied sector contribute to around 27% of States income<sup>20</sup>. The three regions of the State namely Jammu, Kashmir and Ladakh have distinct geographical features and agro climatic zones which determine the respective cropping pattern and productivity of crops. Paddy is the main crop of Kashmir, followed by maize, oilseeds, pulses, vegetables, fodder and wheat. In Jammu region, wheat is the predominant crop followed by maize, paddy, pulses, oilseeds, fodder, vegetables and other crops while in Ladakh, barley is the major cereal crop followed by wheat. Saffron cultivation is a bonus to the agricultural sector of the State.

J&K is among the world's very few places where quality saffron is cultivated. Pampore tehsil of district Pulwama is famous for its high grade saffron in the world. Saffron is also grown in limited scale in Kishtwar district of Jammu region. Saffron cultivation has been introduced in temperate areas of other districts as well and some areas of Doda and Udhampur districts have seen wonderful output. Traditional Basmati rice of temperate areas in the State is gaining economic significance through various departmental interventions in quality improvement, productivity enhancement, marketing, etc.

While the magnitude of impact might vary over the region but it is expected that variability of the climatic condition will impact agricultural productivity and shifting crop pattern. The vulnerability of the State agriculture sector to climatic variability would be accentuated at multiple levels including the crops or livestock, farm or cropping system and the food chain. The implication

<sup>20</sup>[http://www.diragriju.nic.in/salient\\_features.htm](http://www.diragriju.nic.in/salient_features.htm)

of climatic variability or extremes over agricultural sector could be wide-reaching and it could affect food security, livelihood activities, trade policies, water conservation issues impacting large portion of population. Adverse impacts of climate change on agricultural production would be severe in the absence of appropriate adaptation and mitigation measures with far reaching consequences in terms of food shortages and consequent inflation which could endanger the food and livelihood security of the State.

To respond to the climate change impact on agriculture sector and allied sector, the State Mission in line with the National Sustainable Agriculture Mission wants to strategize actions towards climate proofing of the sector. It seeks to undertake suitable adaptation and mitigation measures in the domain of crops (both agricultural and horticultural) and animal husbandry. These interventions would be embedded in research and development activities, absorption of improved technology and best practices, creation of physical, financial infrastructure and institutional framework, facilitating access to information and promoting capacity building. While promotion of dry-land agriculture would promote drought and pest resistant crop varieties and ensure adequacy of institutional support, the Mission would also expand its coverage to rain-fed areas for integrating farming systems with management of livestock and fisheries, so that agricultural production continues to grow in a sustainable manner.

## 9.2. Key trends in the sector

The favorable agro climatic conditions, fertile soil, sub-tropical climate are ideally suited for cultivation of fruits and vegetables in the State. Fruit growing has become a major industry and contributes largely to the export trade of the State<sup>21</sup>. Rice, maize and wheat are the major crops. While in the Kashmir region wheat, oil seeds and fodder cultivation is being introduced as a second crop, in Jammu farmers are raising paddy as an additional crop. The major fruits grown in the State are apple, walnut, almond, pear, cherry, apricot, peach, plum, etc. The major vegetables grown in the State are onion, potato, tomato, turnip, peas, radish, carrot, green vegetables, etc. and spices like chillies, garlic, turmeric, etc. The State of J&K is predominantly a mono-cropped and rain-fed with about 40% of the area in Jammu division and 60% in Kashmir division having assured means of irrigation.

Of the net area sown (7.14 Lakh ha) only 42% is irrigated. The cropping intensity is 152% & fertilizer consumption has increased in recent decades. Besides basmati rice, rajmah and saffron are important crops. Rice, Wheat and potatoes are the main crops whose total production is around 7 Lakh tonnes. Agriculture exports from State include apples, cherry, rice, peaches, saffron, rajmah, pulses & wheat.

In Kashmir Division out of Total net sown area of 3.50 Lakh hectares, an area of about 2.10 Lakh hectares is irrigated. The per capita

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<sup>21</sup>State of Environment Report



available area for crop cultivation i.e. average land holding size is 0.53 hectares and 1.08 hectares in Kashmir Valley and Ladakh region

respectively. The numbers of farm operating families are about 8.12 Lakh.

*Table 46: Crop-wise/ Division-wise details of Area Irrigated*

Year	Division	Crop	Area under crop	Area irrigated under crop	% age of area irrigated under the same crop
			(Ha.)	(Ha.)	
2011-12	Jammu	Rice	114.558	96.00	83.80
	Kashmir		158.00	158.00	100.00
	J&K State		272.56	254.00	93.19
2012-13 (Est Ach)	Jammu	Rice	111.00	96	86.49
	Kashmir		158.00	158	100.00
	J&K State		269.00	254.00	94.42
2011-12	Jammu	Wheat	236.56	83.20	35.17
	Kashmir		8.25	4.50	54.55
	J&K State		244.81	87.70	35.82
2012-13 (Est Ach)	Jammu	Wheat	248.00	83.2	33.55
	Kashmir		9.25	5.5	59.46
	J&K State		257.25	88.7	34.48
2011-12	Jammu	Maize	206.401	2.49	1.21
	Kashmir		100.00	12.00	12.00
	J&K State		306.401	14.49	4.73
2012-13 (Est. Ach)	Jammu	Maize	200.00	2.49	1.25
	Kashmir		100.00	12.00	12.00
	J&K State		300.00	14.49	4.83
2011-12	Jammu	Oilseed (Kh. & Rabi)	36.91	0.06	0.16
	Kashmir		85.50	85.50	100.00
	J&K State		122.41	85.56	69.90
2012-13 (Est Ach)	Jammu	Oilseed (Kh. & Rabi)	37.00	0.06	0.16
	Kashmir		85.50	85.50	100.00
	J&K State		122.50	85.56	69.84
2011-12	Jammu	Vegetable (Kh. & Rabi)	32.50	29.03	89.32
	Kashmir		30.03	30.03	100.00
	J&K State		62.53	59.06	94.45
2012-13 (Est. Ach)	Jammu	Vegetable (Kh. & Rabi)	32.70	29.03	88.78
	Kashmir		30.06	30.06	100.00
	J&K State		62.76	59.09	94.15
2011-12	Total J&K State		1008.71*	500.81*	49.65
2012-13(est.Ach.	Total J&K State		1011.51*	501.84*	49.61

\* figures are excluding area under "other" crops

Source: Agriculture Production Deptt.

Source : Economic survey 2012-13





Primary agricultural cooperative societies in State facilitate farming communities. For promoting integrated use of manure & fertilizers, vermin-compost units have been set up in State. Saffron development is being given thrust under a centrally sponsored scheme to increase productivity of Saffron. Tulip garden has been set up in Kashmir.

Horticulture plays a significant role in State's economy & the sector contributes 7% to GSDP. The Horticulture sector provides

greater opportunities for agro-industries. It is considered a core sector of economy in the State. As per the Directorate of Horticulture around 7 lakh families are actively involved in horticulture sector with an area of 3.07 lakh hectares under major horticulture crops for the year 2008-09 with 66% area under fresh fruits. With efforts of the department of horticulture there have been an increase in the production and also in the area under production.

*Table 47: horticulture productions of Kashmir division in 2012-13 are as follows*

Fresh Fruits	Area (ha)	Production (MT)
Apple	140156	1326740
Pear	6887	38054
Apricot	3362	12163
Peach	748	2848
Plum	2062	6388
Cherry	3699	11112
Grapes	191	525
Olive	91	1
Other Fresh	1702	6215

Apart from the fresh fruits dry fruits like walnut, almonds are also produced in considerable quantity.

Livestock is an integral part of agriculture in the State. The population of livestock is high in Rajouri, Poonch & Kargil district of the State. The fodder production and its availability is a pressing problem in the State. The total fodder availability to animals in J&K is 2.29 kg/head/day including green fodder to the tune of 1.62 kg/head/day which is far below the national average for fodder of 5.15 kg/head/day as grazing in the State does not allow for regeneration. Hence effective policy for range and pasture land needs to be developed and implemented.

The rivers, streams & lakes of the State facilitate farming of over a 40 million tonnes of fish. Farmers' skills are being enhanced by increasing their poultry rearing & hatching capacity.

The State has suitable agro-climatic conditions for floriculture. This industry produces flowers for domestic and international markets. Kashmir is well known for Sericulture industry too and is home to large silk factories. The set up at Srinagar alone manufactures 3 Lakh meters of silk fabrics.

Apart from Agriculture sector, allied sectors namely Horticulture, Fishery, Sericulture, Floriculture, Sheep Husbandry, Social / Agro-Forestry are important in sustainable agriculture mission. A description of allied sectors and its requirement is given below:

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<sup>22</sup>State of Environment Report J&K

**1. Floriculture:** Floriculture sector in Jammu & Kashmir is still in its infancy. With the introduction of Centrally Sponsored Schemes i.e, Technology Mission from 2006-07 and RKVY from 2009-10, this sector has attracted the attention of the farming community irrespective of their age or gender. Observing the trends of growth in Agriculture Sector, more recently GOI has declared floriculture as sunrise industry as it promises huge employment potential. During the year 1998-99, an area of only 100 ha. was under flowers with annual turnover of INR 100.00 lakh, which has reached to 400 ha. during 2011-12 with annual turnover of INR 1500.00 lakh, with indirect employment generation of 15000 unemployed people<sup>22</sup>. In order to maintain ecological balance and minimize repercussions of global warming on mankind, development of parks/strips, and commercial floriculture with judicious use of water by adopting drip/ sprinkler irrigation system is very essential in climatic change scenario.

**2. Sericulture:** Sericulture is one of the traditional practice in the State. The climate being temperate is highly congenial for rearing both univoltine and bivoltine species for cocoon production. These sericulture practices are however declining in the State. The new areas are yet to be identified and existing trees are not adequately protected including



inadequacy of mulberry leaves and damage being caused by insects and pests in development and expansion of mulberry varieties.

It can play important role in climate conserving with massive mulberry plantations on State land, wastelands, community lands which can thrive well under different conditions. This would also help to prevent soil erosion, land degradation and constitute as one of the most effective carbon sinks. The mulberry foliage could be utilized for silk worm rearing, multi cropping during spring, late spring and early autumn as climatic change has drastically affected sprouting of mulberry plants.

In the context above it is essentially to evolve high yielding superior varieties of disease resistant silk worm races and mulberry varieties that suit local conditions. Laying stress on development and rising of dwarf mulberry trees to supplement and replenish the traditional tall mulberry trees and improving mulberry leaf quality both qualitatively and quantitatively can also be adopted towards increasing production.

- 3. Social/Agro Forestry:** Components of social forestry such as turning waste lands into nurseries and plantation along with soil conservation measures, planting of different kinds of grasses and fodder on available wastelands would go a long way to increase forest cover to desired level, for reducing carbon emission, soil erosion and

increase grass cover on wastelands.

- 4. Sheep Husbandry:** Most of the districts are hilly and have sufficient forage/ fodder/Bushes for sheep and goat rearing. In cold areas, most of the people are non-vegetarians, large number of sheep and goats are imported from Rajasthan and other parts of the State.
- 5. Research Interventions:** Research priorities such as development of infrastructure for advanced centre for climate change, assessment of carbon sequestration potential under different agro-ecosystem, monitoring of crop health, greenhouse gases in different ecosystem and around industrial units, development of improved varieties of crops, fruit crops with enhanced drought/heat tolerance need to be focused in SKUAST Jammu, SKUAST Kashmir, universities, research and development institutions, etc.

## 9.3. Vulnerability of the sector

### 9.3.1. Climate change and its impact on agriculture and allied sector

Weather variability or climate extremes resulting from climate change could impart direct and indirect effects on the crops, soils, livestock and pests. Increase in atmospheric carbon dioxide level will have a fertilization effect on crops with C3 photosynthetic pathway and likely to promote their growth and productivity. The increase in temperature, depending upon the current ambient temperature, can reduce crop



duration, increase crop respiration rates, alter photosynthate partitioning to economic products, affect the survival and distribution of pest populations, hasten nutrient mineralization in soils, decrease fertilizer-use

efficiencies, and increase evapo-transpiration rate.

The impact of climate change on the agriculture and its allied sector are depicted in the table below<sup>23</sup>:

*Table 48: Possible impact of climate change on agriculture and allied sector*

Sector	Impact
Crop	<ul style="list-style-type: none"> <li>• Increase in ambient CO<sub>2</sub> concentration is beneficial since it leads to increased photosynthesis in several crops, especially those with C<sub>3</sub> mechanism of photosynthesis such as wheat and rice, and decreased evaporative losses. Despite this, yields of major cereals crops, especially wheat are likely to be reduced due to decrease in grain filling duration, increased respiration, and / or reduction in rainfall/irrigation supplies.</li> <li>• The primary effects of increased concentration of CO<sub>2</sub> include higher photosynthetic rate, increased light-use efficiency, reduction in transpiration and stomatal conductance and improved water-use efficiency.</li> <li>• Most of the studies on impact of elevated CO<sub>2</sub> on crop species, reported earlier, have been based on controlled environment or enclosures like green houses, controlled environmental chambers, open top chambers, and other enclosures to confine CO<sub>2</sub> gas around the experimental plants. However, concerns have been expressed that the results obtained from such enclosure-based CO<sub>2</sub> enrichment systems might not be the true representatives of the open field conditions<sup>24</sup>.</li> <li>• Increase in extreme weather events such as floods, droughts, cyclones and heat waves will adversely affect agricultural productivity.</li> <li>• Reduction in yields in the rainfed areas due to changes in rainfall pattern during monsoon season and increased crop water demand.</li> <li>• Incidence of cold waves and frost events may decrease in future due to global warming and it would lead to a decreased probability of yield loss associated with frost damage in northern India in crops such as mustard and vegetables.</li> <li>• Quality of fruits, vegetables, tea, coffee, aromatic, and medicinal plants may be affected.</li> <li>• Incidence of pest and diseases of crops to be altered because of more enhanced pathogen and vector development, rapid pathogen transmission and increased host susceptibility.</li> <li>• As temperature increases, the insect-pests will become more abundant through a number of inter-related processes, including range extensions and phenological changes, as well as increased rates of population development, growth, migration and over-wintering.</li> <li>• Agricultural biodiversity is also threatened due to the decrease in rainfall and increase in temperature, and increased frequency and severity of droughts, cyclones and floods.</li> </ul>

<sup>23</sup>Aggarwal PK, Joshi HC, Singh SD, Bhatia A, Jain N, Shiv Prasad, Chaudhary A, Gupta N and Pathak H (2009a) *Agriculture and environment, In: Hand Book of Agriculture, Directorate of Information and Publication Agriculture, ICAR, New Delhi*

<sup>24</sup>Climate Change Impact, Adaptation and Mitigation in Agriculture: Methodology for Assessment and Application Division of Environmental Sciences, Indian Agricultural Research Institute

Water	Demand for irrigation water would increase with rise in temperature and evapotranspiration rate. It may result in lowering of groundwater table at some places.
Soil	<ul style="list-style-type: none"> <li>• Organic matter content, which is already quite low in Indian soils, would become still lower. Quality of soil organic matter may be affected.</li> <li>• The residues of crops under the elevated CO<sub>2</sub> concentrations will have higher C:N ratio, and this may reduce their rate of decomposition and nutrient supply.</li> <li>• Rise in soil temperature will increase N mineralization, but its availability may decrease due to increased gaseous losses through processes such as volatilization and denitrification.</li> <li>• There may be a change in rainfall volume and frequency, and wind may alter the severity, frequency and extent of soil erosion.</li> </ul>
Lives-tock	<ul style="list-style-type: none"> <li>• Climate change will affect fodder production and nutritional security of livestock. Increased temperature would enhance lignification of plant tissues, reducing the digestibility. Increased water scarcity would also decrease production of feed and fodder.</li> <li>• Major impacts on vector-borne diseases will be through expansion of vector populations in the cooler areas. Changes in rainfall pattern may also influence expansion of vectors during wetter years, leading to large outbreaks of diseases.</li> <li>• Global warming would increase water, shelter, and energy requirement of livestock for meeting the projected milk demands.</li> <li>• Climate change is likely to aggravate the heat stress in dairy animals, adversely affecting their reproductive performance.</li> </ul>
Fishery	Increasing temperature of lake, tank and river water is likely to affect breeding, migration and harvests of fishes

### 9.3.2. Assessing vulnerability

The future vulnerability of the agricultural sector in Jammu and Kashmir is determined to a great extent by the analysis of the vulnerability of the sector to the present climatic, economic and policy scenarios. Agricultural systems which are currently subject to climatic annual variability are likely to be more vulnerable under the most commonly expected scenarios of climate change (i.e. increased temperatures, increased rainfall variability). Similarly, agricultural systems which are currently

subject to changes in economic and policy scenarios are also vulnerable to expected climate-change conditions. The agricultural sector of the State has been subject to important variations in economic conditions and policies. These conditions have affected the structure of agricultural production and resulted in reduction of number of small farmers who have migrated to urban areas. Even for larger, commercial farmers, unstable and often inconsistent agricultural policies have increased their vulnerability. The State has identified some specific vulnerability in the agricultural sector, these are as follows:

- Water availability will be reduced, which is altering the crop rotation and cropping patterns
- Drastic reduction in cereal production, e.g. Wheat and rice, and yields of other major cereals would be on decline.
- Some minor improvements may happen in yield due to increased duration of growing period
- Livestock production may be decline, creating crises in milk, meat and poultry supplies and pushing prices beyond reach of the average population of Jammu and Kashmir.
- Rangelands would be over-stressed from prolonged droughts and shifting human and livestock populations around riverine areas and in mountainous regions. This will reduce tree and shrub cover.
- Inland fisheries predicted to be reduced due to decreased water availability and changing river flows; plant diseases, weeds and insect attacks will increase considerably, resulting in major crop losses
- Fruits, vegetables and horticultural products and flowers are high-value exports for Jammu and Kashmir. A predicted reduction in these will severely impact on balance of payments.
- The livelihood of farm communities will be affected, and marginalized groups like women, children and the elderly will be negatively impacted through widespread malnutrition.
- Increase of ambient temperature has lowered milk production, conception rate in winter is affected in instances when the breeding season occurs in spring and summer months.
- Climatic changes affect certain parasites and pathogens which could result in adverse effect on host animal.
- Direct effect of the climatic changes on animal may be due to heat / cold stress, dehydration, etc. Indirect effect will be malnutrition, fluctuations in vector and water borne infectious diseases. Changing patterns of diseases due to climatic changes are observed in<sup>25</sup>:
  - o Infectious diseases, viz: mastitis, para tuberculosis, anthrax, Rift Valley Fever (RVF), gastro-intestinal parasitic infestations and arthropod borne diseases.
  - o Metabolic and deficiency diseases due to irregular availability of fodder and imbalance of nutrients.
  - o Increased HCN poisoning in drought conditions
  - o Allergic and skin diseases

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<sup>25</sup>State of Environment Report

## 9.4. Key issues in the sector

### 9.4.1. Agricultural productivity

Major crops are paddy, wheat maize and barley, sorghum and gram are the minor ones. State faces massive deficit in food (40%), Oilseeds(70%) and vegetables (30%)<sup>26</sup>. The increasing demand and complex agricultural problems of the temperate and cold arid region of the State has increased the import of food grains from other States.

The crop growth rate in the State is in declining phase. As per the Economic Survey 2012-13 the growth registered agriculture & allied sectors during 10<sup>th</sup> Five Year Plan and 11<sup>th</sup> five year plan was 2.24% and 2.16% respectively as against the target of 4%. Growth rate for the agriculture & allied sector for the 12<sup>th</sup> Five year plan period has been targeted to be around 2.99% and as per the advance estimates, growth rate for the year 2012-13 has been projected at 3.84%.

The horticulture production is also in the declining phase. According to Economic Survey 2012-2013 in the last three consecutive years the horticulture production has decreased from 22,20,493 MTs to 18,83,500 MTs. The decline in agricultural growth rate and horticulture production is most likely due to low productivity, inadequate of agricultural research, low seed replacement rate, yield stagnation, lack of adequate irrigation facility, etc. Weather variability in terms of changes in precipitation and temperature might impact the yield resulting in lower productivity. As per the economic survey 2012-13, 58% of

the net area sown is rain-fed. Roughly 94% of the holdings fall in the size class of less than 2 hectares and around 81.5% in less than 1 hectare.

As per the State of Environment Report injudicious use of agrochemicals like fertilizers and pesticides is resulting in to loss of long-term agricultural productivity of the land. The surface runoff with agricultural residues is also causing degradation of surface water bodies through algal bloom, and contamination of ground water sources. The report also suggests that Saffron cultivation in Kashmir has been facing a threat of extinction as the area under Saffron cultivation has declined from 5707 hectares in 1996 to 3715 hectares in 2009-10. The productivity of saffron has also declined from 3.13 kgs per hectare in 1998-99 to around 2 to 2.5 kgs per hectare in the last few years. The production practices followed in Kashmir whereby farmers have traditionally adopted longer cycles and sowing of unsorted corns of different grades together with senility of saffron fields and moisture stress are responsible for low production.

### 9.4.2. Climate Variability and Horticulture

The State of J&K is blessed with varied topographic and agro-climatic status, which contributes significantly for diversified fruit crops cultivation and production. While the temperate agro climatic zone is favorable for fruits like apple, pears, peach, plum and apricot the sub-tropical areas are favorable for crops like mango, guava, citrus, berry, aonia

<sup>26</sup>[http://www.diragriju.nic.in/salient\\_features.htm](http://www.diragriju.nic.in/salient_features.htm)



and litchi besides cash crops and other high value low volume crops like strawberry. Some of the key climate related issues identified in the sectors are outlined as follows:

- 1) Increase of mean temperature in Jammu region has affected the crop line forcing shifting of cultivation of fruits like apple and walnut to upper belts.
- 2) Declining and erratic rainfall, soil erosion coupled with decreasing fertility, increasing industrialization and urbanization, drying up perennial irrigation source with decrease in catchment areas etc are some of the issues threatening the ecosystem in Jammu region comprising of eco-sensitive Shivaliks and Peer-panchal ranges of the lesser Himalayas.
- 3) Incidence of drought and water scarcity
- 4) Due to increase of mean temperature in Jammu region the fruit plants are not getting the required chilling hours which is essential in maintaining the quality of the fruits.
- 5) Higher rates of evapotranspiration are resulting in huge loss of the soil moisture level resulting in lowering of the water table and scanty water availability for cultivation.
- 6) Climate variability is resulting in resurgence of insect/pests and diseases.
- 7) Reduction in self life of the harvested produce due to the physiological

changes in trees and fruits as well.

- 8) Depletion of local gene pool.

#### 9.4.3. Weather and Agriculture in the State

Due to less precipitation, the plants are generally found growing along moist river margins or in moist rock crevices. The rain fed agriculture in Jammu is relatively weak and contains the untapped genetic plant. The promotion of agriculture growth needs the technological interventions which include:

- Off season tillage
- Ploughing across the slope
- Adoption of in-situ moisture conservation plan
- Conservation agriculture practice
- Pest management
- Soil health improvement
- Promotion of hybrid varieties

The alpine herbs grow in belts along the edges of melting glaciers and never spread to exposed slopes. The characteristic features of some the vegetation are the cushion like nature of plants, which is an adaptation for cold dry winds and blizzards.

Cultivation of fruits and other horticulture crops has been practiced over ages. The agro-climatic condition is well suited for cultivation of a large number of temperate and sub-tropical fruits of different varieties, viz., mangoes, bananas, oranges, apples, cherries, pears, mulberry and apricots.

The three rivers viz. the Tawi on which Jammu city stands, the Chenab and the

Jhelum together with its tributaries irrigate the fertile Valley of Kashmir. The major water bodies are Dal and Nagin. The lakes abound swampy lagoons and distinctive hydrophytic formations. The higher ridges and upper reaches of the State are permanently snow covered i.e. glaciers. The foothills and high passes get seasonal snow fall. Some of the regions have low lying clouds.

According to the National Mission for Sustainable Agriculture the State has also developed a vision which are as follows:

- Transform Agriculture into Climate Resilient Production system
- Grow and Ecologically Sustain agricultural production to its fullest potential
- Ensure Food Security and Equitable Access to Food Resources
- Enhance Livelihood Opportunities
- Contribute to Economic Stability at the State Level

With respect to the above vision the State has identified Climate change risks on agriculture sector at three levels, these are:

- Crop (Livestock) Level: Productivity and Quality of Produce
- Farm (Cropping System) Level: Soil quality, Water resources, Pest & Diseases
- Food System Level: Pricing, Food Security

On the basis of above three levels sectoral

issues of Agriculture and allied sector identified by the State are:

- Hilly terrain, fragile soil & limited mechanized farming.
- Single cropping season & lack of private investment.
- Absence of post-harvest infrastructure & proper market.
- Poor genetic livestock.
- High cost of fodder & cattle feed in winter.
- Shift in land use from staple Rice cropping to horticulture.

Due to increasing variability in temperature and precipitation, the State has also identified some climate change impacts on agriculture and livestock breeding. These are:

- Reduced availability of water
- Decline in production and yield of wheat, rice and maize
- Enhanced scope of crop diseases and insect pests
- Desertification trend of grasslands
- Rising fire incidences
- Growing risk of livestock epidemics

#### 9.4.4. Mechanization and agricultural productivity<sup>27</sup>

Farm mechanization is highly essential towards enhancing the yield and productivity of current agriculture. Farm tools and equipments are needed for timely completion of various agricultural operations

and precise application of input resulting in higher productivity as well as profitability including reduction of drudgery of woman work force involved in farm sector. The mechanization would possibly augment agricultural productivity by 10-15% and even post-harvest management could add 5-10% by reducing losses. Laser leveling and zero tillage have the potential to make positive contribution to increase productivity and income of farmers. Weeding equipment can add to the reduction in cost of cultivation.

## 9.5. Programme and Policies in the sector

The ongoing schemes and programmes in Agriculture sector in Jammu and Kashmir are as follows:

- 1) Technology Mission,
- 2) Apiculture Development Programme,
- 3) Mushroom Development Programme,
- 4) National Mission of Saffron Development in Jammu & Kashmir,
- 5) Integrated Scheme for Development of Oilseeds, Pulses, Oil palm and Maize (ISOPOM),
- 6) Rashtriya Krishi Vikas Yojana (RKVY),
- 7) Support to State Extension Programme for Extension Reforms through Agriculture Technology Management Agency (ATMA),
- 8) Macro-Management of Agriculture (MMA)

It is seen that through some of the ongoing schemes and programmes the State has already initiated some steps for climate

change adaptation and mitigation. However, the main thrust of majority of the schemes are to increase the production and productivity of Cereal crops by promoting High Yielding Varieties of seeds, improving soil health, strengthening and promotion of farm mechanization, quality control arrangement for seed production and distribution, human resource development, management and development of natural resources through National Watershed Development Project for Rain-fed Areas (NWDPPRA) and demonstration on crop management and Integrated Pest Management (IPM). But the main challenges in agriculture sector are shrinking land base, depletion of water resources, shortage of Farm labor, Increasing costs of inputs, uncertainties of weather, soil erosion, and volatility in national and international markets.

The draft State Agriculture Policy 2013 is aimed to develop a road map that would seek to actualize the vast untapped growth potential of the agriculture sector, promote value addition, accelerate the growth of agri-business, create employment in rural areas, secure fair standard of living for the farmers, agricultural workers and their families, discourage migration to urban areas and face the challenges due to economic liberalization, globalization and climate change.

## 9.6. Key Priorities

1. Planning of cropping system and crop varieties through Crop diversification, drought tolerant crops and water saving crops:

The new cropping system would be focused

on promoting the cultivation of crops and varieties through development of new seed varieties with high adaptation capability, development of varieties for high temperature, drought and submergence tolerance, variety which would respond positively to high CO<sub>2</sub>e concentration without reduced growth and yield along with varieties with high fertilizer and radiation use efficiency.

Diversified cropping system can also be promoted as alternate land use as the predominant cropping system in the State is rice-wheat or maize-wheat. Such cropping pattern has declined the productivity across time. It is therefore required to facilitate over cropping system. There are also scope for cultivation of medicinal, aromatic and high yielding plants which have greater demand in coming years. A new diversified cropping pattern is established by SKUAST and can be adopted based on the ground condition and demand.

Moreover considering the changing weather pattern and biotic and abiotic stresses on the agricultural produce it is imperative to develop and promote location specific variety. Key varieties of rabi and kharif crops developed by SKUAST might be promoted on case to case basis followed by successful pilot and time testing.

## 2. Capacity building of farmers and extension workers and dissemination of new and appropriate technology:

Combating climate change is a new challenge for agriculture and allied sectors. So some precautionary measures are to be taken for

better management of land, water & crops. Capacity building and technical support to the farming community and the technical officers is necessary. Stakeholders' consultation & training workshops and demonstration exercise are to be carried out through sharing of meteorological information and field experience of the farmers. New technologies have to be developed with use of climate information with the initiatives of the related Department. Online regional database for the soil, weather, crop genotypes, sustainable land use patterns and water resources are also to be developed.

## 3. Integrated nutrient management (INM) in 50000 ha area:

Integrated Nutrient Management (INM) has a vast potential to mitigate effects of climate change. These processes help through increased rice yields and thereby increased net CO<sub>2</sub> assimilation, 30-40% increase in nitrogen use efficiency. The technology decreases greenhouse gas emissions linked with Nitrogenous fertilizer use. The government wants to increase the INM activity for climate change mitigation and this effect can only be tapped under sufficient integrated nutrient supply particularly nitrogen (N).

## 4. Zero Tillage:

Zero tillage agriculture is a climate friendly farming system and has greenhouse gas mitigation potential according to the IPCC Fourth Assessment Report. Zero tillage (ZT) has effectively reduced the demand for water in rice-wheat cropping systems in more than 1 million ha of area in the Indo-Gangetic



Plains. With this technology, farmers can get higher yields and reduce production costs. In addition, Zero tillage has a direct mitigation effect as it converts the greenhouse gases like CO<sub>2</sub> into O<sub>2</sub> and carbon, and enriches soil organic matter.

#### 5. Introducing mulching in agriculture:

Mulches would be used in agriculture to suppress weeds, conserve soil moisture, reduce soil erosion and modify soil temperature. The soil under the mulch is also favorable for earthworms, helpful through addition of organic matter with mulch decomposition. So to reduce the Green House Gas (GHG) concentration the State Government wants to introduce trash mulching.

#### 6. Combating climate related risk through Micro Irrigation programme:

Irrigation system can address the climate-related risks in agriculture arising from water scarcity. Micro irrigation reduces the water volume required to grow crops. This also allows the use of polyethylene mulch, which would help in soil-water conservation and reduce fertilizer and nutrient leaching from rainfall. The State government wants to increase water efficiency through micro irrigation.

#### 7. Management of climate change risk for sustainable productivity:

The weather variability is related to variability in production and yields. Some of these risks, such as catastrophic events that are

systemic, rare and highly damaging should be managed with government intervention. Sometimes the disaster assistance is provided through ex post payments to farmers. Some other risks can be managed on the farm or through few market instruments like weather insurance. This would give economic security against calamities. New credit and insurance mechanism should also be devised to facilitate adoption of desired practices. However due to climate variability, compensation for the farming community should be arranged.

#### 8. Weather based Crop insurance:

Weather based crop insurance programmes with subsidies would be initiated by the government as a disaster assistance service. Climate change affects the mean and variability of weather conditions, and the variance and covariance of weather events, including an estimated increase in the frequency and scope of extreme events. These weather variability trends imply changes in yields, their average and the distribution of more extreme values. The implementation would vary with location and crop. So subsidized insurance or ex-post payments would protect farmers from climate shocks and farmers could be less inclined to change their production techniques and portfolio of activities.

#### 9. Enhancing capacity for livestock disease management and forecasting monitoring and management:

Heat stress is one of the main reasons for decreasing rate of reproduction among

livestock. As per the secondary literature it is seen that number of changes in reproductive systems has occurred due to heat stress. The effects on reproduction can be prolonged and the impact on animals is severe. Weather variations have increased the incidents of vector-borne diseases. To minimize the impact of climate change on animal health and reduced impact of vector borne diseases, the State wants to enhance the capacity for livestock disease management. For capacity building the State has plans to carry out a study on impact of climate change on livestock and poultry population, ensure vaccination of farm animals against contagious diseases, de-worming and early disease warning system, develop a breeding policy and use of biotechnology to breed genetically climate resilient breeds of farm animals and increase the availability of vaccines.

#### 10. Conservation of water bodies and fish stock augmentation in natural water bodies and promotion of fish farming:

One of the major concerns of State government is fisheries management and impact of climate change on inland water bodies and inland fisheries. So the government wants to work for stock enhancements in inland waters and their possible effects on biodiversity, since most of the population depends wholly or partially on exotic species. Secondly, freshwater fishes are known to be among the most threatened species due to weather variability. The following are the effects on fish population:

- Longer growing seasons and increased rates of biological processes - and often

of production;

- Greater risk of oxygen depletion;
- Species shift to more tolerant of warmer and perhaps less-oxygenated waters;
- Introduction of new disease organisms or exotic or undesired species;
- Establishment of compensating mechanisms or intervention strategies;

#### 11. Screening of crops for moisture/heat/disease/pest tolerance and nutrient use efficiency

Crop production in different agro-ecological regions varies according to crop composition, edaphic conditions, and the cropping pattern. A wide range of variation in edaphic, topographic, climatic conditions and selection procedures has cumulatively helped in preservation of crop genetic diversity. Climate change may influence the present pest scenario by increasing or decreasing insect pest or disease, infestation/incidents and severity. To help the situation, screening of crops for moisture/heat/disease/pest tolerance and nutrient use efficiency is required. Appropriate new farming techniques for plant protection measures would be undertaken on the basis of information gathered from the screening.

#### 12. Crop yield and weather modeling for future projections

In agriculture, crop productivity would be affected with a combination of several climatic, physiological, technological, hydrological, and economic factors. So an integrated climate model is required for sustainable crop productivity. Integrated crop

modeling system offers several advantages:

- Data exchange within the models can address different aspects of the impacts of climate change in a consistent way
- Standardized methods and tools would allow users to carry out impact studies in different areas and to get a result which can be compared. So the State wants to do a research work on weather modeling for future projections and establish a weather monitoring station with the help of Centre for Climate Change and Mountain Agriculture, SKUAST.

### 13. Carbon pool assessment / sequestration in forest and agricultural ecosystems

To measure the impact of climate change in the agricultural ecosystem the State wants to do a research work on assessment of carbon sequestration and greenhouse-gas (GHG) fluxes in ecosystems. Both terrestrial (forests, wetlands, grasslands/shrublands, and agricultural lands) and aquatic (rivers, lakes, and streams) ecosystems would be evaluated through this study. The assessment would be conducted by using a methodology framework through

- Land use and land management data, climate data with statistical and process-based methods and models to generate spatially and temporally explicit carbon storage and GHG flux estimates
- Remote sensing input data, existing resource and soil inventories, climate

histories

- A set of future land- and climate-change scenarios to the assessment to estimate a range of carbon stocks and sequestration rates in agricultural ecosystems of Jammu and Kashmir.

### 14. Conservation of pollinators, pollination and plant phenology mismatch:

Temperature plays an important role to determine the phenology of plants and animals, and increasing temperatures is associated with climate variability have caused rapid and dramatic shifts in the phenologies of numerous and diverse organisms. In the State still we have a very incomplete understanding of how interactions between plants and pollinators will be affected by the phenological shifts that accompany climate change. Overall, the directions and magnitudes of phenological responses to climate change are highly variable, and it is also difficult to forecast the impacts of altered phenologies on plant-pollinator communities. The government wants to determine how shifts in flowering phenology associated with climate change affect by potential pollinators, contrasting historically advanced and unchanged plant species.

### 15. Grass Land Management / Forage/ Fodder production:

Strengthening of management of both grassland and arable areas and agricultural abandonment on many marginal grazing areas, have had deep impacts on natural conservation value and landscape integrity.

Since J & K is an area where intensive livestock production is practiced so to reduce the impact of livestock on biodiversity the State wants to do the grass land management, and fodder production for the livestock's.

## 16. Developing Cold-Chain Infrastructure

Cold-Chain Infrastructure will help to reduce post-harvest wastage of fruits and vegetables, which is estimated to be as high as 35%<sup>28</sup> in India. Reduction in post-harvest wastage together with better irrigation technologies will contribute to a more efficient use of water resources. This will also contribute to reducing rural poverty. Through development of Cold chain infrastructure, the State Government wants to help farmers, increase their yields, and capture a higher share of the final price paid by the consumer.

## 17. Root-Stock & Progeny Plant Material

Water availability is one of the major factors for plant productivity and the breeding of crop varieties that use water more efficiently is a key strategy for the improvement of agro systems. Improvement of the genetic material of plant is essential in the context of climate change. Rootstock selection is the most promising method for achieving this goal, because the graft genotype controls the typical features of the plant.

## 18. Protected cultivation and Precision Farming under Hi-tech Green Houses, Poly Green Houses & Shade Nets:

To reduce the impact of climate variability (especially irregular rainfall), precision farming both polyhouse and open precision farming has become successful in bringing the certainty to agriculture production. Decreased farming land, declining food production, uncertainty in climate, the new concept of farming with higher skills urged the need for popularizing hitech farming.

## 19. In-situ moisture Conservation through Roof-top water harvesting:

Water harvesting and conservation at field or micro level can bring sustainability to the water sector for irrigation and agriculture, consequently, increase water availability in drought years. Water harvesting is the process of concentrating rainfall as runoff from a catchment to be used in a target area. With increasing human population and demand for food, shortfall in groundwater, these rainwater harvesting systems are attracting growing attention. Modern technologies of rainwater harvesting and groundwater recharge such as percolation tank, subsurface barrier and pond with infiltration wells have recently been developed to rejuvenate the depleted freshwater aquifers.

## 20. Establishment of two numbers of Bio-Diversity Parks (one in Jammu division and second in Kashmir division):

Due to climate variability some of the crop species are under threat. To restore the crop biodiversity, the State government wants to establish bio diversity parks in Jammu and Kashmir so that the government can able to restore some indigenous variety for future use.

<sup>28</sup><http://www.adb.org/projects/46943-014/details>



## 9.7 List of Key Priority Action

Table 49: List of key priority action sustainable agriculture mission

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Planning of cropping system and crop varieties through Crop diversification, drought tolerant crops and water saving crops Agriculture = 50.00 Horticulture = 70.00 Sericulture = 10.00 Floriculture = 20.00	Dept of Agri, Horti	Nil	150.00	150.00	Gol, Govt. of J&K and EFA
2	Capacity building of Planners farmers and extension workers and dissemination of new and appropriate technology  Agriculture = 50.00 Allied sectors = 50.00	Dept of Agri, Horti	Nil	100.00	100.00	Gol, Govt. of J&K and EFA
3	Integrated nutrient management (INM) @ Rs. 1500.00 per ha in 50000 ha area  Agriculture (35000Ha) = 52.5 Horticulture (14000Ha) = 21.0 Sericulture (1000Ha) = 1.5 Floriculture (667Ha) = 1.0	Dept of Agri, Horti	Nil	76.0	76.0	Gol, Govt. of J&K and EFA
4	Promoting Zero Tillage (Zero till drills@ Rs. 15000 per unit) Agriculture (1000 No.) = 15.0 Horticulture (1000 No.) =15.0	Dept of Agri, Horti	Nil	30.00	30.00	Gol, Govt. of J&K and EFA
5	mulching @ Rs. 2000.00 per ha in 15000 ha area Agriculture (6250 Ha) = 12.5 Horticulture (6250 Ha) = 12.5 Sericulture (1250 Ha) = 2.50 Floriculture (1250 Ha) = 2.50	Dept of Agri, Horti	Nil	30.00	30.00	Gol, Govt. of J&K and EFA
6	1. Combating climate related risk through Micro Irrigation programme Agriculture = 60.00 Horticulture = 60.00 Sericulture = 15.00 Floriculture =15.00	Dept of Agri, Horti	Nil	150.00	150.00	Gol, Govt. of J&K and EFA

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
7	<p>Management of climate change risk for sustainable productivity including Integrated Farming System (IFS) Models of 0.5 Ha in Rainfed (500 no) &amp; Irrigated (500 no) ecosystems of Jammu @ Rs. 1.65 lacs &amp; 1.85 lacs per model respectively, Organic Farming @ Rs.0.2 lac/Ha (10000 Ha Certification), Bio-Control Labs (2) @ Rs 200 Lac each, Bio-Fertilizer lab (2) @ Rs 100 Lac each. Establishment of vermicompost and vermibeds @ of Rs 0.30 lac big unit and 0.10 lac small unit, management of disease/ pests and promotion of forest linked farming system.</p> <p>Agriculture = 485.00</p> <ul style="list-style-type: none"> <li>• IFS Model 1000 No. = 175.00</li> <li>• Organic Farming = 200.00</li> <li>• Bio-Control Labs = 40.00</li> <li>• Bio-Fertilizer Labs = 20.00</li> <li>• V e r m i c o m p o s t / Vermibeds=20.00</li> <li>• Disease/ Pests=10.00</li> <li>• Forest Linked Farming System=20.00</li> </ul> <p>Horticulture = 250.00 Sericulture = 60.00 Floriculture =60.00</p>	Dept of Agri, Horti	Nil	855.00	855.00	Gol, Govt. of J&K and EFA
8	<p>Weather based Crop insurance</p> <p>Agriculture = 80.00 Horticulture = 80.00 Sericulture = 20.00 Floriculture = 20.00</p>	Dept of Agri, Horti	Nil	200.0	200.0	Gol, Govt. of J&K and EFA

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
9	Enhancing capacity for livestock disease management and forecasting monitoring and management Animal Husbandry= 100.00 Sheep Husbandry = 100.00	Dept. of Animal Husbandry	Nil	200.0	200.0	Gol, Govt. of J&K and EFA
10	Conservation of water bodies and fish stock augmentation in natural water bodies and promotion of fish farming  Fisheries = 88.7	Dept of Fisheries	Nil	88.7	88.7	Gol, Govt. of J&K and EFA
11	Screening of crops for moisture/heat/disease/pest tolerance and nutrient use efficiency SKUAST-K = 5.00 SKUAST-J = 5.00	SKUAST	Nil	10.0	10.0	Gol, Govt. of J&K and EFA
12	Crop yield and weather modeling for future projections SKUAST-K = 10.00 SKUAST-J = 10.00	SKUAST	Nil	20.0	20.0	Gol, Govt. of J&K and EFA
13	Carbon pool assessment / sequestration in forest and agricultural ecosystems SKUAST-K = 7.50 SKUAST-J = 7.50	SKUAST	Nil	15.0	15.0	Gol, Govt. of J&K and EFA
14	Conservation of pollinators, pollination and plant phenology mismatch SKUAST-K = 5.00 SKUAST-J = 5.00	SKUAST	Nil	10.00	10.00	Gol, Govt. of J&K and EFA
15	Grass Land Management / Forage/ Fodder production. Agriculture = 100.00 Animal/Sheep Husbandry = 50.00		Nil	150.00	150.00	Gol, Govt. of J&K and EFA
16	Developing Cold-Chain Infrastructure Agriculture = 70.00 Horti P&M = 140.00 Floriculture = 30.00		Nil	240.00	240.00	Gol, Govt. of J&K and EFA

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
17	Root-Stock & Progeny Plant Material  Agriculture = 20.00 Horticulture = 60.00 Sericulture = 20.00 Floriculture = 20.00		Nil	120.00	120.00	Gol, Govt. of J&K and EFA
18	Protected cultivation and Precision Farming under Hi-tech Green Houses, Poly Green Houses & Shade Nets Agriculture = 140.00 Horticulture = 20.00 Floriculture = 40.00		Nil	200.00	200.00	Gol, Govt. of J&K and EFA
19	In-situ moisture Conservation through Roof-top water harvesting (2500 RTWH Units with assistance of Rs 6000/ Per Unit), Storage tanks (291 Low cost storage tanks of 20x20x20 m <sup>3</sup> @ Rs 1.03 lac/tank assistance, Ponds/Trenches, Check-Dams (250 no @ Rs 2.00 Lac/CD), Land levelling by Laser leveller (100 units with Rs 1.5 lac/Unit assistance) Agriculture = 380.00 <ul style="list-style-type: none"> <li>• Roof Top Water Harvesting = 15.00</li> <li>• Storage tanks = 100.00</li> <li>• Check-Dams = 200.00</li> <li>• Land Levelling = 15.00</li> <li>• Gully Plugging=25.00</li> <li>• Bench Terracing=25.00</li> </ul> Horticulture = 100.00 Sericulture = 20.00 Floriculture = 20.00		Nil	520.00	520.00	Gol, Govt. of J&K and EFA
20	Establishment of two number of Bio-Diversity Parks (one in Jammu division and second in Kashmir division) (Agriculture and Allied sector)		Nil	20.00	20.00	Gol, Govt. of J&K and EFA
<b>Total (INR in Million)</b>			<b>Nil</b>	<b>3,184.70</b>	<b>3,184.70</b>	



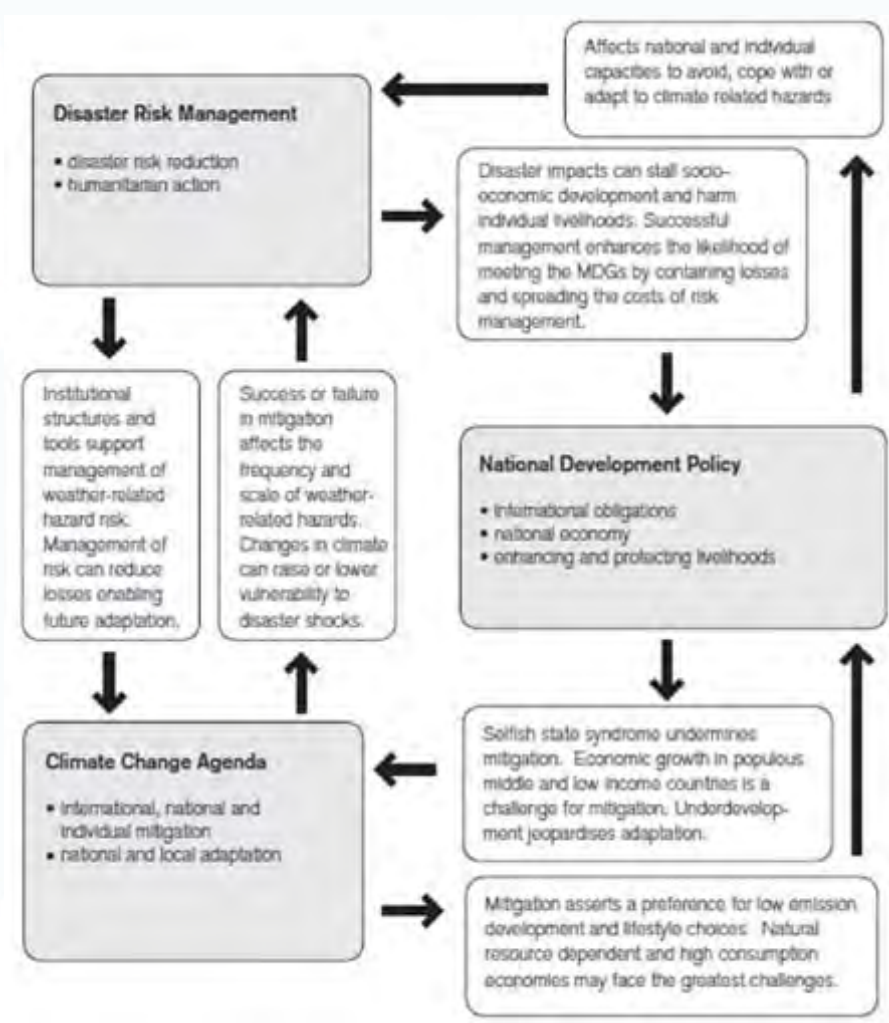


# 10. Disaster Management

## 10.1 Introduction

Disasters relate to extreme impacts from hazardous physical events on human, ecological, or physical systems resulting

in alterations in the normal functioning of a society and livelihood disruptions. Climate change assessment has also in turn projected alteration in frequency of physical events including climate and hydro-



meteorological extremes that are likely to exacerbate the stress on human and natural systems. Adverse impacts of climate change on society often increases disaster risk (recent events unfolding in Himalayan Region of India is a testimony), disasters themselves erode environmental and social resilience, and thus increase vulnerability to climate change. Moreover climate variability is projected to result in more frequent and intensive disasters – with the most severe consequences on infrastructure, food security and livelihoods of natural resource and dependent vulnerable communities. Since both disaster risk (including climate associated disaster risk) and climate related vulnerabilities are likely to undermine the economic sustainability and development it is therefore planned that disaster risk management strategies and climate change adaptation planning be integrated in context of development and development planning towards promoting sustainability in social and economic development. The physical and social determinants of disaster risk and climate vulnerabilities are dependent upon the intensity of the extreme events and the level of exposure and vulnerability. The impacts of hazardous physical events including climate extremes disproportionately affect resources, poor communities with little access to alternatives, exposure, and vulnerability. Strategizing disaster risk mitigation technique (reactive, adaptive, and anticipatory) or adaptation planning therefore requires a thorough assessment of the social profile including the vulnerability of the region; exposure of the community to extreme events or chronic risks, development

practice and preparedness. Plan should therefore be to improve the understanding of disaster risk, foster disaster risk reduction and promote continuous improvement in disaster preparedness, response, and recovery practices. Reduction in the rate of depletion of ecosystem services, improvements in urban land use and territorial organization processes, strengthening of rural livelihoods, specific advances in urban and rural governance, enhancing awareness, capacity building of the communities and poverty reduction are few of the effective strategies.

## 10.2. Key trends in the sector

The State comprises of three distinct regions which correspond with three administrative divisions. Of the three divisions Ladakh alone covers about 70% of the total area of the State followed by Jammu accounting for 19% and the valley of Kashmir accounting for the remaining 11%. The State has no homogeneity with regard to its physical features but represents an interesting morphology.

Morphologically the State is divided into three distinct micro regions which are as follows:-

- 1) The outer hill division
- 2) Jhelum valley division
- 3) Indus valley division.

The outer hill division starts from the plains in the south to Pir-panjals in the north is separated by the Pir-Panjals from the Jhelum valley in the south. Rainfall in this region is scanty and is more or less dry. Southern part of this division is known as sub-mountainous

region and the northern part is known as semi-mountainous region. The average altitude of the former is 369 meters and of the latter is 1385 meters above mean sea level. River Chenab forms the main drainage system of the division.

Near Kulu the central Himalayas bifurcate into two, one going towards the north-western direction and are known as Zaskar range and the other towards the south-west called as the Dhaulader range. In between these two ranges lies green valley of Kashmir.

The northern most extremity of the State is the extensive mountainous territory of Ladakh or the valley of Indus. Extending from the Zaskar in the south to the Karakorum, the Nunkun and the Nanga Parbat in the north, Ladakh is almost a plateau desert and mostly is devoid of vegetation. The average altitude of this division is 3,692 M above the sea level. River Indus which rises from the Mansarowar Lake forms the main drainage of the region.

The State is a multi-hazard prone region with natural disasters like earthquakes, floods, landslides, avalanches, high velocity winds, snow storms, besides manmade disasters including road accidents and fires etc. Human activities disturbing the ecological balance in most of the case directly results in disastrous event or exacerbate the natural disaster. Observation exhibited that construction of road under Pradhan Mantri Gram Sadak Yojana (PMGSY) schemes or railway track has

altered stream course, discharge areas and closed aquifers due to lack of geo-hydrological assessments while sanctioning or developing the projects. Moreover the unauthorized and unplanned construction on the river banks has disturbed the river ecosystem. Sand and gravel dredging or top soil denudation for brick industry to support growing real estate industry have significantly enhanced the human induced disaster risk in the eco-sensitive zones of the State. With projected increase in the frequency and intensity of extreme events including cyclones, droughts, and floods, disaster management needs greater attention. The projected increase in the occurrence of extreme events is likely to include:

- Increase in areas affected by drought
- Increase in areas affected by heavy precipitation and floods
- Areas affected by earthquakes, landslides, soil creeps and avalanche falls

Apart from the projected hydro-meteorological hazards viz. floods, droughts and cloud-bursts there are likely scenarios of natural hazards such caused due to earthquakes, landslides and snow avalanches.

#### ***Disaster and hazard profile of J & K State:***

The typical natural and anthropogenic disasters in the State of J&K are as follows:

Table 50: Natural and Anthropogenic disaster type

Natural Disaster	Manmade Disaster
Incessant Rainfall	Urban fire-house & Forest
Flash Flood	Village fire-house & Forest
Hailstorm, Snow avalanches and Snow tsunami	Road accidents
Earthquake	Communal disturbances
Landside	
Drought	
Wind Storm	

1. **Earthquakes:** Both cities Jammu and Srinagar are in zone IV and V. The geological structure in the State makes it vulnerable to earthquakes. A Main Boundary Fault Thrust (MBFT) underlies Pir Panjal region and runs NW-SE through Manwal-Udhampur-Reasi and further northwest is weak zone susceptible to natural disturbances. Zanskar mountain ranges underlain by Zanskar geological Thrust, and Kashmir Valley lie between Pir Panjal and Zanskar Thrust plane. These thrust-planes are the largest strike-slip faults responsible for the occurrence of earthquakes and disasters in the region.

Most parts of the Kashmir Valley (11% of the area of the State) covering the Districts of Srinagar, Ganderbal, Baramulla, Kupwara, Bandipora, Budgam, Anantnag, Pulwama Doda, Ramban, Kishtwar come under Seismic Zone V, where around 50% of the population of the State lives. Rest of the State including whole of Ladakh region and Jammu Division (89% of the total area of the State) are under the Seismic Zone IV.

Table 51: Major earthquakes experienced by the State with Mb=5 and above

Date	Region	Magnitude	Cause-area affected
8th October 2005	Kashmir earthquake	7.60	Activation along MBT which devastated Kashmir region
Feb 2005	Snow storm	-	Destroyed villages in southern Kashmir
May 30, 1885	Western Himalayan area	7.50	Western Himalayan Thrust
Jan15, 1934	Activation along MBT	8.10	Rupturing along MBT zone



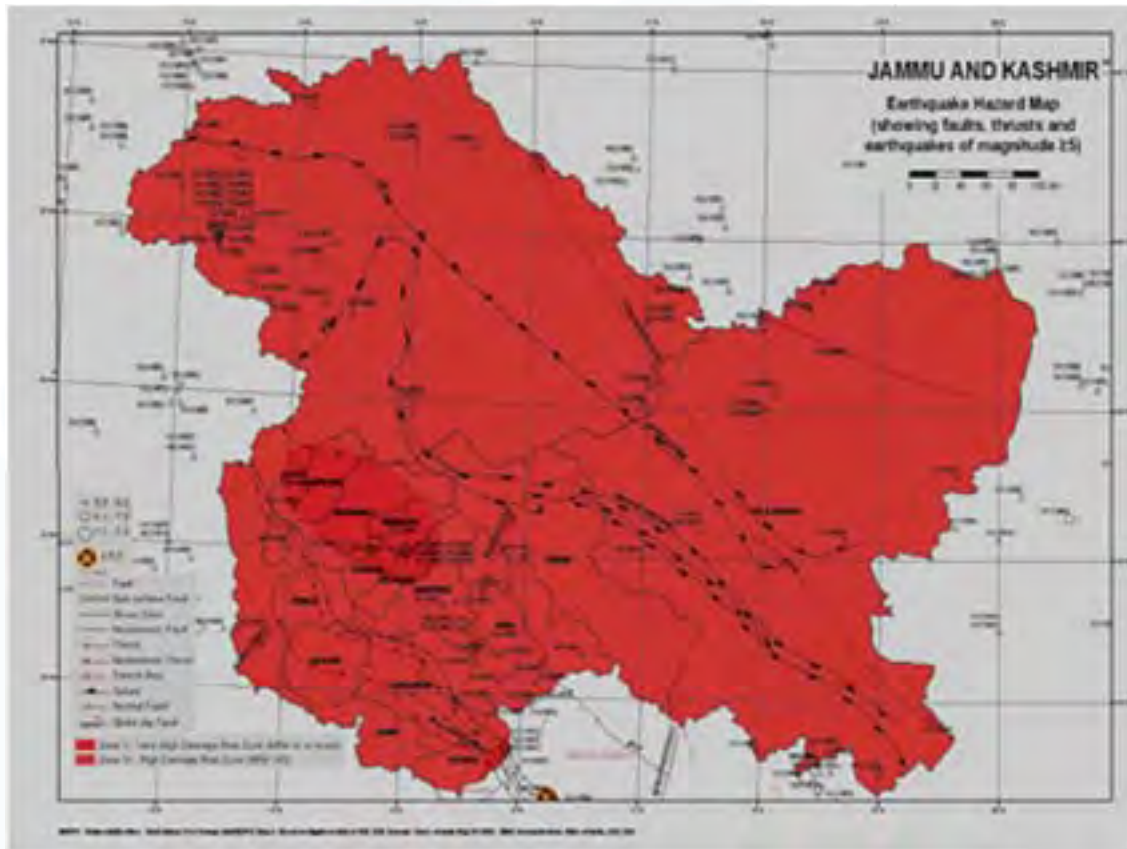


Figure 21: Earthquake Hazard map of Jammu and Kashmir shows that entire State is categorized as Zone IV and V

**2. Flood, Flash flood Cloud-burst:**

Cloudburst and flash flood are common disasters which have caused loss of life and property in various regions of the State. Glacial melting due to warming causes flash floods. About 16% of glaciers have been lost in Suru basin. Kolhai loosing 18% glacier is yet another example. Flash floods cause tremendous losses in catchment of Jhelum, Chenab and Tawi rivers. All hilly area of the State is prone to cloudbursts similarly low-lying areas of the Kashmir Valley, especially Sonawari, Awantipora, Srinagar, along with parts of Jammu are prone to floods. Upper catchments of all the tributaries of the

Jhelum, Indus, Chenab and Tawi rivers are also prone to flash floods.

- 3. Landslides:** Large and small landslides occur every year in all three region of the State. They are complex disaster phenomenon caused by heavy rainfall, snowfall, earthquakes and mining etc. Soil creep and down-slide movements of rock masses occur to cause landslips and landslides. Famous land slide area exists between Batote and Banihal on National Highway.

Areas along major highways particularly Ramban, Panthial, Banihal, Doda, Kishtwar, Gulmarg, Dawar, Gurez, Tangdhar, Rajouri etc. are prone to landslide.

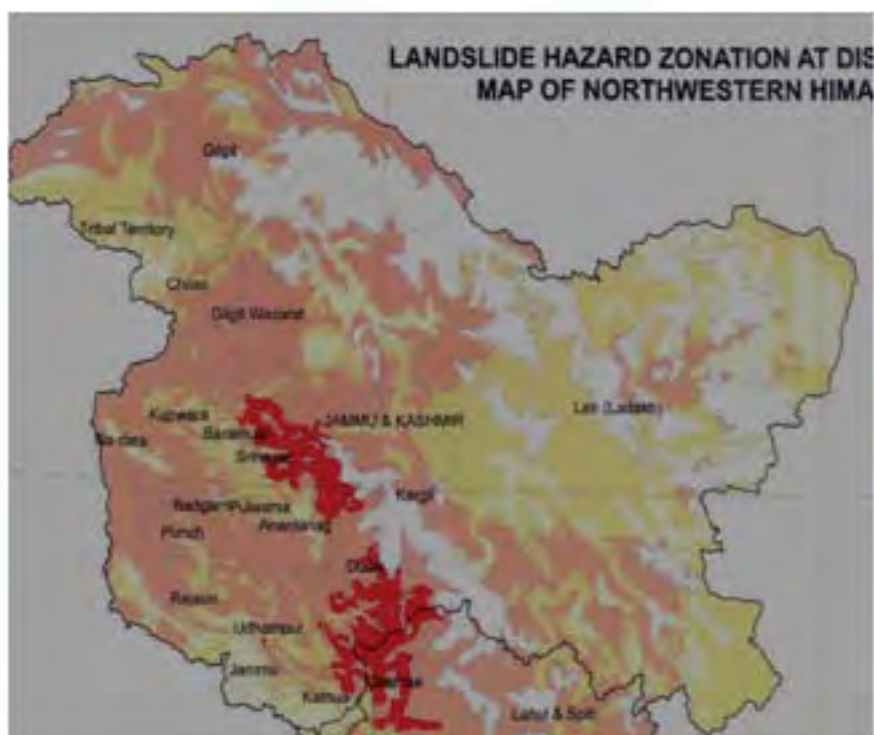


Figure 22: Landslide hazard zonation map of North western Himalaya showing Jammu and Kashmir

4. **Snow avalanches** are common in elevation of more than 3,500 m with 30° to 35° hill slopes. North facing slopes have avalanche falls in winter and south facing slopes in summer. Higher reaches of Kashmir including Anantnag, Kulgam, Gurez, Kargil, Leh, Doda, Ramban, Kishtwar, Banihal, etc. face avalanches.
5. **Wild Fires:** Fire hazards occur frequently both in forest and congested urban sprawls. Doda, Kishtwar and Gurez have witnessed heavy losses due to fires in the past. Precautionary and emergency services are needed to safe-guard against local urban area as well as forest fires. All District headquarters/ densely populated towns and especially Gurez, Doda, Kishtwar and other inaccessible areas are prone to fire incidents. However, incidents of fires are equally high in the plains as well as in Srinagar city.
6. **Drought:** Most parts of Jammu Division including Doda, Udhampur, Kathua, Jammu etc. are drought prone and are subjected to similar climate related disaster.
7. **Wind Storm:** Occasional wind storms destroy crops, horticulture and roof-tops of houses. Ladakh has been identified as prone to high speed winds but there are hardly any damages due to wind storm, perhaps due to the sparse population and traditional house construction practices.



*Figure 23: Wind hazard map of Jammu and Kashmir shows that State is categorized as very high to moderate damage risk zone*

**8. Other :** Several parts of the State face hazards like thunderstorms, cloud burst, hailstorms, forest fires, dam bursts, heavy snow-fall, human and livestock epidemics, etc. from time to time; few of which occasionally convert into situations like disaster. Moreover Hilly roads especially in Doda, Ramban, Udhampur, Rajouri, Reasi, Poonch, Kishtwar, Ramban, Baramulla, Anantnag, Pulwama, Budgam, Jammu, Kathua, Zojila, Kargil, Leh, etc. are prone to road accidents.

The snow blizzard in February 2005, devastating earthquake of magnitude 7.6 in October 2005, devastating cloudburst followed by flashfloods in August 2010 in Leh, cloud burst at Bagger in Doda on June 2011, have forced State establishment as well as local authorities and civil society to think

and form an effective Disaster Management Policy. The focus of disaster management has undergone a paradigm shift from relief to prevention, mitigation and preparedness.

### 10.3. Vulnerability of the sector

Disaster causes socio-economic and environmental impacts that disrupt the normal functioning of the vulnerable communities in the affected areas. Extreme weather and climate events will lead to disaster if the communities are exposed to dangerous extreme events or subjected to high exposure and vulnerability levels. J&K unlike other Himalayan States are highly susceptible to the impacts of climate change and disaster risks mainly due to the fragile ecosystem and lower adaptive capability of

the community. One of the anticipated effects of climate change is increase in the frequency and intensity of extreme weather events leading to hydro-meteorological disasters. The State has experienced several disasters of recurrent nature that has resulted in loss of life, livelihood and properties.

Extreme weather events/ natural calamities pose severely affect on the infrastructure and livelihood of the people. The matrix below represents the correlation between vulnerability and the hazardous physical events:

2007, the Government has notified and constituted the State Disaster Management Authority (SDMA), State Executive Council (SEC) and District Disaster Management Authorities (DDMAs). The State Disaster Management Authority has been constituted under the chairpersonship of Hon'ble Chief Minister and the State Executive Committee under the Chief Secretary. The State Disaster Response Force (SDRF) has been formed and has two companies (Coys) for field duties and deployment. Existing facilities for the Fire & Emergency Services (F&ES) and SDRF

Table 52: Vulnerability against the Hazards

Sector	Flood & cloud burst	Snow/ avalanches	Earthquake	Land-slide	Fire	Communal distribution	Drought	Wind storm	Heavy Snow fall
Road Network	√	√	√	√	×	√	×	×	√
Water Supply	√	√	√	√	×	×	√	×	×
Hospital	√	√	√	×	×	×	×	×	×
Sewages	√	×	×	×	×	×	×	√	×
Food stock and supply	√	×	√	√	×	√	×	×	√
Communication	√	×	√	√	×	×	×	√	×
Bridges	√	×	√	×	×	×	×	√	×
Shelters	√	×	√	×	√	×	×	×	×
Livestock	√	√	√	√	√	×	√	√	√
Forest Ecosystem	√	×	√	×	√	×	×	×	√
Livelihood sector like agriculture and Ecotourism	√	√	√	√	√	×	√	√	√

## 10.4. Key issues in the sector

### State level institutional mechanism for disaster management

In accordance to the Jammu and Kashmir Disaster Management Rules in the year

are continuously strengthened by provision of capacity-building in terms of equipment and training. District Disaster Management Authorities under the respective Deputy Commissioner too have been formed in the State. According to the recommendations of Thirteenth Finance commission (TFC), State



Disaster Response Fund (SDRF) was created in the State in 2010 and the existing Calamity Relief Fund (CRF) was merged with the said Fund.

**The payments out of SDRF are scheduled to be made on the following ground:**

- Ex-Gratia payments/ Gratuitous Relief.
- Clothing and utensils/ Household goods.
- Supplementary Nutrition.
- Desilting/ removal of debris/ restoration/ repair of agricultural land and fish farms.
- Loss for agricultural/horticultural/ annual plantation crops.
- Input subsidy/ Assistance to farms/ fish farms.
- Employment generation.
- Replacement of animals, purchase of fodder/feed.
- Repair / Replacement of boats/ nets.
- Repair/ Replacement of Tools/ equipment's and purchase of raw material.
- Repair/ restoration of damaged houses.
- Emergency supply of drinking water.
- Provision of medicines, disinfectants, insecticides for prevention of outbreak of epidemics.
- Medical care for cattle and poultry against epidemic as a sequel to a notified natural calamity.
- Evacuation of people affected/ likely to be affected.

- Hiring of boats for carrying immediate relief and saving life.
- Provision of temporary accommodation food, clothing medical care etc.
- Air dropping of essential supplies. Repair / restoration of roads and bridges, drinking water supply works, irrigation, power, primary education, primary health centers and community assets owned by Panchayats.
- Replacement of medical equipment.
- Operational cost for Ambulance Service, Mobile Medical Teams and temporary dispensaries.
- Clearance of debris and draining off flood water.
- Search and rescue measures and disposal of dead bodies / carcasses.
- Training to specialist multi-disciplinary groups/ teams of the State personnel.
- Procurement of essential search, rescue and evacuation equipment.

**Institutional stakeholders who play key roles in disaster risk reduction and managements are:**

- All concerned departments of the State Government and Central Government agencies present in the State.
- State, Divisional & District Disaster Management Authorities.
- Local authorities such as ULBs, PRIs, etc.
- Fire & Emergency Services.
- State Police & Central Para Military Forces.

- Voluntary and Civil Society organizations.
- Indian Red Cross Society, Multilateral aid agencies and UN agencies.
- Public sector undertakings, corporate sector, Hoteliers & other allied organizations.
- Armed Forces.
- Indian Air Force.
- Airport Authority of India.
- Indian Railways
- National Disaster Response Force, State Disaster Response Force.
- Community
- Print & Electronic Media

**Various departments handling different types of disasters are as follows:**

- Department of Home is the nodal department of management of manmade and human-induced disasters including air, train, road, rail accidents, fires, chemical, biological & radiological nuclear disasters
- Department of Health & Medical

Education is the nodal department to deal with Pest attacks & Hailstorms

- Agricultural & Horticulture Department is the nodal department to deal with pest attacks & Hailstorms
- Animal & Sheep Husbandry Department is the nodal department to handle livestock epidemics
- Irrigation & Flood control (IFC) Department is be the nodal departments for disasters related to Floods and Dam bursts
- Public works Department (R&B) is the nodal department for disasters related to infrastructure damage
- Forest Department is the nodal department for disasters related to forest fire
- Power development department (PDD) is the nodal agency for management of disasters related to Electric Power Plants, Grid Network, Transmission lines etc.
- Revenue Department is the nodal department for disasters related to avalanches and landslides, droughts, windstorms and earthquakes



## Gap identification in current Institutional structure to tackle Disaster

### Infrastructural gap in addressing the DRM for flood and related disaster

Flood: Flooding is caused by the inadequate capacity of the rivers to contain the high flows brought down from the upper catchment areas following heavy rainfall..

Flash floods are characterized by very fast rise and recession of flow of small volume and high discharge, which causes high damages because of suddenness. This occurs in hilly and not too hilly regions and sloping lands where heavy rainfall and thunderstorms or cloudbursts are common.

Snowmelt is a gradual process and usually does not cause major floods. Glacial melt is usually slower than snowmelt and is not capable of causing severe flood. But sometimes glaciers hold large quantity of bounded water, which may be suddenly released with melting of ice block resulting into Glacial Lake Outburst Floods (GLOFs).

Cloud bursts: In case of cloud bursts, cyclonic winds virtually compress the clouds and forced nucleation amounting to sudden precipitation takes place where all the water from the clouds is poured out.

- Non-availability of close contour maps and digital elevation models of flood prone areas
- Flood forecasting and warning (FF and W) network of the CWC, though developed on scientific basis, does not cover all the flood prone rivers and rivulets
- Very few river basins have been covered with automatic sensors for observations and telemetry system for communication of data.
- Flood plain zoning regulations have not been enacted and enforced
- Implementation of the flood proofing Measures are yet to be fully implemented
- Lack of flow of information among the basin-states resulting in gaps in preparedness on their part to face incoming floods.
- The flood response system lacks public participation. There is also lack of awareness among the people about simple ways of safeguarding their lives and properties during floods. They are also not aware of the role they can play in the preparedness, mitigation, rescue and relief during floods.

### Infrastructural gap in addressing the drought risk management

Drought: Drought is a natural hazard that differs from other hazards since it has a slow onset, evolves over months or even years, affects a large spatial extent, and cause little structural damage.

- Development of standard procedures for drought vulnerability assessment and generation of vulnerability maps are to be undertaken.
- The critical areas for minimizing loss of lives, livelihood and property are to be addressed purposefully and systematically.
- Measures are to be put in place for drought proofing of chronically drought-prone areas.

### Infrastructural gap in addressing the earthquake related DRM

- Early warning system
- Lack of Disaster management support network

## 10.5. Programme and Policies in the sector

### 1. State Disaster Management Policy 2012

The Government of Jammu and Kashmir has developed a State Disaster Management Policy 2012 for effective disaster management in the State. The aim of the policy is mainstreaming Disaster Risk Reduction into all the developmental initiatives to ensure sustainability of investments and minimizing the losses due to disasters by taking all necessary measures.

The approach of the policy States that holistic, comprehensive and integrated multi-hazard approach should be evolved towards disaster management focusing on building strategic partnerships at various levels. It will be based on inter-sectoral coordination, capacity development of all stakeholders at all levels and in all sectors, community participation, and involvement of cooperation with other agencies. The Policy identifies that hazards are inevitable which need not necessarily convert into disasters. Disaster risk can be mitigated with appropriate, advanced measures.

#### **Objectives of the policy are:**

- To institutionalize Disaster Risk Reduction into governance as envisaged in Disaster Management Act, 2005 and National Disaster Management Policy, 2009.
- To promote and mainstream DRR into developmental planning.
- To build capacities and promote

effective institutional mechanisms for mainstreaming DRR.

- To promote community-based DRR to reduce vulnerabilities and effective responses through awareness-generation and capacity-building.
- To promote research and development for Disaster Risk Reduction through appropriate disaster prevention, mitigation and preparedness measures and strategies.
- To develop mechanism for an effective, well-coordinated and timely response system.
- To establish a framework for post-disaster recovery and reconstruction.

#### ***The State Disaster Management Policy, 2012 has made provisions for following:***

- Financial Arrangements
- The Nodal Departments (The concerned nodal department should prepare plans for handling these disasters and should regularly update the plans. The nodal department can seek assistance from any other department, agency/ organization etc. as and when required).
- Techno – Legal Framework
- Strengthening Institutional Mechanisms and Capacity Building
- State Institute of Disaster Management
- Emergency Operation Centres
- Framework for Mainstreaming Disaster Management in the State



## **2. Jammu and Kashmir Disaster Management Rules in the year 2007**

The State Executive Committee should prepare the State Disaster Management Plan which should in addition to the provision laid down in subsections (2) and (4) of the section 23 of the Act include provision for:

- I. Information dissemination
- II. Co-ordination among different departments
- III. Training of personnel associated with disaster management
- IV. Periodic assessment of resources for disaster management in the States
- V. Post disaster evaluation

## **3. Disaster Management Act, 2005**

The Act provides for the effective management of disasters (“disaster” means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or destruction of property or degradation of environment, and is of such a nature or magnitude beyond the coping capacity of the community. Under Disaster Management Act 2005 a National Plan will be formulated for the prevention of disasters, or the mitigation of their effects and undertake measures for preparedness and capacity building to effectively respond to any threatening disaster situations or disaster. Following the enactment of the Disaster Management Act, 2005, (DM Act, 2005) the Government of India (GOI) constituted the National Disaster

Management Authority (NDMA) as the apex body for Disaster Management (DM) in India with the mandate, inter alia, for laying down policies and guidelines on DM. These efforts will conserve developmental gains and also minimize loss of lives, livelihood systems and property.

## **4. The Jammu & Kashmir Natural Calamities Destroyed Areas Improvement Act, 1955**

The Jammu & Kashmir Natural Calamities Destroyed Areas Improvement Act, 1955 was enacted for improvement of towns, villages and other areas destroyed by natural calamities in the State. However, not much mileage was achieved through the enactment of the Act.

## **10.6. Key Priority**

### **1. Hazard risk mapping using GIS and Remote sensing**

- Preparation of natural hazards zonation map
- Identification of multi hazards zone map
- Perform risk and hazard analysis in hazard prone area

Applications of Geoinformatics in Disaster Risk Management are emerging trends in the last two decades. Geoinformatics, which includes Remote Sensing, Geographic Information System, Global Positioning Systems, and Internet Mapping Services, provides the most powerful tools for disaster management through hazard mapping, monitoring, risk assessment, emergency

response and reconstruction as planning for disaster management requires consideration of the spatial and temporal aspects of the location.

13 Districts in J&K out of 100 in the country have been identified as Multi Hazard prone Districts. It is, thus, imperative to have a solid base to start activities related to DRR. SDMA in association with the Divisional DMA and DDMA should coordinate assessment of hazards, vulnerabilities and risks prevailing at various levels in the State. SDMA should involve all line departments and all relevant agencies in this task. As an outcome of this exercise, State-specific hazard, vulnerability and risk maps should be prepared at the earliest.

Scenarios need to be developed to depict the impact of different types of disasters. These scenarios should be used for developing detailed prevention, preparedness and mitigation measures. Specific measures like micro-zonation of cities (Jammu and Srinagar) and all major towns, land use planning and zoning regulations, retrofitting of infrastructure and buildings, disaster-safe construction technology and strengthening the capacities of communities should be promoted for different hazard/disaster-prone areas of the State in a time-bound manner.

## 2. Risk reduction through implementable planning and policy development

- Development of prefabricated structures instead of cast-in-place construction in vulnerable areas

- Improve infrastructure resilience through restoration of buildings in vulnerable areas and critical facilities protection
- Enforcement of building codes; better urban planning and zoning of vulnerable areas

As a planned adaptation strategy, reducing risks from natural disasters needs to be a part of infrastructure project design, especially in areas vulnerable to extreme events. It is generally much cheaper to incorporate appropriate features in the initial design and construction of infrastructure projects, including siting, than to undertake retrofits later. The various elements of this program may include:

- Disaster-specific vulnerability assessments and sector specific impact assessment at the State and district level for preparing contingency plans
- Maintenance of critical facilities such as health care services, roads, schools and water supplies
- Collaboration with insurance providers to ensure the loss recovery of infrastructure
- Mainstreaming disaster risk reduction into Sarva Shiksha Abhiyan, Jawaharlal Nehru National Urban Renewal Mission and Indira AwasYojana
- Capacity building among design engineers, project planners and financial institutions on incorporating elements of disaster management

In addition to above SDMA should ensure to carry out the vulnerability check of dams,

power projects, bridges, PMGSY roads, tunnels and other key infrastructure facilities and take appropriate measures to make them safe to face severe earthquakes. For this purpose, resource mapping should be carried out through geo-spatial technology wherever feasible. The construction work and other activities that affect the environment should be monitored by relevant departments in vulnerable regions particularly in landslide earthquake and avalanches-prone areas and in areas where dams-power projects are located especially in environmentally-fragile regions, like areas along the national highways, water-bodies. Hilly areas and the rivers should be protected by legal enforcement from detrimental interventions that may lead to situations eventually resulting in disasters.

### 3. Strengthening Communication Networks and Disaster Management Facilities

- Strengthening and improving weather forecasts and services network of Meteorological observatories / Seismic observatories including Doppler Weather Radars for each region/district to serve as Information network
- Developing linkage between SDMA and line departments engaged in relief and disaster risk reduction
- Setting up Emergency Operation Center (EOC) and implement Incident Response System (IRS)
- Develop and/or upgrade forecasting, tracking and early warning systems for hazard events

Ensuring that communication channels are not severed during disasters can protect lives and expedite relief and rehabilitation operations. Furthermore, it is essential to have a regular monitoring programme in place to provide early warning of imminent disasters to facilitate a planned response, including evacuation from vulnerable areas to minimize the impact of disasters. Specific action areas will include:

- Monitoring climate system and hydro-meteorological pattern for early estimation
- Generation of hazard maps in regional scale and their hazard specific zonation
- Upgrading forecasting, tracking and early warning system for flood, cloud burst and flash flood
- Community level disaster response training to minimize loss of life and infrastructure
- Awareness for medical preparedness and emergency medical response to manage mass casualties during extreme events

SDMA should ensure development of a State-specific Disaster Management Information System (JKDMIS). JKDMIS should include a comprehensive repository of available manpower, machinery and other resources available at the State level. The JKDMIS should ensure easy accessibility to all relevant authorities at all times to facilitate quick contact with people and availability of resources on the onset of a disaster. The JKDMIS should be made available to the public through a web-based technology.

SDMA should ensure a mechanism aligned with overall disaster management plan of the State to receive forecasting and early warning from the nodal agencies like Indian Meteorological Department (IMD), Snow and Avalanches study Establishment (SASE), etc. The modern gadgets like Doppler Radars and satellite based information should form the basis of accurate forecasting and early warning. The available information should be disseminated to vulnerable communities to the last mile. Early Warning mechanisms should be instituted by the FCR Office to give advance warning and alerts for floods, cloudbursts, snow-storm etc. through mobile telephony/ SMS service. An alternative wireless-based communication mechanism should be introduced for communication from State to districts and from districts to blocks and villages. State, Divisional, District & local administration will communicate with community through media in order to prevent panic reaction and get feedback on relief measures and urgent needs of various agencies involved in emergency relief measures.

EOC and IRS should be established/ implement respectively for effective management of disasters and maximum coordination of all agencies responsible for disaster management in this State. The Incident Response System would provide combination of facilities, equipment, personnel, procedures and communications operating with common organizational structure, with a clear responsibility for the management of resources to effectively accomplish the stated objectives pertinent to an incident.

SDMA should establish a proper chain of command for effective management of disasters and coordination of all agencies responsible for disaster management in the State. The Incident Response System would provide combination of facilities, equipment's, personnel, procedures and communications operating with common organizational structure, with a clear responsibility for the management of resources to effectively accomplish the stated objectives pertinent to an incident.

#### 4. Hazard specific multi-parameter vulnerability assessments and societal impacts assessments at the regional and local levels for preparing contingency plan

SDMA should facilitate carrying out hazard specific multi-parameter vulnerability assessments and societal impacts assessments at the regional and local levels for all the districts towards preparation of the contingency plan. In order to move towards safer and sustainable development, all developmental activities should be sensitive towards disaster risk reduction. SDMA and SEC should encourage all departments to spend a little extra in a planned manner on steps and components that could help in disaster risk reduction.

#### 5. Developing and promoting concept of Climate Smart Disaster Risk Management (CSDRM)

The impacts of climate change on disaster risks are profound, complex and somewhat uncertain. It is already evident that trends in economic and livelihoods-related disaster



losses are on an upward curve and the majorities are associated with extreme weather events. These trends are likely to continue and may even accelerate as some hazards become more severe and unpredictable and greater numbers of vulnerable people are living in harm's way. Climate Smart Disaster Risk Management (CSDRM) is an integrated development and disaster risk management approach that aims simultaneously at

- changing disaster risks,
- enhance adaptive capacity,
- address poverty, exposure, vulnerability and their structural causes and
- promote low/no-carbon development in a changing climate

The CSDRM approach should therefore be integrated into strategic planning, program development and policymaking so as to develop an inclusive planning to address the changing climate concern and disaster risk. The CSDRM approach broadly encompasses:

- Tackle changing disaster risk and uncertainties
- Enhance adaptive capacity
- Address poverty, vulnerability and their structural causes

The CSDRM approach builds on DRM, climate change adaptation and development concepts and approaches for disaster risk mitigation.

## 6. Preparation of disaster rescue and rehabilitation plan.

SDMA should ensure preparation of disaster rescue and rehabilitation plan. All line departments at the State, Divisional and District levels should also have their plans customized to cater to the DRR needs. The guidelines for such plans should be developed by SDMA. The plans so developed should be operational, regularly reviewed and updated. The State experiences certain typical winter-related seasonal disasters such as snow avalanches and landslides. Disaster-specific crisis management plans by various departments should also be prepared in the State. Measures to address issues arising out of global warming and climate change which have increased the risk of the State due to natural disasters should be given highest priority in the risk reduction activities. Standard Operation Procedures (SOP), for every department, relief manuals/ codes, etc. should be developed/reviewed and updated by relevant government departments under the overall guidance of the SDMA. DDMPs should spell out strategy for mitigating the impact of disasters of women and children and should prepare specific plans for disbursement of speedy relief to them. Specific plans should be prepared for safety and protection of animals as well.

Facilities like hospitals, fire services, police stations, schools, water supply, bridges, flyovers and underpasses, electricity grid stations and houses of VVIPs are critical in nature for post-disaster management.

To ensure functioning of critical facilities, buildings occupying such facilities and falling in Seismic Zone-V have to be retrofitted. SDMA should develop a clear-cut retrofitting strategy at State level for this purpose. Safety audit of all existing Government buildings should be done within one year.

Schools should be developed into multi purpose permanent community shelters in vulnerable areas with due provisions for accommodating displaced families. Provisions in the State Disaster Response Fund should be utilized to procure equipments necessary for different departments, subject to needs assessment and the availability of funds.

Following are the immediate rescue and relief measures for which the SDMA should always be prepared for:

- Immediate supply of foodstuffs, fuel, clothing, blankets, tents and cash etc.
- Cash relief/ex-gratia grant to affected families.
- Schemes for repair/restoration of public as well as private properties
- Medical assistance is given to the needy and injured persons.

#### 7. Awareness/ Sensitization/ Capacity Building in form of :

- Enhancing Knowledge among the Stakeholders
- Disaster preparedness and prevention
- Response training
- Disaster Response training for community, design engineer, project

planners and insurance personnel

Awareness and preparedness are key strategies towards disaster risk reduction. Following are the major activities planned under stakeholder's knowledge build up:

- Inclusion of disaster management principle under school curriculum: Appropriate materials will subsequently be developed for various climate changes and disaster related issues and the same would be introduced in the school curriculum.
- Development of information and education material: The SDMA has to develop information material in vernacular language and promote through online and social medium.
- School awareness program: Awareness programs to be regularly organized by the Department for school children.
- Awareness program for officials: It is highly necessary to sensitize the government officials at all levels. The Department has to regularly organize sensitization programs for government officials at State, district and tehsil / block level. Various key issues related to climate change have to be included under the training programs.

#### 8. Community based disaster management in the Disaster Management Plan at all levels

Experiences from past disasters indicate that reaching out to the affected community within the critical period following a disaster is a major challenge in the efforts to protect

human lives and assets. It is also a fact that communities being the first responders have more contextual familiarity with the local hazards and the available resources. They are also in a better position to plan and execute activities related to disaster management at the local level.

SDMA should develop mechanisms to manage disasters at the grass-root level through community participation. The Policy envisages leveraging and capitalizing the existing social capital and traditional wisdom in management of disasters. The Policy visualizes a need for a culture for prevention, mitigation, preparedness, quick response and strategic thinking to be incorporated into the minds of the vulnerable communities. SDMA should encourage PRIs/ULBs to work out Community Based Disaster Management Plans to safeguard lives, livelihood and property, to prevent losses and, at the same time, enable a faster recovery in the event of a disaster. Involvement of multilateral aid agencies and civil society organizations should be encouraged to put the Community Based Disaster Risk Management (CBDRM) system into practice in the State. While developing CBDRM, due recognition should be given to most vulnerable groups like women, children, elders and differently-abled persons.

SDMA, with the help of line departments, should periodically conduct social audits to ensure appropriate participation of all vulnerable groups.

#### 9. Disaster response training at the community level to build infrastructure and

#### human resources for medical preparedness and emergency medical response to manage mass casualties during extreme events

The diverse nature of disasters to be dealt with calls for a wide variety of training inputs in disaster response, for the SDMA personnel as well as all other target groups. Floods, cyclones, earthquakes, landslides and avalanches, besides chemical and biological emergencies, all call for mutually-different techniques of response, to effectively contain the potential loss of life, limb and property from each of them. The need for specialized training encompassing disaster management techniques for all categories would need to undergo an all-embracing training program in the response strategies for different types of disasters. Para-medics and medical personnel, who have a very crucial role in disaster rescue operations, will also need to undergo a basic training course, tailored to their training needs in pre-hospital handling and treatment of victims.

#### 10. Institutional development and operationalization of the regulatory framework for effective management of disaster under State Disaster Management Act (DM Act) 2005 for preparation of Disaster response and management plan

The DM Act 2005 envisages a paradigm shift from the erstwhile response centric syndrome to a proactive, holistic and integrated management of disasters with emphasis on prevention, mitigation and

preparedness. This national vision, inter alia also aims at inculcating a culture of preparedness among all stakeholders and training of different stakeholders is the most important tool to achieve this end. The new approach covers the entire cycle of disaster management encompassing prevention, mitigation, preparedness, response, relief and rehabilitation. Effort will also be made to strengthen the State and District Disaster Management Authorities (DMAs) to reduce disaster risk proactively, and implement timely, sustainable, and locally relevant recovery activities in post-disaster situations. It would emphasize institution-building and technical capacity-building, including NGOs, private sector and academia. As part of the training and capacity-building component, attention will be on regulating engineering and architecture professionals including the introduction of a process of registration and pre-qualification, etc. Substantial effort will be invested in building capacity through structured and varied training program targeted at engineers, architects, construction site supervisors, construction artisans, quality auditors and developers and town planners etc. Enhancing capacity in DM Departments/ Cells, municipal corporations and urban local bodies will be undertaken in a concerted manner. This activity will also encompass strengthening existing institutional training facilities for specialized training in hazard-resistant construction

practices. Efforts will also be made to involve the private sector including construction companies and construction sector associations/federations to promote capacity building initiatives through their networks targeted at construction fraternity/artisans in the private or informal sector. Appropriate linkages with national/state level training and technical institutions will be promoted and strengthened to complement the same. In addition, awareness and sensitization will be created by informing house owners, developers, financing institutions, contracting companies and the construction fraternity about safer construction practices.

The National Act of disaster Management 2005, District Disaster management Plan is to be mandated as one of the most important tools for DRR. Strategy should also be framed towards mainstreaming Disaster Risk Reduction (DRR) into the Development and Disaster Management Plans. Approaches of mainstreaming disaster management into the development process and disaster management plans are through

- o Structural Measures
- o Non Structural Measures
- o Disaster Mitigation Projects

Mainstreaming the DRR in the development plan can also be strategized through inclusion into Government of India flagship program.



Sl. No	Name of the Programme	Department / Sectors	Proposed Strategies for DRR Integration into the Flagship Programmes
1	Indira Awas Yojana	Rural Development Department	<ul style="list-style-type: none"> <li>• Inclusion of such measures like application of Hazard resistant design in construction of IAY houses, appropriate sitting of IAY housing in guideline of IAY</li> <li>• Development of model design for IAY houses which could be easily referred to by DRDAs at district level and used for community awareness depending on the geographical location.</li> <li>• Capacity Building of Rural masons on safe construction.</li> <li>• Capacity Building of PRIs.</li> <li>• Community Awareness.</li> <li>• Capacity Building Programmes for DRDA officials on Disaster Risk</li> <li>• Reduction issues</li> </ul>
2	Mahatma Gandhi National Employment	Rural Development Department	<ul style="list-style-type: none"> <li>• Utilisation of MGNREGS funds to reduce the vulnerability of Panchayat vis-a-vis natural hazards such as landslide, drought, forest fire, cloud burst, flash floods, earthquake etc.</li> <li>• Giving priority to those works which reduce the vulnerability of area over the works which enhances the vulnerability of the area to natural hazards.</li> <li>• Identified works are available which take into account the hazard profile and offer continuous employment opportunities in the event of disasters to ensure livelihood security in the event of disasters.</li> <li>• Works which reduce disaster risk are given priority in plans-such as local mitigation works, etc.</li> <li>• Any other implements able suggestion within the ambit of the scheme.</li> </ul>

Sl. No	Name of the Programme	Department / Sectors	Proposed Strategies for DRR Integration into the Flagship Programmes
3	Pradhan Mantri Gram Sadak Yojana	PWD	<ul style="list-style-type: none"> <li>The Master Plan for rural roads, the district rural road plan and identification of core network under the planning process of this scheme should, which the overall guidelines of its preparation, explicitly address the disaster risk reduction concerns and accord priority to connect the vulnerable habitations.</li> <li>The technical guidelines should explicitly provide for suitable protection and inclusion of disaster risk concerns explicitly - while provision of cross drainage, slope stabilization, protection works are already included, in multi-hazard and especially flood and landslide prone areas fair weather roads need to be upgraded on a priority basis.</li> <li>The maintenance guidelines are modified to ensure that in case of disasters these roads get provision for restoration to ensure all weather connectivity.</li> </ul>
4	Jawaharlal Nehru Urban Renewal Mission	Urban Development Department	<ul style="list-style-type: none"> <li>Strengthening of the compliance mechanism at the detail project report submission and appraisal stage in case of infrastructure projects as well as housing scheme to ensure structural safety.</li> <li>Emphasis on disaster risk audit at the stage of preparation of detail project reports.</li> <li>Inclusion of amending of building byelaws to ensure structural safety as a mandatory reform in the Mission cities to ensure safe habitat development. (Both structural safety and fire safety norms).</li> <li>Inclusion of disaster management as a function of the Urban Local Bodies and allocate resources.</li> <li>Inclusion of Disaster Resistant features in the houses being constructed under the BSUP component as well as promote development of safe habitat.</li> <li>Inclusion of strategies for disaster management in the City Development Plans.</li> <li>Training and Capacity Building Programmes for municipal officers on disaster risk reduction.</li> </ul>

Sl. No	Name of the Programme	Department / Sectors	Proposed Strategies for DRR Integration into the Flagship Programmes
5	Sarva Siksha Abhiyaan	Education	<ul style="list-style-type: none"> <li>• Development of a Policy paper of school safety.</li> <li>• Introducing school safety as a part of the guidelines of SSA which is currently focusing on inclusive development.</li> <li>• Developing model structurally safe designs for schools.</li> <li>• Introducing School Safety in the Teacher's Training Curriculum.</li> <li>• Training of Rural Engineers appointed under SSA Scheme as well as the SSA State Coordinators.</li> <li>• Training of masons in rural areas.</li> <li>• Construction of Technology Demonstration Units.</li> <li>• Community Awareness.</li> </ul>
6	National Rural Health Mission	Health and family welfare	<ul style="list-style-type: none"> <li>• Ensure that the village Health Plan and the District health plan explicitly address the disaster risk reduction concerns in the vulnerable habitations and the vulnerable districts and the disaster management plan as per DM Act 2005 takes links itself to the District and village Health plans.</li> <li>• Provide training to the ASHA workers on disaster health preparedness and response.</li> <li>• Strengthening of Disease Health Surveillance System in rural areas.</li> <li>• Ensuring structural safety of the CHC/PHC and other health care service delivery centers in rural areas.</li> <li>• Training of doctors and hospital staffs on mass casualty management and emergency medicine.</li> <li>• Community awareness on disaster management.</li> </ul>

Sl. No	Name of the Programme	Department / Sectors	Proposed Strategies for DRR Integration into the Flagship Programmes
7	Rajiv Awas Yojana	Urban Development	<ul style="list-style-type: none"> <li>• Since Rajiv Awas Yojana focuses on developing slum free cities and Capacity Building and Community Mobilization is also an important component of RAY. Through this programme, attempts can be made towards community level disaster preparedness as slum dwellers often become the most vulnerable community during such disasters as floods, fire and high wind speed.</li> <li>• Also the Housing Programmes to be implemented in these selected cities can ensure incorporation of hazard resistant features and safe sitting</li> </ul>





## 10.7. List of Key Priority Actions

Table 53: List of key priority Disaster Management Mission

Sl. No.	Title	Organiz-ations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	<b>Hazard risk mapping using GIS and Remote sensing</b>	SDMA, SEC and DDMA				Gol, Planning Commission, DDMA
1.a.	Preparation of natural hazards zonation map		Nil	12.00	12.00	
1.b.	Identification of multi hazards zone map		Nil	8.00	8.00	
1.c.	Perform risk and hazard analysis in hazard prone area		Nil	22.00	22.00	
2	<b>Risk reduction through implementable planning and policy development</b>	SDMA, SEC and DDMA, Dept of Home, Irrigation, Revenue				Gol, Planning Commission, DDMA
2.a.	Development of prefabricated structures instead of cast-in-place construction in vulnerable areas		Nil	12.00	12.00	
2.b.	Improve infrastructure resilience through restoration of buildings in vulnerable areas and critical facilities protection					
2.c.	Enforcement of building codes; better urban planning and zoning of vulnerable areas					
3	<b>S t r e n g t h e n i n g Communication Networks and Disaster Management Facilities</b>	SDMA, SEC , DDMA, NIC				Gol, Planning Commission, DDMA

Sl. No.	Title	Organiz-ations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
3.a.	Strengthening and improving weather forecasts and services network of Meteorological observatories / Seismic observatories including Doppler Weather Radars for each region/district to serve as Information network		Nil	5.00	5.00	
3.b.	Developing linkage between SDMA and line departments engaged in relief and disaster risk reduction		Nil	6.00	6.00	
3.c.	Setting up Emergency Operation Center (EOC) and implement incident Response System (IRS)		Nil	32.00	32.00	
3.d.	Develop and /or upgrade forecasting, tracking and early warning systems for hazard events		Nil	20.00	20.00	
4	Hazard specific multi-parameter vulnerability assessment s and societal impacts assessments at the regional and local levels for preparing contingency plan	SDMA, SEC , DDMA, NIC, Dept of Home, Irrigation, Revenue and PWD	Nil	26.00	26.00	Gol, Planning Commission, DDMA
5	Developing and promoting concept of Climate Smart Disaster Risk Management (CSDRM)	SDMA, SEC , DDMA, NIC, Dept of Home, Irrigation, Revenue, Agriculture and PWD	Nil	4.00	4.00	Gol, Planning Commission, DDMA
6	Preparation of disaster rescue and rehabilitation plan.	SDMA, SEC , DDMA, Dept of Home, Irrigation, Revenue, Agriculture and PWD	Nil	10.00	10.00	Gol, Planning Commission, DDMA

Sl. No.	Title	Organiz-ations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
7	Awareness/ Sensitization/ Capacity Building in form of <ul style="list-style-type: none"> <li>Stakeholders knowledge build up</li> <li>Disaster preparedness and prevention</li> <li>Response training</li> <li>Disaster Response training for community , design engineer, project planners and insurance personnel</li> </ul>	SDMA, SEC , DDMA, Dept of Home, Irrigation, Revenue, Agriculture and PWD	Nil	24.00	24.00	Gol, Planning Commission, DDMA
8	Community based disaster management in the Disaster Management Plan at all levels	SDMA, SEC , DDMA, Dept of Home, Irrigation, Revenue, Agriculture and PWD	Nil	38.00	38.00	Gol, Planning Commission, DDMA
9	Disaster response training at the community level to build infrastructure and human resources for medical preparedness and emergency medical response to manage mass casualties during extreme events	SDMA, SEC , DDMA,	Nil	2.00	2.00	Gol, Planning Commission, DDMA
10	Institutional development and operationalization of the regulatory framework for effective management of disaster under State Disaster Management Act 2005 for preparation of Disaster response and management plan	SDMA, SEC , DDMA, Dept of Home, Irrigation, Revenue, Agriculture and PWD	Nil	2.50	2.50	Gol, Planning Commission, DDMA
<b>Total (INR in million)</b>			Nil	<b>223.50</b>	<b>223.50</b>	







# 11. Tourism

## 11.1 Introduction

Whether it is for adventure or just for leisure, Jammu and Kashmir, rightly called the “Paradise on Earth” has been one of the most sought after getaways in India. The State is endowed with few of the biggest destinations of religious values and the peaks offering the best to the adventure lovers have made the tourism industry one of the most flourishing and the mainstay of the State economy.

Other than the destinations of tourism value, climate is another principal attraction for tourists from all over the world. Preference of locations during a particular period of time and the profitability of enterprise is largely determined by the climatic conditions. Thus any regional manifestation of climate variability and extremes are likely to influence the popularity of any tourist destination. So the projected climate variability and change can severely affect the tourism industry in the State through increased infrastructure damage, additional emergency preparedness requirements, higher operational expenses

and business interruptions. Barring the vulnerability of the sector the tourism sector also contributes to climate change through GHG emissions from transportation and accommodation facilities for tourists.

Tourism sector contributes substantially to the State’s economy and also provides livelihood opportunity to around 20% of the State’s population. The critical challenge is therefore to develop a coherent policy strategy that separates the growth of tourism industry from enhanced GHG accumulation and contribute substantially towards poverty alleviation and livelihood improvement.

## 11.2. Key trends in the sector

Pleasant and favorable atmosphere in the State has resulted in multi fold growth of the tourism industry. The State has three distinct niches, while leisure tourism is available in Kashmir valley, pilgrim tourism in Jammu and Ladakh has the potential to offer adventure tourism. Following are the list of major tourist destinations coming under these

three regions:

**1) Jammu Region:** Jammu, Akhnoor, Jhajjar Kotli, Aghar Jitto, Patnitop, Sanasar, Bhaderwah, Kishtwar, Baba-Dhansar, Reasi, Sihard Baba, Udampur, Kud.

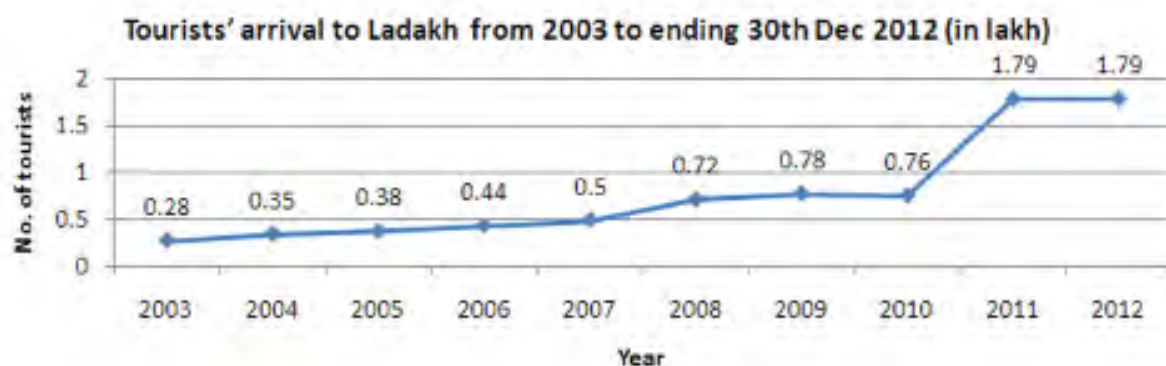
**2) Kashmir Region:** Srinagar, Gulmarg, Pahalgam, Sonamarg, Daksum, Kokernag, Yusmarg, Aharbal, Watlab, Verinag, Lolab Valley.

**3) Ladakh Region:** Kargil, Zaskar, Leh, Nubra, Lamayuru, Spitik.

*Table 54: Arrival of tourists (both domestic and international) across the three regions of the State's Tourists' arrival from 2003 to ending 30th December 2012 (in Lakh)*

Year	Kashmir Valley		Jammu	Ladakh
	Amarnath Ji	Domestic/ Foreign	Mata Vaishno Devi Ji	
2003	1.53	1.91	54.00	0.28
2004	4.00	3.77	61.00	0.35
2005	3.88	6.05	62.52	0.38
2006	2.65	4.33	69.50	0.44
2007	2.13	4.42	72.22	0.50
2008	4.98	5.72	65.76	0.72
2009	3.73	6.01	82.35	0.78
2010	4.58	7.36	87.49	0.76
2011	6.34	13.14	101.15	1.79
2012	6.21	13.09	101.54	1.79

Source: Jammu and Kashmir Economic survey report 2012-2013



*Figure 24: Tourists' arrival to Ladakh from 2003 to ending 30th Dec 2012*

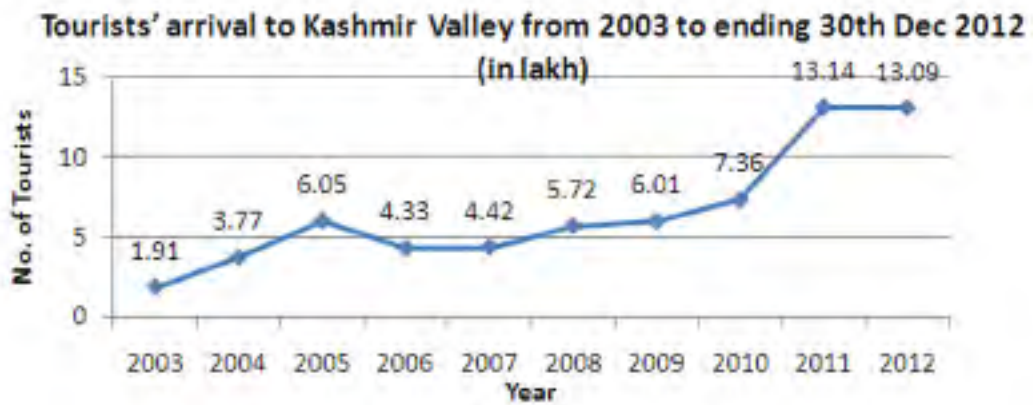


Figure 25: Tourists' arrival to Kashmir valley from 2003 to ending 30th Dec 2012

The infrastructure of some of the locations in the State is already under stress leading to congestion, pollution, water and sanitation issues. Providing hospitality to excess tourists during the peak time has led to unplanned infrastructural growth in the climate sensitive region thereby enhancing the chances of catastrophic destruction of life and assets

under climate extreme scenario.

### Tourism Connectivity

#### a. Airways

Srinagar, Jammu and Leh are major airports, connecting Jammu and Kashmir with the rest of the country.



Figure 26: Air Connectivity





## b. Roadways

Jammu and Kashmir is well connected by National Highway 1-A, connecting Srinagar with Jammu (300 km) which is an all-weather road.



Figure 27: Road Connectivity



### c. Railways

Jammu Tawi, a major railway junction of North India, and Udhampur in Jammu province, Srinagar's nearest railhead (302 km) can be reached by a large number of trains from most parts of country. Trains operate within Kashmir valley from Qazigund to Baramulla. Kashmir is being connected by rail with Jammu and the project is expected to be commissioned in near future.

### Tourism Growth

#### 1. Increase in Domestic Tourist

The Ministry of Tourism Government of India aims at maintaining the annual domestic tourist growth rate of 12.16% for the next 5 years (Source: Letter DO No. 8(12)/2011-MRD, issued by Ministry of Tourism, Government of India to Secretary Tourism of all States)

#### 2. Increase in international Tourist

The Ministry of Tourism, Government of India aims at increasing the country's share

of World Tourist Arrivals from 0.6% to 1% for the next five years (Source: Letter DO No. 8(12)/2011- MRD, issued by Ministry of Tourism, Government of India to Secretary Tourism of all States).

## 11.3. Vulnerability of the Sector

Extreme weather and climate events mostly lead to widespread adverse effects on mankind, material, economy or environment. Climate projection predicts future changes in temperature and other important features of climate which are likely to manifest themselves differently across the States. According to the IPCC, hot extremes, heat waves and heavy precipitation events are likely to occur more frequently. Depending upon wide range of factors, including anthropogenic climate change, natural climate variability and socioeconomic development, the vulnerability would be determined. Major weather related stress and implication on tourism destination is outlined as follows:

*Table 55: Wather stress and related vulnerability of the tourism sector*

Weather Stress	Implication
Increased Temperature	Altered seasonality, heat stress for tourists, cooling costs and increased incidence of infectious disease ranges
Decreasing snow cover and shrinking glaciers	Lack of snow in winter sport destinations, shorter winter sports seasons, aesthetics of landscape reduced and increased chances for flash flood
Increasing frequency and intensity of landslide, avalanches and extreme storms	Risk for tourism facilities, infrastructure damage , business interruption costs
Increased frequency of heavy precipitation in some regions	Flooding damage to architectural and cultural assets, damage to tourism infrastructure, altered seasonality

The impacts of climate change on tourism based on weather stress can be categorized as follows:

**Direct Climate Change impacts:** Direct impact of climate change is categorized both from the point of seasonal variability and climate extremes. Suitability of tourism at a location is highly dependent on the climate /seasonal variations. Thus, change in the duration and quality of climate-dependent tourism seasons could impact the profitability of the tourism enterprise.

Variation or shortening of duration of favourable climate condition might result in incremental population in already stressed tourist destinations resulting in increased environmental degradation and vulnerability.

Climate change studies have predicted a number of climate extremes including flood from more intense precipitation, cloud burst, drought, landslide, storm intensity and avalanches. Such climate extremes are likely to affect the tourism industry through increased infrastructure damage, additional emergency preparedness requirements, higher operation costs (e.g. insurance, backup water and power systems, and evacuations) and business interruptions.

**Indirect environmental impacts:**

Since environmental conditions are critical to tourism sector, therefore environmental changes would have profound effect on destination based regional tourism enterprise. Deterioration in the quality of available water including contamination of surface water

source, increased solid and liquid waste load, biodiversity loss, reduced landscape aesthetic, increased natural hazards, damage to infrastructure and increasing incidence of vector-borne diseases would affect tourism industry to varying degrees.

**Adaptation strategy for mountain and winter tourism destination**

- 1) Stimulate product and seasonal diversification e.g. all year tourism
- 2) Groom ski slopes to reduce snow dept
- 3) Preserve glacier areas
- 4) Move ski areas to higher altitudes
- 5) Improve insurance cover in the face of extreme events
- 6) Educate and raise awareness among tourists on the impacts of global warming environment
- 7) Improve water use efficiency and protect watershed.

**Adaptation strategy for nature based destination**

- 1) Develop response plans i.e. water supply planning (in drought susceptible destinations), risk assessment and preparedness strategies, and implement early warning systems (e.g. for flooding/flash flood)
- 2) Develop new areas/circuits to decongest regularly visited areas
- 3) Improve adaptive capacity of authorities and managers of protected areas through capacity building initiatives, especially in biodiversity hotspots
- 4) Establish scientific monitoring survey

programmes to assess ecosystem changes and take necessary protection measures (monitoring activities could especially focus on species and habitats most vulnerable to climate change impacts and most important for tourism activities).

#### **Adaptation strategy for religious destination**

- 1) Development of climate resilient rehabilitation centre based on the carrying capacity
- 2) Since most of the tourist destination in the State lies in climate sensitive and vulnerable areas therefore permission should be granted only based on the carrying capacity of the location
- 3) Since most of the location does not have adequate transportation facilities therefore disaster management should be planned for rehabilitation of tourist under climate stressed condition.

### **11.4.Key issues in the sector**

The unplanned and unprecedented growth of the tourism industry in the State has resulted in severe and detrimental impact on local environment. The inflow of tourist beyond the carrying capacity of the location has put tremendous pressure on existing resources and infrastructure. The pressing issues are

1. Increased Pollution load, enhanced health/safety concern
2. Increased issues of sanitation and garbage management

3. Weather related risks e.g. changes in temperature may discourage tourists to visit existing tourist destinations. Extreme climate events may lead to disruption of services.
4. Pressure on drinking water resources
5. Siltation and pollution of water bodies
6. Lack of collection and disposal mechanism of solid waste
7. Increased urban congestion and lack of proper transportation facilities
8. Lack of sewage disposal facility
9. Poor Maintenance and Use of Existing Tourist Infrastructure
10. Inadequate medical and DRM plan at climate sensitive tourist spots
11. Deforestation and land degradation
12. Unplanned infrastructure in climate sensitive zones
13. Lack of transport infrastructure
14. Lack of sufficient connectivity with rest of the country and adjacent countries
15. Un-regulated developments of tourist destinations including problem of accommodation
16. Poor waste disposal system
17. Restricted & protected access to important tourist destinations in State.
18. Requirement of Herringbone drainage system (Gulmarg).

The sector has structural & institutional weaknesses despite being one of the oldest & longest operating industries in the State. Besides other things there is a need for continuous effort to make tourism resorts/

places in State secure & safe. The important issues relating to the tourism sector is the carrying capacity of the destination. Infrastructure Leasing & Financial Services (IL&FS) has estimated the carrying capacity

of the tourist circuit of Srinagar. The analysis also portrays infrastructural gap that are likely to exacerbate under projected climate change scenario.

*Table 56: Carrying Capacity study for tourist location in Kashmir*

Town	Destination	Existing Load (2010)	Carrying Capacity	Available daily capacity (persons) 2010	Estimated Load (2020)	Available daily capacity (persons) 2020
Srinagar	ChashmaShahi, Botanical Garden	1,325	6,563	38,050	2,513	18,695
Srinagar	NishatBagh	16,868	6,143	-488	20,684	-4,304
Srinagar	Shalimar Bagh	12,682	4,784	76	15,577	-2,819
Srinagar	Dal lake	23,667	16,659	22,980	46,248	-6,963
Srinagar	Dachigham National Park	131	342	554	248	437
Srinagar	Hazratbal shrine	31,204	2,925	37,046	48,456	19,794
Gulmarg	Gulmarg Tourist resort	9,093	11,250	2,157	23,190	-11,940
Watlab	Wular Lake	3,646	60,275	96,812	7,191	93,268
Sonmarg	Sonmarg	5,170	67,500	62,330	13,002	54,498
Manasbal	Manasbal lake	4,376	16,439	23,022	8,629	18,769
Tangmarg	Tangmarg	2,553	15,000	1,17,447	6,810	1,13,190





## 11.5. Policy and Program

There are no definite tourism policies in place across the State<sup>29</sup> that addresses the concerns over climate change concern or reduce greenhouse gas emission. Action has therefore been proposed to develop a tourism policy that can address the climate change concern as well as contribute to low carbon inclusive growth of the sector.

## 11.6. Key priorities

### 1. Undertaking carrying capacity studies and developing EMP for ten tourist locations:

The Assessment of carrying capacity is based on three major indicators: Physical-Ecological, Socio-Demographic and Political-Economic. Physical and Ecological Indicators are based on fixed components (ecological capacity, assimilative capacity) and flexible components (infrastructure systems like water supply, electricity, transportation, etc.). Socio-demographic indicators refer to social and demographic issues with importance to local communities, as they are related to the growth of tourism. Political-economic indicators refer to the impacts of tourism on local economic structures, activities, etc. including competition to other sectors. The primary focus here is to study the Existing Capacity and Carrying Capacity of different tourist destinations in Kashmir circuit. The Available Capacity of a particular destination is calculated by deducting

Existing Capacity from Carrying Capacity. Estimation of carrying/ available capacity will prevent physical, economic and socio cultural environment degradation. The ten identified locations are:

1. Leh (Ladakh Region)
2. Lola-bangas (Kashmir Region)
3. Dadpatri (Kashmir Region)
4. Aharbal (Kashmir Region)
5. Verinag(Kashmir Region) and
6. Mansbal (Kashmir Region)
7. Mansar (Jammu Region)
8. Kistwar (Jammu Region)
9. Poonch (Jammu Region) and
10. Rajori (Jammu Region)

### 2. Construction of Bio-toilet

Human waste disposal is a pressing problem across all tourist destinations in the State. Open disposal of such waste leads to organic pollution & infectious diseases (dysentery, diarrhoea, amoebiasis, viral hepatitis, cholera, typhoid) in epidemical proportions due to contamination of surface water and drinking water resources. Moreover the sub-zero temperature does not allow natural biodegradation of organic matter leading to accumulation of the human waste over the years, contaminating the ice which is the only source of drinking water. Further, melted ice loaded with human waste can contaminate the rivers and other water sources exacerbating the health risks. The

<sup>29</sup><http://kashmirheadlines.in/06142013-ND-jk-only-state-in-india-without-tourism-policy-2191.aspx>

DRDO designed bio toilets are ideal for biodegradation of human waste at high altitude and can operate even at ambient temperature as low as -50°C. The bio-digester technology has two components: anaerobic microbial consortium and specially designed fermentation tank. The microbial consortium has been made by acclimatization, enrichment and bio-augmentation of the cold-active bacteria collected from Antarctica and low temperature areas. It is composed of four clusters of bacteria belonging to hydrolytic, acidogenic, acetogenic and methenogenic groups with high efficiency of biodegradation. Fermentation tank is

made of metal/ FRP and has the provision for preserving the bacteria in large numbers.

Since the route to major tourist destination and pilgrim lies in eco sensitive zones and fragile terrain therefore construction of permanent toilets is a major problem in this location. Moreover the ambient temperature of the location would prevent biodegradation of human waste in normal digester. Therefore bio-toilets are proposed on pilgrimage routes and at tourist posts in Jammu and Kashmir. Following are the locations and number of bio-toilets proposed:

*Table 57: Proposed location for construction of bio-toilet*

Sl. No	Location	Proposed Budget (INR in Million)
1	Dal Lake – Mugal garden	5.00
2	Manasbal	2.50
3	Verinag	2.50
4	Kokernag	2.50
5	Kargil	2.50
6	Mansar	2.50
7	Kistwar	2.50
8	Katra	5.00
9	Jammu City	2.50



### 3. Implementation of solid and liquid waste management facility

Solid and liquid waste management (SLWM) takes care of collection, transport, processing, recycling or disposal of waste materials, usually produced from human activity. Management of solid and liquid waste has turned out to be a pressing problem in the city. Generation and accumulation of waste leads to nuisance, air and water pollution, vector and water borne diseases and also contribute to greenhouse gas emission to the atmosphere. The problem of implementation of comprehensive solid and liquid waste management facilities are

- 1) Lack of knowledge in regard to technology that can ideally be implemented to address the solid and liquid waste
- 2) Unavailability of proper dumping site
- 3) Apathy of the Municipal Authority and absence of community participation.

***So implementation of the solid and liquid management facility is planned as follows***

- 1) Classification of waste
- 2) Identification of the Technology based on the following considerations
  - the origin and quality of the waste
  - presence of hazardous or toxic waste
  - availability of outlets for the energy produced
  - marketforthe compost/anaerobic

digestion sludge

- energy prices/buyback tariff for energy purchase
- cost of alternatives, land price and capital and labor cost
- capabilities and experience of the technology provider.

- 3) Identification of dumping site
- 4) Undertaking EIA
- 5) Identifying implementation partner.

***Implementation of solid and liquid waste management facility is planned across the following locations:***

- 1) Gulmarg
- 2) Leh
- 3) Patnitop
- 4) Sonmarg
- 5) Pahalgam
- 6) Bandipore.

### 4. Improve climate change related knowledge base of tour operators

Lower level of awareness is common among the tourism sector's stakeholders. Lack of knowledge and research regarding the complexities of tourism-climate interrelationships are common to the sector. Reduction of the impact of climate extremes requires a thorough knowledge about the early warning systems related to weather variability and climate induced disaster risk reduction techniques.

Tour operators are likely to play a vital role

in ensuring adaptation and mitigation initiatives through their capacity to influence the whole tourism supply chain. It is therefore imperative that the operators be made aware and trained on the climate change adaptation and mitigation issues. They could generate awareness among customers and soft mobility product development. However the operators are also less sensitive to the climate change issues, possible greenhouse gas mitigation and adaptation strategy. Tour operators and guides must therefore be trained over

- 1) Understanding climate change and climate induced disaster
- 2) Knowledge on assessing information related to early warning
- 3) Disaster risk management techniques
- 4) Reduce greenhouse gas emission

The mode to be followed for imparting knowledge would be through awareness and capacity building workshops. Awareness building would be done on a mass scale in phases for the tour operators and associated public in general and communities in tourism locations/destinations. Additionally, specific customized awareness and capacity building programmes have to be undertaken for tour operator groups/associations and staff from government tourism facility. Such programmes should be repeated and that capacity and awareness building would continue.

## 5. Undertake study on tourist-related transport emissions

Transportation causes around 75% of the CO<sub>2</sub> emissions generated from tourism sector, with aviation accounting for the bulk of it (40%)<sup>30</sup>. Although transport has a relatively small share in current global emissions, there is a need to develop effective mitigation measures, considering its projected dynamic growth. Technological development is still a key mitigation tool, but is insufficient to contain the problem of climate change. Therefore, there is a need of a mix of measures, including undertaking baseline studies relating to tourist related transport emissions, technological improvements, regulatory and market based measures, as well as behavior changes. Although the second communication to UNFCCC by India estimates the emission from the related sector but segregation was not in place for tourism sector. The following actions are proposed under the assignment

- 1) Calculate the emission portfolio of the State transportation sector
- 2) Calculate the emission portfolio of total energy consumption in hotel and hospitality enterprise in the State
- 3) Identifying the core area of reduction in fossil fuel consumption

## 6. Strategizing Restoration of Dal Lake

The ecologically sensitive Dal Lake is facing severe degradation from indiscriminate



disposal of solid and liquid waste<sup>31</sup>. The solid and liquid wastes generated from the households in and around Dal lake finds its way to the lake. The pollution created is harmful to the ecological and aesthetic balance of the lake. Above the pollution load; 61,000 tons of soil equivalent to 2.7 mm per year get deposited on the beds of the lake annually<sup>32</sup>. The indiscriminate disposal of solid waste in the interior areas of the lake has choked various interlinking channels. The Channel passing through Naidyar and Jogilankar has turned into foul smelling drain/cesspool. Decaying biodegradable solid waste stinks and emits hydrogen sulphide gas bubbles from the water bed. The Khujiyabal area in Nagin Basin of Dal Lake has turned into marsh filled with garbage. Dirty clumsy habitations all around the interlinking channels have choked the drains with wastes.

Studies by appropriate agencies are imperative to develop the baseline condition

of the Dal lake and prepare a detailed project report aimed at restoration of the lake along with conservation plan. Few of the strategies recommended for consideration are:

- 1) Dredging and De-weeding
  - 2) Rehabilitation
  - 3) Removal of willow plantation
7. Undertake study to identify new environmental friendly natural tourist destinations for their full-fledged operation as tourist spots

Most of the tourist destinations in the State have exceeded their carrying capacities. It is therefore required to identify additional tourist destinations so as to reduce the population burden for the existing tourist locations.

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<sup>31</sup>Parvaiz Ahmed and G. A. Bhat, University of Kashmir

<sup>32</sup>Press Bureau of India, <http://www.dzinternational.com/pbionline/Detail.aspx?ID=5365>







## 11.7 List of Key Priority Action

Table 58: List of key priority Action Tourism

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Undertaking carrying capacity studies and developing EMP for ten tourist locations	Dept. of Tourism	Nil	50.00	50.00	DoT, GoJ&K, MoT, PPP-Viability Gap Funding (VGF) from MoT
2	Construction of Bio-toilet	Dept. of Tourism, Urban Dev Dept and PWD	Nil	27.50	27.50	DoT, GoJ&K, MoT, PPP-Viability Gap Funding (VGF) from MoT JNNURM
3	Implementation of solid and liquid waste management facility at six locations	Dept. of Tourism, LAWDA, Urban Development Dept and PWD	Nil	600.00	600.00	DoT, GoJ&K, MoT, PPP-Viability Gap Funding (VGF) from MoT JNNURM
4	Improve climate change related knowledge base of tour operators	Dept. of Tourism,	Nil	5.00	5.00	DoT, GoJ&K, MoT, PPP-Viability Gap Funding (VGF) from MoT JNNURM
5	Undertake study on tourist-related transport emissions	Dept. of Tourism	Nil	5.00	5.00	DoT, GoJ&K, MoT, PPP-Viability Gap Funding (VGF) from MoT JNNURM
6	Strategizing Restoration of Dal Lake	Dept. of Tourism, Lake Conservation Dept	Nil	10.00	10.00	DoT, GoJ&K, MoT, PPP-Viability Gap Funding (VGF) from MoT, JNNURM, Lake development Authority
7	Undertake study to identify new environmental friendly natural tourist destinations for their full-fledged operation as tourist spots	Dept. of Tourism,	Nil	10.00	10.00	DoT, GoJ&K, MoT, PPP-Viability Gap Funding (VGF) from MoT JNNURM
<b>Total ( INR in Million)</b>			<b>Nil</b>	<b>697.50</b>	<b>697.50</b>	









## 12. Health

### 12.1 Introduction

Gradual and widespread climate changes with major impacts have occurred repeatedly in Jammu and Kashmir in the past. Although climate changes can occur for many reasons, it is conceivable that human activities are forcing an increase in the probability of large, abrupt events. Such change in climate condition might have natural causes, or could be triggered by humans or be among the dangerous anthropogenic interferences. The interactions of global climate change, air pollution and the extreme weather conditions have visible repercussions on the eco-system manifested through multiple sectors including health. From symptoms of normal flu to stomach problems, climate change has manifested its impacts on human and livestock health. Human adaptability in many cases has failed to shape itself according to the drastic changes in climatic

parameters due to lack of livelihood facilities. Climate change in Jammu and Kashmir has enhanced morbidity and mortality due to direct exposure to climatic adversities or indirectly through increased cases of vector attacks, scarcity of nutritious supplements, degrading water quality. Interstate migration in search for livelihood has increased infiltration of diseases in the State. The State government of J&K is on a drive to ensure better health through institutional up-gradation, infrastructural improvement and ensuring easy access to health care facilities to all.

### 12.2. Key Trends in the sector

From the National Family Health Survey (NFHS-3)<sup>33</sup>, conducted in 2005-06, the following trend for the State of Jammu and Kashmir can be deduced on health related issues:

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<sup>33</sup>National Family Health Survey 2005-06 Report published by International Institute for Population Sciences, Deonar, Mumbai

- Earlier the infant mortality rate was higher due to cold wave. But with the recruitment of additional manpower in neonatology, the infant mortality has reduced from 65 (as per NFHS-2, conducted in 1998-99) to 45 deaths per 1,000 live births.
- Abnormal rainfall, flash flood, improper sewerage system, etc. together causes spreading of water borne diseases like diarrhoea, cholera, etc. Children are mostly affected with diarrhoea. Despite of huge awareness programme on ORS (Oral Rehydration Solution), it is hardly administered. Around 85% of children have lesser liquid intake during diarrhoea which leads to an increased risk of dehydration.
- Mortality rate of children below the age of 5 years has decreased from 80 (as per FHS-2, conducted in 1998-99) to 51 per 1,000 live births.
- 25% women and 28% men are found anorexic and 17% women and 6% men are overweight within age group of 15 to 49 years.
- 52% of women and 20% of men suffer from anaemia in the State of Jammu and Kashmir. This clearly indicates the deficiency of nutrients in their daily diet.
- Out of every 1,00,000 persons, 96 suffer from tuberculosis. Vulnerability

to this disease is more for those who use wood, charcoal, dung cakes, straw or other agricultural wastes as domestic fuels. About 1% of adults in the State suffer from asthma (897 per 1,00,000 women and 816 per 1,00,000 men).

- In Jammu and Kashmir, 63% households depend on public medical services. But the scenario is different in the urban areas where, 58% households go for private medical services. The main reasons why people do not opt for public medical services are unsatisfactory services (55%), unavailability of accessible healthcare facility (33%) and longer response period (22%).

Comparative figures of major health and demographic indicators are as follows:

*Table 59: Health profile of the State*

Sl. No.	Particulars	Value
1	Decadal Growth <sup>34</sup> (%)	23.71
2	Total Fertility Rate <sup>35</sup>	2.40
3	Crude Birth Rate (CBR) <sup>36</sup>	17.80
4	Infant Mortality Rate <sup>37</sup>	41.00

The healthcare system of the State was found to be active and supported the human health sustainability against climate change. The infrastructures of healthcare facilities have been well maintained. But, there is a

<sup>34</sup>Census 2011

<sup>35</sup>SRS 2004

<sup>36</sup>SRS 2011

<sup>37</sup>SRS 2011

huge scope of development for additional healthcare infrastructure, inventory for medicine and creating awareness about hygienic practices. Although, there is decent availability of equipment and supplies, hospitals still lack in modern facilities. To meet

the increasing demand for healthcare services and reduce the response period, recruitment of medical practitioners of different category is essential as the State already has sufficient paramedical practitioners.

*Table 60: Health infrastructure in the State*

Particulars		No.
District, Sub-district/Private Hospitals and Associated Hospitals		115
Allopathic and Primary		259
Unani		175
Ayurvedic		282
Primary Health Centres		412
Medical Aid Centres and Mobile Units		573
T.B. Centres		11
S.T.D./V.D. Clinics		9
Family Planning Centres and Sub-centers/others		2,081
Leprosy Sub-centers and Leprosy Control Units		55
Trachoma Units/Amichi Centres/others		97
Medical Personal in Health Department	Doctors	5,573
	Nurses	2,721
	Compounders	2,864
	Vaids/Hakims	613
	Dawasaazs	444
	Sanitary Inspectors	136
	Health Inspectors	180
	Basic Health Workers	560
	Lady Health Visitors	201
	Auxiliary Nurses/ Dias/ Midwives	3,041
	Health Educators	335
	Others	8,209
	<b>Total</b>	<b>24,877</b>

## 12.3. Vulnerability of the sector

The health sector is highly vulnerable to the impacts of climate change. Changes in local climatic conditions majorly influence health issues in the State. Following are the climatic variability affecting the health sector:

### 12.3.1. Precipitation

The annual rainfall in the State has increased over years and it is mostly above average except in Ladakh (Leh) and Udhampur<sup>38</sup>. This continuous increase in rainfall may cause water borne diseases (diarrhoea, cholera etc.) which might also take form of an epidemic. High rainfall would increase the chances of weather events like flash floods further aggravating the spread of water borne diseases.

### 12.3.2. Temperature

The vulnerability of the State towards vector borne diseases is high due to increase in temperature that multiplies the reproduction rate of the carriers. The temperature in Kashmir has risen by 1.45°C and 2.32°C in Jammu over last two decades<sup>38</sup>. This increases cases of malaria, dengue as the vector population is easily multiplied in the higher temperature. Although Kashmir region is not affected by malaria as anopheles does not survive at high altitude, but the scenario is different in Jammu as incidents of malaria

can significantly increase in this region because of comparatively high temperature, low altitude, etc.

### 12.3.3. Cold wave

In winter season, cold wave poses threat to human lives. The infants are highly vulnerable to the cold wave on direct exposure. In 2012, more than 400 infants died due to cold wave. But the situation has been tamed with immediate steps including augmenting manpower especially para-medicals, nurses and other staffs for neonatology.

### 12.3.4. Anthropogenic activity

In rural areas of the State, wood, charcoal, dung cakes, straw etc. are used as fuels for cooking purpose. These kinds of fuels result in emission of smoke which causes tuberculosis, asthma and other respiratory diseases. Women and children are most vulnerable.

The improper disposal of solid waste generated from households creates problem for the Municipal Corporations and Municipalities. The waste materials have to be segregated into categories before using for waste-to-energy transformation. But as there is no specialised mechanism for waste sequestration, the waste is used for land filling only.

The bio-medical wastes also come along with the other wastes in the land filling site. These

<sup>38</sup><http://indiawaterportal.org>

<sup>39</sup>Source: IMD: India Meteorological Department, ministry of Earth Sciences, Govt. of India



are highly hazardous for human health and may contain several kinds of diseases.

Disposal of wastes, sewerages etc. by the people living in houseboats, hotels and markets surrounding the Dal lake is a common practice. This not only causes degradation of lake ecology, but also spreads water borne diseases.

#### 12.3.5. Pollution

Increasing emission from vehicles, dust particles in urban area also has significant effect on human health. Also aeroallergens and other allergic diseases are increasing due to pollen and mould spores. Elevated level of mould spores present in the atmosphere especially during the summer seasons easily carried by air currents can pose significant threat to the respiratory system and may lead to cardiovascular diseases, asthma, tuberculosis, etc.

## 12.4. Key issues in the sector

### 12.4.1. Inadequate sewerage system

Though the sewerage system of the State is in a good shape, but still there is a wide scope for improvement. Sewerage treatment plants and effluent treatment plants are required to reduce the tendency of water and vector borne diseases. People are found to dispose off the untreated sewerage in the Dal Lake, Jhelum. The same practice is also observed among the people living in houseboats. The inmates of the houseboats are more vulnerable to water borne diseases due to use of contaminated water of the Dal Lake

for cooking and other domestic purposes. The sewerage from hotels and markets also affect the wetlands and during heavy rainfall or flash flood, it becomes a breeding ground for water borne diseases.

### 12.4.2. Absence of high risk zone demarcation

Jammu and Kashmir comes under earthquake vulnerable zone IV and V. The State is also vulnerable to flash floods, landslides and snow blizzard. But, no identification or mapping has been done for high risk areas (especially in disaster recovery planning). The mapping or identification of high risk zones can be very useful to improve preparedness and making contingency plan in order to encounter the health related issues.

### 12.4.3. Malnutrition

Malnutrition among children is a common health issue in Jammu & Kashmir. While Anganwadi centers take care of 83% children below 6 years, only 19% actually receive the benefits from the centers. Among the benefitted children of the Anganwadi centers, 17% receive supplementary food, 10% have access to pre-school and 8% have taken the vaccination service by the Anganwadi centers. Health check-up and growth monitoring has been administered to only 5% children. This is revealed in the 2005-06 report of National Family Health Survey (NFHS-3). Amongst the children from age group of 0-5 years, around 35% have stunted growth, 15% are anorexic and 26% are underweight which clearly indicates inadequacy of nutritious food. The scenario is not only true for children, but also

among the people of age group of 15 to 49 years, where 25% women and 28% men are found wasted; and 17% women and 6% men are overweight and also 52% of women and 20% of men have anaemia.

#### 12.4.4. Ground water level depletion

The ground water quality is depleted with industrial effluents, untreated wastes and sewerage disposed off in uncovered disposal site and run-off from agricultural fields due to hydraulic connectivity in the hydrological

cycle. These waste materials contain organic and chemical contents. Wastes generated by households also contain disease causing microbes. This also degrades the quality of ground water. Unavailability of clean drinking water may lead to problems in digestion, stomach problem and skin diseases in addition to water borne diseases. Installation of Effluent Treatment Plant and Sewerage Treatment Plant at the disposal sites and proper handling of wastes are essential to prevent depletion of ground water.

*Table 61: Impact of climate change on human health*

Climate Change Issues	Impact
Abnormal Rainfall with an Increasing Trend	<ol style="list-style-type: none"> <li>Flash Flood, Landslides, Surface Run-off</li> <li>Increase in occurrence of Diarrhoea</li> </ol>
Increasing Surface Temperature	Increase in Malaria, Dengu, Chikungunya Prevalence, Heat stress
Malnutrition	<ol style="list-style-type: none"> <li>Most of the children of age below 5 year are found to be either stunted or wasted or underweight</li> <li>Anaemia</li> </ol>



## 12.5. Programmes and Policies in the sector

**ICDS Programme:** The ICDS (Integrated Child Development Services) programme was launched to provide nutrition and health services for children of age below six years and pregnant or lactating women. This programme also covers pre-school activities for children of age 3 to 6 years. Community based local Anganwadi centers are responsible for such activities.

**Janani Shishu Suraksha Karyakaram:** This programme has been initiated to provide free services to the pregnant women and sick new born child of age below 30 days. The services provided under this programme include free food, blood for transfusion and transport facilities. This programme is under implementation in all Government hospitals, Associated Hospitals of Medical Colleges and Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Soura, Srinagar. 84,307 pregnant women & 14,796 sick new born have been benefited under this scheme within a short span of April to October 2012<sup>40</sup>.

**Mother and Child Tracking System (MCTS):** This programme has started from 2011-12 to monitor ante-natal/post natal check-ups and complete immunization of children. For tracking the services, a unique ID no. is given to the patients. For successful implementation of the project, Chief Medical

Officer (CMOs), Block Medical officer (BMOs), District Programme Management Unit (DPMUs), Block Programme Management Unit (BPMUs) and field workers have been trained by the expert teams engaged by Ministry of Health & Family Welfare, GoI and NIC (National Informatics Centre). 1,00,734 pregnant women and 65,543 children were registered under the scheme during 1<sup>st</sup> April to 21<sup>st</sup> November 2012<sup>41</sup>.

### **SMS based Process Automation and Performance Monitoring System for ANMs:**

In Jammu and Kashmir, a mobile SMS based process automation and performance monitoring by BSNL has been enforced. The objective of the program is to track the due services for Mother and Child and that provided by ASHAs (Accredited Social Health Activist) and ANMs (Auxiliary Nurse Midwife). The program is launched in only two districts (Jammu and Srinagar) on pilot basis for about 600 ANMs<sup>42</sup>.

**Promotion of Menstrual Hygiene among Adolescent girls (10-19 Yrs):** Under this programme, 100 ANMs/LHVs in 10 districts have been trained as Block Facilitators for Menstrual Hygiene for Adolescent girls<sup>43</sup>.

**Referral Transport Service:** J&K Health Referral Transport Service No-102 has been launched in all the districts of the State with an aim to provide referral transport service to the patients. The programme has shown satisfactory result in providing ambulance

<sup>40</sup>Economic Survey-2012-13

<sup>41</sup>Economic Survey-2012-13

<sup>42</sup>Economic Survey-2012-13

<sup>43</sup>Economic Survey-2012-13



services both in rural and urban areas with quick response time in case of medical emergencies and accidents. People during emergency can avail ambulance services by dialing a toll free no. under this programme. All the districts of J&K are covered under the scheme. The existing fleet of approximately 800 basic life-support ambulances operating at various levels of health care are being networked under this scheme. In addition to this, 50 Basic Life Support Ambulances procured under NRHM, for placing on National Highway after every 30 km, shall also be brought in the network<sup>44</sup>.

#### **Trauma Centres on National Highways:**

Construction of 10 no. of Trauma Centres was started at Leh, Kargil, Gund, Mirgund, Kangan, Qazigund, Anantnag, Ramban, Mahanpur (Kathua), Udhampur and Thathri (Doda) with the assistance of Government of India. Out of these 10 Trauma centers, 7 were completed and work of 3 centers is in progress. The Department of Health, Govt. of Jammu and Kashmir, has started construction of a Trauma Hospital at Khillani (Doda)<sup>45</sup>.

**Family Welfare Programme:** This programme is funded by the Central Government. The main objective of the programme is to reduce the rates of birth and death through various family welfare planning measures<sup>46</sup>.

**Immunization Programme:** The Immunization Programme was launched much before the study in 1978 with a target to reduce child morbidity and mortality by protecting them from seven diseases like Tuberculosis, Polio, Diptheria, Pertussis, Tetanus, Measles & Hepatitis B. Under this programme, children below 2 years are vaccinated against stet diseases. The growth in programme outreach is observed from 1988-89 vaccination coverage rate of 57% to that 67% in 2005-06<sup>47</sup>. During 2011-12, the progress related to DPT/Polio (3 dose), Measles, BCG and TT 2nd Booster were 2.21 lakh, 2.22 lakh, 2.29 lakh and 1.94 lakh respectively. The level of achievement of Immunization remained 80 to 90%<sup>48</sup>.

**Janani Suraksha Yojana (JSY):** In the year 2009, the Janani Suraksha Yojana was re-initiated. The reach of the programme is increased through benefitting 7,771 mothers from 2008-09 to 1,32,645 in 2011-12. A total of 4.40 Lakh beneficiaries have been benefited under JSY by October 2012<sup>49</sup>.

#### **Computerization of Hospital Services:**

Under the ICT project, 16 no. of hospitals were computerized under the pilot project through NIC. The pilot project covered 2 DHs (District Hospitals), 4 CHCs (Community Health Centres) and 10 PHCs (Public Health Centres)<sup>50</sup>.

<sup>44</sup>Economic Survey-2012-13

<sup>45</sup>Economic Survey-2012-13

<sup>46</sup>Economic Survey-2012-13

<sup>47</sup>Source: NFHS -2 conducted in 1988-89 and NFHS -3 conducted in 2005-06

<sup>48</sup>Economic Survey-2012-13

<sup>49</sup>Economic Survey-2012-13

<sup>50</sup>Economic Survey-2012-13



**National Rural Health Mission:** The Ministry of Health and Family Welfare, GoI launched a programme named National Rural Health Mission (NRHM) on December, 2005. The institutional arrangements of the Mission are in place in State Head Quarter and in all districts of Kashmir and Jammu divisions. The main objectives of the programme are to reduce Maternal Mortality Ratio (MMR), Infant Mortality Ratio (IMR) and stabilization of Total Fertility Rate (TFR). The target TFR has already been achieved by the State. According to the result of survey conducted by the Directorate of Economics and Statistics, MMR has reduced and the IMR of Jammu and Kashmir has shown a declining trend. 9,814 ASHAs have been selected till 2012 in the State. 6,886 Village Health Sanitation and Nutrition Committees (VHSNCs) headed by the Sarpanches/Panches have been constituted. During 2010-11, NRHM workshops were conducted at the district level to generate awareness regarding the programme amongst NGOs, members of the civil society and the field health functionaries' viz. ASHAs, ANMs, AWWs (Anganwadi Workers) etc. During the year 2012-13, 307 Block level workshop have been conducted in order to sensitize the PRIs and other ground level functionaries<sup>51</sup>.

**Pradhan Mantri Swasthya Suraksha Yojna:** This programme by the Ministry of Health & Family Welfare, GoI, aims to ensure availability of affordable/ reliable tertiary level health care. To augment facilities for good quality medical education, infrastructural

development has been taken up in Govt. Medical Colleges (GMC) of Jammu and Srinagar. Govt. Medical Colleges of Jammu and Srinagar have been taken up for up-gradation under Pradhan Mantri Swasthya Suraksha Yojna (PMSSY) each at the cost of INR 120.00 Crore, which was subsequently revised to INR 135.00 Crore. In GMC Srinagar, Institute of Traumatology is being established under PMSSY with 9 allied Super Specialties. 15 Super Specialties are being created at Government Medical College, Jammu. CPWD (Central Public Works Department) took up construction of 6-storied 220-bedded Super Speciality Hospital Block at Government Medical College, Jammu and 4-storeyed Institute of Traumatology and allied super specialties at Shreen Bagh, Srinagar<sup>52</sup>.

## 12.6. Key Priorities

### 1. District wise inventory of water borne and vector-borne diseases with respect to weather variability

To strengthen the healthcare facilities of the State to deal with the vector borne and water borne diseases, a separate medical wing can be established at the block level hospitals/ Public Health Engineer (PHEs). Actions such as diagnosis, treatment and supply of medicine along with awareness generation in patients and their family members would be undertaken by this wing. This team would also be responsible for maintaining stock and emergency preparedness.

<sup>51</sup>Economic Survey-2012-13

<sup>52</sup>Economic Survey-2012-13

## 2. Capacity building of all stakeholders on emergency preparedness and rapid action on health context in situations of flash flood and earthquake

The State of Jammu and Kashmir falls in earthquake vulnerable zone IV and V. Flash flood is another natural disaster with a high occurrence probability. Capacity building of all stakeholders is needed to enable them to take rapid actions to tackle health hazards during disasters. The programme of capacity building will be done by the consultants, disaster management organizations in association with government in PPP mode.

## 3. Research and study on impact of climate change on human health

A comprehensive research need to be conducted to understand the impact of the changing climatic variables on human health. The study will be carried out based on the suggestions and feedback of the Sher-E-Kashmir University along with Department of Health and the Department of Environment and Remote Sensing. This study would be very helpful in preparing activities to take appropriate measures according to climate variability in future.

## 4. Construction of new hospitals with modern infrastructure and equipment to cope up with climatic impacts on human population

Climatic variables are expected to cause an increase in occurrence of vector borne, water

borne and zoonotic diseases. Development of infrastructure and healthcare facilities are required to accommodate the victims. In order to improve the infrastructure of health sector of the State, it is very necessary to construct new public hospitals with advanced and modern instruments and diagnosis equipments. The district headquarters should at least have one public hospital, so that all the people from all socio-economic class can have comparatively easy access to such facilities at lower cost.

## 5. Modernization of existing hospitals and PHC

As healthcare facilities at district level are insufficient to provide services to all the needy people in a district, it is crucial to develop the infrastructure of the PHCs. Also the existing hospitals can be modernized by retrofitting or expansion to provide advanced treatment to more people.

## 6. Increase of surveillance:

- **Systematic collection and analysis of data about vector borne, water borne and zoonotic diseases according to type.**

The present database of the State on vector borne, water borne and zoonotic diseases is not developed according to classification and reason of occurrence. There should be systematic procedure of data collection related to diseases. The data should be analyzed with the help of statistical software and compared with climatic data to draw a clear picture of the interdependence of

climate change and diseases. A thorough survey work can be conducted to collect the baseline data.

### 7. Integration of GIS mapping for collection, analysis and sharing of data and identification of spatial areas of high concern

GIS maps can be applied for data collection, analysis and sharing of data with others to prepare the baseline. This system would also enable the responsible department to identify the spatial zones of high concern. A website can be developed for providing the information on cause of disease and prevention and primary treatment procedure.

### 8. Monitoring system:

- To Understand Changes In Pattern Of Diseases
- To Deal with new diseases from emigrants (H1N1, H7N9 etc.)

In order to understand the changing patterns of diseases with the change in climatic variables, a Monitoring Cell can be established at the district level government hospitals. The cell would be responsible for collection and compilation of data and information on diseases along with the climatic variables. Such database would be helpful in correlating the occurrence and intensity of diseases against climatic condition and adaptation measures can be framed accordingly. The cell would also be responsible to maintain database for the new diseases like H1N1, H7N9 etc.







## 12.7 List of Key Priority Action

Table 62: List of key priority action health mission

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
01	District wise inventory on water born and vector borne diseases with respect to weather variability	Department of Health	Nil	220.00	220.00	Gol/External Funding Agencies/CSR Budgets
02	Capacity building of all stakeholders on preparedness and rapid action on health context in situations of flash flood and earthquake	Department of Health	Nil	50.00	50.00	Gol/External Funding Agencies/CSR Budgets
03	Research and study on impact of climate change on human health	Department of Health	Nil	2.00	2.00	Gol/External Funding Agencies/CSR Budgets
04	Construction of new hospitals with modern infrastructure and equipment's to cope up with climatic impacts on human population	Department of Health	Nil	500.00	500.00	Gol/External Funding Agencies/CSR Budgets
05	Modernization of existing hospitals and PHCs	Department of Health	Nil	100.00	100.00	Gol/External Funding Agencies/CSR Budgets
06	Increase of surveillance – <ul style="list-style-type: none"> <li>• Systematic collection and analysis of data about vector borne diseases</li> <li>• Systematic collection and analysis of data about water borne diseases</li> <li>• Systematic collection and analysis of data about zoonotic diseases</li> </ul>	Department of Health	Nil	25.00	25.00	Gol/External Funding Agencies/CSR Budgets

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
07	Integration of GIS mapping for collection, analyse and share data and identification of spatial areas of high concern	Department of Health	Nil	50.00	50.00	Gol/External Funding Agencies/CSR Budgets
08	Monitoring system - <ul style="list-style-type: none"> <li>To understand changes in pattern of diseases</li> <li>To deal with new diseases from emigrants (H1N1, H7N9 etc.)</li> </ul>	Department of Health	Nil	100.00	100.00	Gol/External Funding Agencies/CSR Budgets
<b>Total (INR in Million)</b>			<b>Nil</b>	<b>1,047.00</b>	<b>1,047.00</b>	



## 13. Sustainable Himalayan Mission

### 13.1 Introduction

Repeated extortion and exploitation of ecology has hit back in the form of disasters in India repeatedly, the recent manifestation being the Uttarakhand tragedy. The environmentalists have mulled ruthless human activities responsible for these kinds of natural repercussions taking a toll on human lives, ecosystem, biodiversity and infrastructure of a region. Jammu and Kashmir, being a rugged unstable hilly terrain is also vulnerable to such repercussions. In wake of the Uttarakhand incident, the National Mission for sustaining the Himalayan eco system has recommended creation of ecological zones in the ecologically sensitive areas.

In Jammu and Kashmir, it is observed that the reasons responsible for such disasters are pretty rampant. Influx of tourists and invasive migratory species are challenges for the state. In a state like J&K, the major causes for increased vulnerabilities are: unplanned construction, vulnerable socio

economic profile, over and unplanned exploitation of natural resource (e.g. Dal Lake or deforestation), unplanned urban growth, conflicts, insufficient institutional capacities and higher climate variability and change. Sustainable development practice that aims at a balanced growth can arrest this regressive trend. The State Action plan for sustaining the Himalayan ecosystem aims to strike a balance between addressing the issues detrimental to the ecosystem while enhancing the activities for economic prosperity like tourism, infrastructure building, etc.

It develops management measures for sustaining and safeguarding the Himalayan glacier and mountain eco-system. Himalayas, being the source of key perennial rivers, the Mission would, inter-alia, seek to understand, whether and to which extent, the Himalayan glaciers are in recession and how the problem could be addressed. This would involve a joint effort from climatologists, glaciologists and other experts.

## 13.2. Key trends in the sector

### Glaciology and Glaciers in Jammu and Kashmir

Glacial covers are important indicators of climate change. The glaciers in the Himalayan region have lost ice mass due to melting which has increased the volume of river flow. There are 32,392 glaciers in the Indus, Ganga and Brahmaputra basins according to an inventory developed under a study to estimate glacial advance and retreat with help of satellite data on around 1000 Indian Himalayan glaciers [Snow and glaciers of the Himalayas – A study by Indian Space Research Organisation, June 2011]. India alone has 16,627 glaciers covering an area of 40,563 sq. km. Himalayan glaciers in the Indian subcontinent mainly drains into three river basins, namely, Indus, Ganga and Brahmaputra. These glaciers are important sources of freshwater for northern Indian rivers and water reservoirs.

The flow of the rivers in the Himalayan region largely depends on the glaciers. The glaciers which are pulled towards the earth surface due to the huge mass moves down the mountain slope accumulating debris and rocks on its way. While moving towards south, the gradual rise in temperature causes it to break into pieces. These pieces melt and flow into the river system. The mass of the glaciers vary in a periodical cycle in accordance to the river cycles. The rate of glacial melting is less in monsoon when the rivers carry enough water and rises before and after the monsoon to feed the rivers. Therefore depleting glacial cover would result in scarcity of water through drop in water levels in the major rivers. Millions of people and the biological diversity rely on glacier-fed, Himalayan water sources for their survival.

According to National Aeronautics and Space Administration (NASA) and the Chinese Academy of Science, deposition of soot, black carbon and other pollutants is the reason behind the fast melting of glaciers.

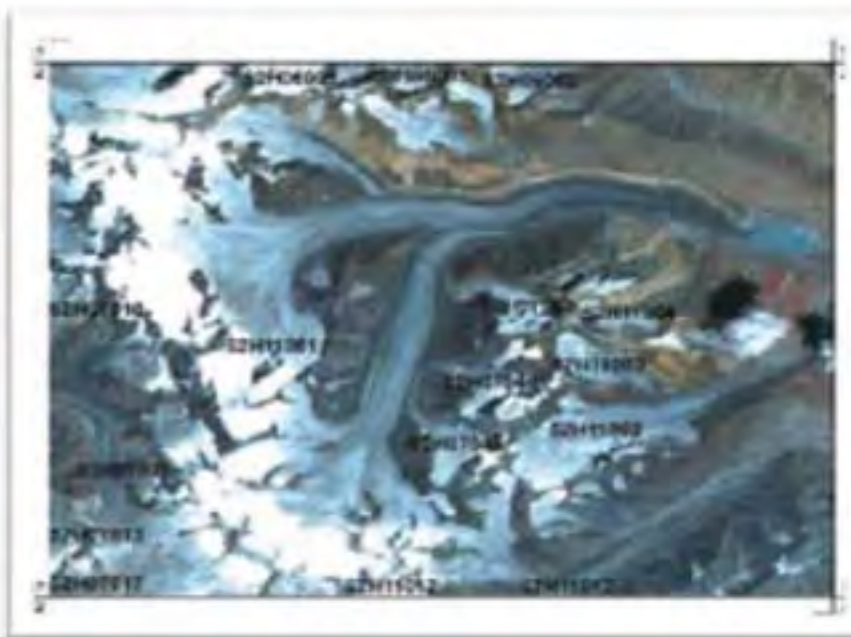


Figure 28: Samudra Tapu Glacier, Chandra Sub Basin, Western Himalayas [ISRO 2011]



Glaciers usually exhibit properties of mirror and hence reflect back most of the heat incident on them. The layer of carbon alters the property and increases the rate of absorption over the rate of reflection. The absorbed heat leads to rapid melting.

Scherler and Book hagen in Nature Geoscience and Public Affairs & Communication, Newsletter, January 2011 [Santa Barbara, California] identified debris coverage with the aid of new remote-sensing methods and satellite images as a prime factor for glacial advancement and retreat.

**This is due to the fact that a debris layer of above 2 cm thickness shields the glacier from heat and prevents melting.** This is the reason why scientists have noted that the glaciers in the Karakoram region of North western Himalaya are stagnant whereas all glaciers in the tropics are retreating. According to them glaciers in the Western, Central, and Eastern Himalaya are retreating, at the highest rate at a maximum of 8 m/yr in the Western Himalayan Mountains. The properties of these glaciers are in contrast to the ones in the gently sloped, low-relief Tibetan Plateau without any debris coverage. Their frontal changes can be explained with temperature and precipitation changes. Till date a total of 15 glaciers in Indian

Himalaya have ground based mass balance measurements. Glaciers such as Patsio (Ref. Snow and Avalanche Study Establishment), Phuche (Ref. National Institute of Hydrology, Jammu), Kolahoi (Ref. TERI - The Energy and Resources Institute) and Nardu Glacier (Ref. by Sharda University) are being investigated using ground based glaciological mass balance observations. Hydrological mass balance has been conducted on Siachen Glacier from 1986-87 to 1990-91 (Bhanu, Wadia Institute of Himalayan Geology, personal communication, June 2013).

### Projection for Himalayan glaciers

Major glacier-fed Himalayan Rivers, along with glaciated catchments have regional importance. The water produced from melting of glacier sustains stream flow in these rivers through out the dry season. The Indus basin has 7,997 glaciers with a total glacier cover of 33,679 sq. km and total ice volume of 363.10 cu. km. The Ganga basin has 968 glaciers with a total glacier cover of 2,857 sq. km. and total ice volume of 209.37 cu. km. The contribution of snow to the flow of major rivers is more than 60% in the western Himalayas. The largest individual glacier is the Siachen glacier with a total area of 926 sq. km.

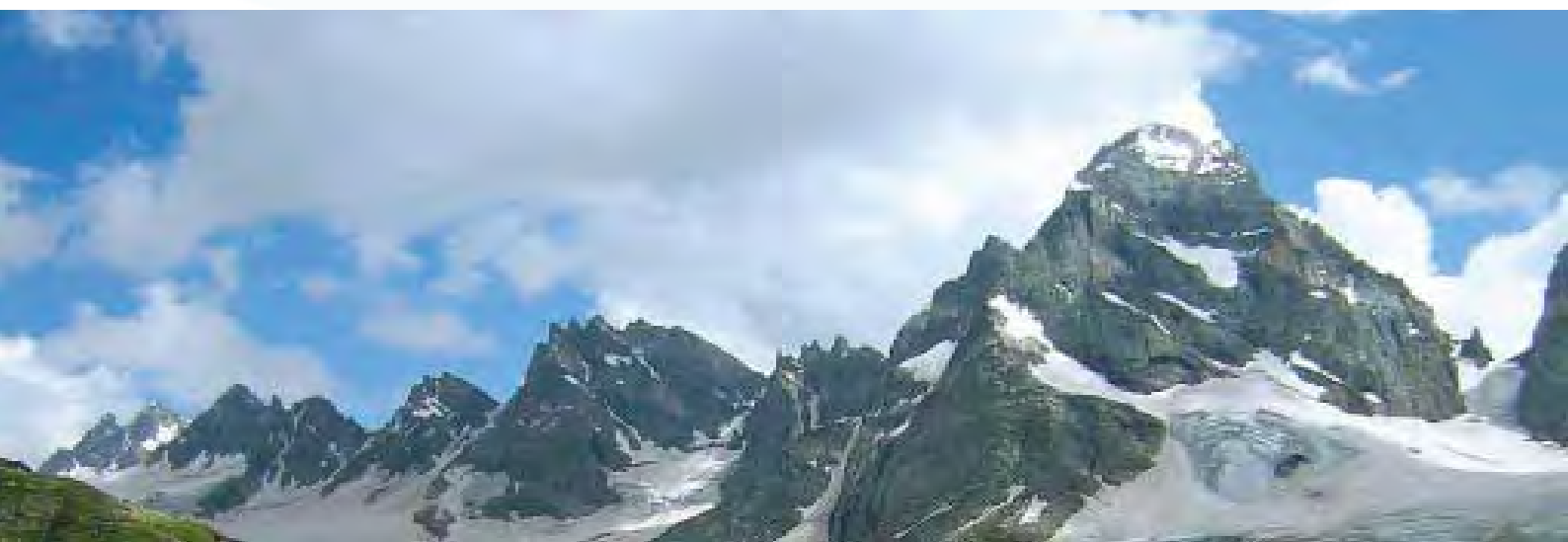


Table 63: Major glaciers in the Indus basin

Basin	No. of glaciers	Glacier Area (sq. km.)	Estimated ice Reserves (cu. km.)
Ravi	217	113.60	5.50
Chenab	2039	2341.20	210.70
Jhelum	733	222.80	9.00
Beas	384	416.60	31.80
Satluj	2108	1315.00	82.90
Upper Indus	2814	1230.00	66.10
Shyok	3357	5937.70	981.70
Nubra	204	1,536.00	NA
Gilgit	535	8,240.00	NA
Kishenganga	222	163.00	NA

Source: ICIMOD 2012

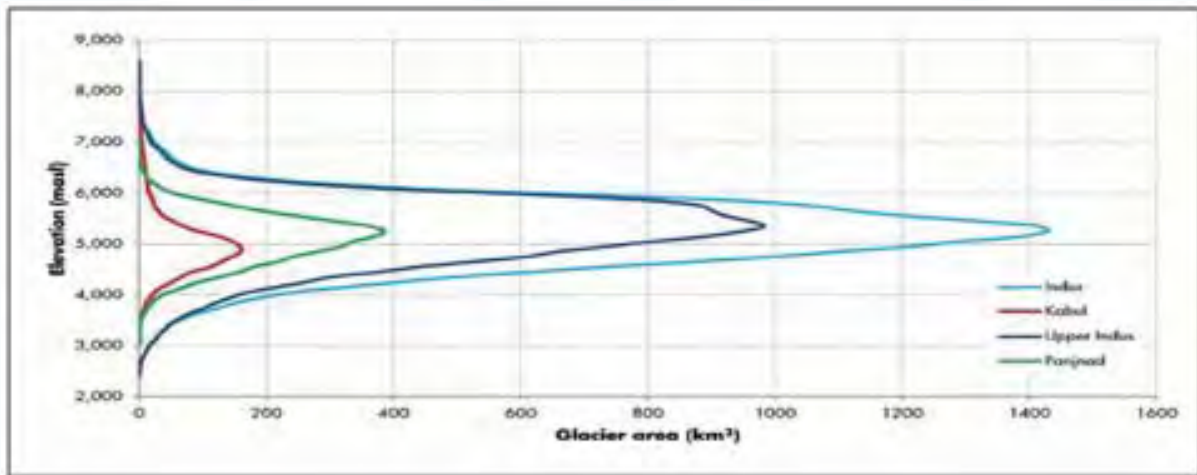


Figure 29: Glacial area under different mountain range



The rate of melting of glaciers is reportedly varies due to winter precipitation, climate warming and anthropogenic elements of landscape. Recent trend related to glaciers are given in following table:

*Table 64: Recent retreat pattern of selected glaciers in Jammu and Kashmir*

Name of the Glacier	Retreat of snout (m)	Observation Period	Trend	Avg. retreat rate (m/yr.)
Drang-Drung	-	2004-07	No Change	-
Kangriz	-	1913-2007	No Change	-
Siachin	NA	1862-1909	Advancing	15.42
	-do-	1909-1929	Retreating	2.50
	-do-	1929-1958	Retreating No Change	14.00
	- NA	1958-1985		-
	-	1985-2004	Retreating No change	3.00
		2004-2005		-





The disastrous cloudburst in Leh, Ladakh in Jammu and Kashmir in August 2010, which led to flash floods and mudslides testified the impacts of climate change. Defense Institute for High Altitude Research (DIHAR) attributed the catastrophe to prolonged winters in the Leh Ladakh region. The study has been quoted in a latest report “Water Sector Options for India in a Changing Climate” brought out by South Asia Network

on Dams, Rivers and People (SANDRP). The analysis by DIHAR dug into the reasons that triggered the cloudburst in a rain shadow area like Ladakh. According to the report, the DIHAR study pointed out that the Leh Ladakh region was witnessing unusual phenomenon like bright sunshine in June and July months, causing melting of snow and high relative humidity (72 %) as compared to earlier years (50 %).



Figure 30: Glacial retreat



## Wetland Ecosystems

Ecosystems play an important role in determining the socio-cultural condition of the State. The economic conditions of the communities are largely dependent on the ecosystem as they are the means of livelihood to boatmen, agriculture dependent communities, tourism industry etc. The hydrological systems in the State are however confined to only around 0.8 % of the total land mass, yet they have a tremendous impact on the lives of the people as the State depends on hydel power generation to a great extent. The main hydrological systems in Jammu and Kashmir are:

- a) **Low altitude lakes** which are fresh water bodies and high in productivity. These are mainly found in the Jammu region.
- b) **Valley Lakes** which are also fresh water lakes of different size in the valley
- c) **Forest Lakes** which are found along the hills. These lakes are small as compared to the valley lakes.

- d) **Glacial Lakes** which are high altitude lakes and are found in and above the alpine areas. Some of the lakes in Ladakh are brackish in nature.

The land cover and land use dynamics in the catchment of the wetland have huge impact on the functionality and health of the wetland. As per the temporal and special analysis of land use and land cover in the catchment by the different researchers, it is seen that there have been significant changes due to climate change from 1972 to 2005 (Romshoo S A & Irfan Rashid, 2012)<sup>53</sup>. In this duration there has been a noticeable increase in the horticulture plantation, settlements. On the other hand, area under agriculture, fallow, forest, pasture has decreased along with water resource. The decrease in area under agriculture and fallow is responsible for increase in spatial extent of horticulture and plantation. Similarly, forest and pasture areas have been transformed into scrub because of deforestation over the past 33 years.

Table 65: Wetland Reserves in the State

	Kashmir Region	Ladakh Region
Wetlands Reserves	1) Hokera, 2) Narkara, 3) Malgam, 4) Chatlam, Pampore, 5)Manibugh 6) Mirgund, 7) Shallabugh, 8) Ajaz Jheel, 9) Hygam	1)Tsomoriri Wetland, 2) Pangong Tso Wetland 3) Chushul Marshes 4) Tsokar Basin, 5) Hanley Marshes

<sup>53</sup>Shakil Ahmad Romshoo&Irfan Rashid, 2012: Assessing the impacts of changing land cover and climate on Hokersar wetland in Indian Himalayas, Saudi Society for Geosciences, Springer.

**Forest Ecology:** The Himalayan region encompassing the States of Jammu and Kashmir, Uttarakhand and Himachal Pradesh shows that out of the 98 IBIS grids covering this region, 56% of the grids are projected to undergo change by 2030s. The net primary productivity (NPP) is projected to increase in the region by an average of about 57% by 2030s.

### 13.3. Vulnerability of the sector

Climate change may adversely impact the Himalayan ecosystem through increased temperature, altered precipitation patterns and episodes of drought. Concerns have also been rising over the Himalayan glaciers along with other entities in the global cryosphere. The Himalayan glaciers may lose significant ice-mass thereby endangering the river flow especially in the lean season when the North Indian Rivers depend on melting snow and ice. Studies by several scientific institutions in India have been inconclusive about the extent of change in glacier mass and whether climate change is a significant causative factor. As per IPCC 2007, glacial meltdown is projected to increase flooding, snow avalanche fall from established slopes and diminish water supplies to rivers as glaciers recede. The impact of change in climate shall be severe on natural resources and the parameters associated with urbanization, industrialization and economic development.

According to IMD, there is increase in the average temperature in Jammu & Kashmir. Kashmir valley has shown rise of 1.45°C

whereas Jammu region has shown a rise of 2.32°C over last two decades. Maximum temperature has increased by 0.5°C per year in Kashmir valley. In Jammu region, maximum temperature has risen by 0.08°C per year. Also amount of snow fall has reduced over the years. As per UNEP and ICIMOD, the temperature in Himalayan region has risen by 1°C since 1970s. This has caused meltdown of snow and glaciers at rate of 15 m/yr. even in winter. The bio-diversity which resides in the higher altitudes will have lesser and lesser place to occupy and will be at increased risk of extinction. There will be a gradual shift of plant species towards higher altitudes. This will force local communities to shift to newer agricultural and fodder species. This coupled with the fact that the area lies in a highly sensitive seismic zone, creates a heavy stress on housing sector.

The increase in temperatures may lead to increase in morbidity due to heat stress. Flash floods due to Glacial Lake Outburst Floods (GLOF) may lead to large scale landslides and subsequent loss of life and property. Changes in the rainfall pattern and relative humidity add to weather inconsistencies which also impacts plantation and harvesting.

Most of the glacial lakes in the Himalayan region are known to have formed in the last 5 decades, and a number of Glacial Lake Outburst Flood (GLOF) events have been reported in this region. At least one GLOF event was recorded about 3-10 years in the Himalayan region. These GLOF events have resulted in loss of many lives, as well as the destruction of houses, bridges, fields, forests and roads. The hazardous lakes, however,

are situated in remote areas. If the potential GLOF is known in advance, the GLOF hazard could be reduced.

### 13.4. Key issue in the sector

The Himalayan ecosystem supports the ecological security of the Indian landmass, through supporting forest cover, feeding perennial rivers which are sources of drinking water, irrigation, and hydropower, conserving biodiversity, providing a rich base for high value agriculture, and spectacular landscapes for sustainable tourism. The ecosystem is however impacted from human intervention explained as follows:

**1. Encroachments:** This has been the main threat to wetland ecosystems of the Kashmir valley with the two major lakes i.e. the Wular Lake and the Dal Lake shrinking to approximately half their size in the last 50 years or so. Encroachments along the Wular Lake are mainly due to expansion of arable fields for paddy whereas those in the Dal Lake are for housing and vegetable gardens. The Dal Lake traditionally held floating gardens (made from dug up weeds of the lake) along the north-western edge of the lake. These have increased in size and the older ones have been reformed into permanent settlements. Consequences of lake encroachment are also apparent in Aanchar Lake in the north-western part of Srinagar city. A major part of this lake has been turned into a residential colony and the remaining portion remains a swamp. Few years back, the

Aanchar Lake was a major source of reeds and lotus stems (*Nelumbo* sp.) used for making mats and consumed as food in Kashmir during winters.

**2. Pollution:** Three main sources of pollution to the water bodies of the State are identified. These are:

**a. Solid waste:** non-degradable materials like polythene and plastics which are dumped into the lakes and rivers by the local people.

**b. Organic pollutants:** Most of the human habitations are settled around the water bodies, i.e. the rivers and the lakes. The human habitations are the major sources for organic wastes and night soil collected from the city and villages. Hotels and resorts mushrooming around the famous Dal Lake also discharge the night soil into the water in absence of a proper drainage (sewage) system. The houseboats also create organic pollution by direct discharge of organic wastes into the lake.

**c. Inorganic pollutants:** The chemical fertilisers and pesticides produced from the agricultural farms around the Dal and Wular Lake runs off into water bodies. This has accumulated inorganic pollutants and heavy metals injurious to the aquatic ecosystem. Though the bio magnification has not been

studied yet, it is a major concern for the life forms depending on the water bodies. These have led to Eutrophication, especially in the enclosed lakes and water bodies. .

3. **Siltation:** Reducing catchment areas of lakes and water-bodies have led to deposition of large sediment loads into the river and lake systems causing an increase in the suspended particulate matter. The water bodies lose transparency which may cause changes in the biota. Heavy particulate matter also causes siltation and subsequent choking of lakes and rivers. The Jhelum River is a case in point where the depth of the river has reduced to barely few inches at certain points.
4. **Increased Resource Extraction:** The water bodies have been sources for vegetables that grow in the lakes, large stocks of lotus stem and water chestnut. The lakes also provide reeds for making mats. In addition to this, fish abound the water systems of the State which are the sources for cheap protein. However, over exploitation of the resources have led to major declines in fish yields.
5. **Inadequate and inappropriate plantations:** Plantation activities taken up along the wetland and lake edges are not appropriate.

Some floral and faunal species are threatened by the weather variability. Following are some of the rare, spectacular and threatened fauna of the state:

#### **a) Rare Mammals:**

The rare mammals of the region include the Kashmir stag or Hangul (*Cervus elephus hanglu*), the Musk Deer (*Moschus moschiferus*), the Tibetan Antelope or Chiru (*Panthelops hodgsoni*), the Tibetan Gazelle (*Procapra picticaudata*), the Serow (*Capricorms sumatraensis*), the Markhor (*Capra falconeri*), the Amon the Wild Yak (*Bos grunniens*), the Tibetan Wild Ass, the Snow Leopard (*Panthera uncia*) and the Brown Bear (*Ursus arctos*), Ibex (*Capra siberica*) to name a few.

Dachigam has witnessed a drastic decline in the population of Hangul in the last three decades. It is reported by Malik and Saxena (2012) that in 1940 the population of Hangul was around 3002, while in 1947 it was estimated at 2000 and ten years later at 4001. It drastically declined in 1971 when its size was estimated at 320 by WWF and 550 according to J&K Wildlife Department. In March 1980 the count was 347 while in March 1983 the Hangul population in Dachigam was estimated to be at 550. According to Wildlife Protection Department the number was estimated to be 605 in 1986 and 818 in 1988. But with increasing insurgency in Kashmir valley, Hangul population suffered a great setback. Its population further slashed to 140-170. In 1995 the population was estimated to be at 290. As per census of 1999 the population of Hangul was estimated at 270-325 in the wintering ground of Dachigam whereas total population of Hangul in and around Dachigam National Park was estimated at 435-520. The census conducted in March 2000 in Dachigam National Park estimated



the population as 350-470 animals. The censuses of 2003, 2008 and 2009 have put the population at 150-170, 117-119 and 201-234 respectively. Recent Hangul population estimation in March 2011 roughly put the number as  $218 \pm 13.96$  (Source: Malik and Saxena in *International Journal of Research in Pharmaceutical and Biomedical Sciences*, 3 (2) Apr – Jun 2012 [www.ijrpbsonline.com](http://www.ijrpbsonline.com) pp. 662)

#### **b) Rare Birds:**

Some of the rare and threatened birds species found in the area include exotic ones like the Himalayan Golden Eagle (*Acquila chrysatos*), the Bearded Vulture (*Gypaetus barbatus*), the Monal Pheasant (*Lophophorus impejanus*), the Koklas (*Pucrasia macrolopha*), the Western Tragopan (*Trogon malanocephalus*), the Black necked Crane (*Grus nigricollis*), the Himalayan Snow Cock (*Tetrogallus himalayensis*.) and the Bar-Headed Goose (*Anser indicus*).

#### **c) Migratory Water birds:**

Migratory Water birds include Duck, Geese and Swans. The most common migratory bird during winter are Mallard (*Anas platyrhynchos*), Common Teal (*Anas crecca*), Pintail (*Anas acuta*), Red Crested Pochard (*Netta rufina*), Greylag Goose (*Anser*), Wigeon (*Anas penelope*), Shoveller (*A. clypeata*), Garganey (*A. guerguedula*), Coot (*Fulica atra*) and Gadwall (*Anas catripera*).

The state has pondered on the role of natural ecosystems in increasing resilience and reducing vulnerability to climate change

which should be considered to address the key issues of wildlife and bio diversity, such as species loss, conservation and impact of climate change on bio diversity.

## 13.5. Programme and Policies in the sector

The National Environment Policy, 2006, inter alia provides for the following relevant measures for conservation of mountain ecosystems:

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

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

Jammu and Kashmir has a huge potential for eco-tourism. It is not only important from tourism point of view but also it creates employment opportunities for local people in the preservation of ecology, environment and natural forests. Taking into consideration the importance of this sector for environmental and economic point of view, the forest department has already prepared a pilot project proposal for eco-tourism development at surrounding area of Dera-Ki- Gali in Districts of Rajouri and Poonch at an estimated cost of 9.23 crore.

Hirpora Wildlife Sanctuary has also submitted an Eco-tourism plan to the State Government at an estimated cost of 69.00 lakh and has been approved the Steering Committee meeting of CAMPA on 12.12.2011 for funding during 2012-13. An additional proposal for constitution of Eco-Tourism Board has also been submitted to the Government for consideration.

## 13.6. Key Priorities

### 1. Baseline study of climate change impact on flora, fauna species and on glacial ecology

Climate change is causing significant loss in glacial mass in the high mountains of the State. Due to some reasons many glacial changes data are not available to

the researchers. Impacts of glacial retreat influences the flow of glacier fed rivers, glacier lake outburst floods (GLOFs) and changing flood severity and frequency. Thus continued and enhanced monitoring of the Himalayan ecosystem is essential to estimate the state of the glaciers and how change in glacial mass can impact river flow. Research study on climate change impact on Glacier ecology and its impact on Flora and Fauna is therefore proposed. Since several other countries in the South Asian region share the Himalayan ecosystem, appropriate forms of scientific collaboration and exchange of information may be proposed to enhance understanding of ecosystem changes and their effects.

### 2. Study on vulnerability of mountain ecology

Himalayan Mountain ecosystem is among the India's most vulnerable bio-geographical domain. Mountain ecosystems in the State are very distinct from lowlands. It is fragile and highly prone to soil erosion, landslides, flood, earthquakes. Due to increase in human density and climatic variability, the indigenous culture, traditional knowledge, and livelihoods are at stake in the mountains. Climate change and variability in water flow resulting in either excess or scarcity of water increases the vulnerability of mountain livelihoods. So vulnerability analysis relating to the impact of climate change on the mountain ecology and its impact on life and livelihood of the people is one of the major tasks proposed.

### 3. Community participation for protection and conservation of mountain ecology, terrestrial ecology and aqua-ecology

Floods, landslides, seasonal drought, heavy rain and hailstorm are reported as major outcomes of climate change vulnerability. Climate change would impact the systems of the communities through loss of livelihood & social capital, changing agro-livestock conditions and the emergence of invasive species. Climate change is also likely to affect perennial aquaculture, fisheries through increasing temperatures, changes to water current and nutrient, changed rainfall pattern leading to threat to local fisheries and aquaculture. Aquaculture is likely to be impacted by climate change through higher temperature, water availability and river bed township impacts. It is therefore imperative and proposed to start a community led movement for the management and conservation of the fragile habitats of the endangered animal species, aquaculture, fisheries and promote sustainable community livelihood. Community orientation should also be planned to address the issue of the human-wildlife conflict through mapping of the conflict sensitive areas and developing site-specific landscape management plans and human-wildlife conflict mitigation strategies. Community will also be trained over maintaining the state forest cover, Ramsar and other wetlands. Developing of biodiversity register is also proposed under the action.

### 4. Capacity building and awareness for all levels of stakeholders

Two important types of climate impact on Ecology have been observed across the world:

- o Phonological change
- o Location to survive and capability of reproduction

These types of impacts have been observed on many species and regions over long periods of time in the State. Taking into consideration the urgency of the biodiversity conservation it is essential to involve communities and stakeholders at all level and build capacity for biodiversity conservation. Community based management of the biodiversity should also be promoted with incentives to community organizations and panchayats for protection and enhancement of forested lands. In mountainous regions, the aim should be to maintain two-thirds of the area under forest covers in order to prevent erosion and land degradation and ensure the stability of the fragile eco-system.

This activity can also be tagged with individual schemes and activity involved in various aspects of capacity building and empowerment for the goal of enhancing conservation in Himalayan ecosystems. The programmes should be planned in such a fashion so as to result in capacity building and empowerment, implementation approaches and methods, case studies, and evaluation.

## 5. Institutional development on biodiversity conservation and protection

Changes in climatic conditions are placing increasing pressure on ecosystems. The threats to Mountain Ecosystems require urgent action to protect mountain biodiversity and to provide environmental services to the state. It is therefore imperative to implement a programme to continue development of overarching legal and institutional framework at State level, and run a pilot scheme to introduce regulations and innovative management and financing approaches in selected protected areas. The pilot scheme would lead the policy advice and the on-going development of existing policies at State level. Mandates should be planned to ensure that stakeholders at all levels gets' involved in the management of protected areas and maintenance of biodiversity be considered which utmost priority.

## 6. Identification of climate grids and effects on forest and ecological resources

The smart grid emerges as a critical tool to address global climate change. Environmental impacts of climate change on water resources and biological components of the landscape is an integral part of hydrological and ecological research, and the results would be used for the natural resource management. Utilities across the State are deploying grid technologies for proper identification of climate change impact on Forest and Ecological resources of Jammu and Kashmir. It is therefore planned

to introduce systems in place to identify and demarcate grids.

## 7. Study on terrestrial and aquatic ecosystem

The bio-geophysical and bio-geochemical processes draw a strong inter dependency of biosphere, aquatic ecosystems and climate. Surface climate of Jammu and Kashmir interacts with vegetation cover, biomes and productivity, respiration of vegetation and soil (all components of the carbon cycle). Various processes in terrestrial ecosystems influence the flux of carbon between land and the atmosphere. On the other hand the aqua biota is also influenced due to bio-optical heating and changes in temperature. It is therefore proposed to conduct a research study on terrestrial and aqua ecosystem. The research scope should also address the major knowledge gaps in the impact of climate change on fisheries and aquaculture. This may include analysis of the impact of changing climate, rising temperature, river/lake water quality, distribution and abundance of riverine species, vulnerability and resilience of the riverine systems.

An observational and monitoring network for the Himalayan environment is also recommended to assess freshwater resources and health of the ecosystem. Cooperation among the neighbouring states and countries would lead to comprehensive network coverage.

## 8. Study on anthropogenic intervention on ecological hotspot



Ecological hotspots are areas which support natural ecosystems that are intact and where native species and communities associated with these ecosystems are well represented. They also have a high diversity of locally endemic species which otherwise are not found outside the hotspot. Due to high population pressure and climatic variability some of the species are endangered and extinct. A study is highly recommended to demarcate the ecological hotspot, undertake inventorisation and strategize measures towards protection.

#### 9. Study of climate impact on migratory birds and their timings

Migratory bird species face the challenge of climate change which impacts the multiple habitats they require to breed, migrate and overwinter. Shifting bird ranges, changing population, time of migration and breeding affect the availability of food needed to raise their offspring, which might lead to extinction some bird species. Climate stressors may impact the variety of common

species found in Jammu and Kashmir. It is therefore recommended to introduce study aimed at reducing the climate impact on migratory birds and develop climate resilient conservation strategy and its implementation plan.

#### 10. Identification of current status of Himalayan ecology and Climatic trend analysis for Himalayan ecology

The ecology of the Himalayas varies with climate, rainfall, altitude and soils, like from tropical at the base of the mountains to permanent ice and snow at the highest elevations. The amount of yearly rainfall varies all across the state. This diversity of climate, altitude, rainfall and soil conditions supports a variety of distinct plant and animal communities and life and livelihood of the people. It is therefore planned to form a specialised body and undertake continuous study to investigate the impacts of climate change on genetic resources, current ecological status, diversity and altitude wise distribution of species in Jammu and Kashmir.









## 13.7 List of Key Priority Action

Table 66: List of Key priority action Sustainable Himalayan Mission

Sl. No.	Title	Organizations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Baseline study of climate change impact on flora, fauna species and on glacial ecology	Department of Env. and forest	Nil	10.00	10.00	GoI, GoJ&K, EFA
2	Study on vulnerability of mountain ecology	Department of Env. and forest	Nil	100.00	100.00	GoI, GoJ&K, EFA
3	Community participation for protection and conservation of mountain ecology, terrestrial ecology and aqua-ecology	Department of Env. and forest	Nil	80.00	80.00	GoI, GoJ&K, EFA
4	Capacity building and awareness for all levels of stakeholders	Department of Env. and forest	Nil	100.00	100.00	GoI, GoJ&K, EFA
5	Institutional development on biodiversity conservation and protection	Department of Env. and forest	Nil	80.00	80.00	GoI, GoJ&K, EFA
6	Identification of climate grids and effect on forest and ecological resources	Department of Env. and forest	Nil	60.00	60.00	GoI, GoJ&K, EFA
7	Study on terrestrial and aquatic ecosystem	Department of Env. and forest	Nil	20.00	20.00	GoI, GoJ&K, EFA
8	Study on anthropogenic intervention on ecological hotspot	Department of Env. and forest	Nil	20.00	20.00	GoI, GoJ&K, EFA
9	Study of climate impact on migrated birds and their timings	Department of Env. and forest	Nil	10.00	10.00	GoI, GoJ&K, EFA
10	Identification of current status of Himalayan ecology and Climatic trend analysis for Himalayan ecology	Department of Env. and forest	Nil	20.00	20.00	GoI, GoJ&K, EFA
<b>Total (INR in Million )</b>			Nil	<b>500.00</b>	<b>500.00</b>	







## 14. Strategic Knowledge Mission

### 14.1 Introduction

The visible signs of bio-diversity and ecological fragility in Jammu and Kashmir have come as a wakeup call for a strategic shift. The State should look at climate change issues with a fresh approach. The impact of climate change on the region has manifested itself through various recent environmental events like depletion of snow cover in high altitude areas like Gulmarg during prime winter, shift in rainfall pattern, flash floods and cloud bursts in Ladakh region and change in all climatic parameters in the sub-tropical and temperate regions of the State. The consequences of the changes are not only restricted to the local population but also affect the overall economy of the State. The effects are visible on sectors like health, forests, agriculture and horticulture and all other major sectors which contribute to the States economy. The current scenario is projected to have future impacts like glacial melting in the Himalayas, which would prove detrimental to the State's interest. The glacial

melt would result in increased flooding, rock avalanches from destabilized slopes, affect water resources and also decrease river flow. This would again impact factors like freshwater availability, power supply which largely depend on hydro power. Other than the immediate effects, this would also result in long term effects as climate change is likely to impinge on sustainable development compounding the pressure on natural resources and the environment parameters associated with urbanization, industrialization and economic development.

While there has been significant improvement in scientific understanding of climate change in the past few decades, there remains considerable uncertainty about the nature, timing, spatial distribution and severity of the particular impacts. In this context, the State mission on Strategic Knowledge on Climate Change intends to create a knowledge system that would help implement adaptive actions to reduce vulnerabilities as well as take advantage of the mitigation opportunities. The State Action

Plan for Strategic Knowledge seeks to build a vibrant and dynamic knowledge system that would inform and support national as well as regional actions for responding effectively to the objective of ecologically sustainable development. A strong and strategic knowledge system is essential for identifying, formulating, planning and implementing policy driven actions while maintaining the necessary economic growth rate. (Such a strategic knowledge system for informing and supporting climate sensitive actions will need to address a number of objectives. The mission addresses climate science with region specific modeling; assessment of various technology scenarios and alternatives for complying with national objectives; leveraging international cooperation and strengthening initiatives for selection and development of new technologies for adaptation and mitigation; and ensuring that knowledge gaps are bridged.)

***The principal objectives of the mission can be listed as below:***

- To monitor climate variability and make climate change projections for the State through global and regional climate modeling. Climate modeling at regional level will help to improve the quality and specificity of climate change projections including changes in hydrological cycle.
- To build GHG inventory and identify the dominant GHG/CO<sub>2</sub> emitting sectors, industries, districts, municipalities in order to enable selection of mitigation opportunities.

- To model and plan for the climate sensitive sectors and regions, assess the impacts of climate change, analyze the vulnerability of regions/districts, sectors and population groups and evaluate the traditional adaptation practices to climate variability and extremes.
- To integrate the processes of assessment of vulnerability, knowledge and data on natural resources, institutions and capacities with the bottom-up approach for planning of adaptation and mitigation projects for the benefit of climate sensitive sectors, regions and population groups.
- To enable government including its policymaking bodies in the policy-formulation function.
- To inform and assist the development agencies to evolve suitable management for adaptation and mitigation measures.
- To empower and upgrade the capabilities of people and administrative officers to take appropriate steps at their own level for the reduction of risk.
- To strengthen regional cooperation through the establishment of mechanisms for exchanging information with regions sharing the borders and ecology of the State.

The existing knowledge bases of the Government departments and their responsiveness towards the recent weather events have been integrated to develop a holistic response towards the climate change

issues apparent in the State. The main signs of climate change in the State are manifested through increase in erratic temperature fluctuations, an average rise in temperature, receding glaciers, change in rain and snowfall pattern which are likely to affect water resources, farming, power generation, forests, human health, tourism and several other natural ecological systems.

SAPCC J&K identifies ten missions specific to the State and corresponds to the responsibilities of containing the issues through ten working groups identified and sanctioned by the Government. The identified sectors are:

- Energy - Solar Mission and Renewable Energy
- Enhanced Energy Efficiency
- Water
- Sustainable Habitat,
- Sustainable Agriculture
- Tourism
- Green India Mission

- Sustainable Himalayan Ecosystem,
- Health
- Disaster Management
- Strategic Knowledge mission

## 14.2. Key Issues

Measures to generate strategic knowledge should carefully include the perspectives, knowledge and understanding of the population, policy makers, decision makers and the stakeholders. The knowledge strategy developed should be comprehensible and executable by the stakeholders at large. This should minutely address the issues and at the same time support the need for economic and livelihood enhancement of the State.

### ***The identified State specific constraints are:***

- Insufficient observational and scientific information database at sub divisional levels essential for validating the modeling outputs is a handicap.

Information	Components
Meteorology	Precipitation (Daily), maximum and minimum temperature (Daily), solar radiation, Wind speed, Relative humidity, Glacial melting, Evapotranspiration data, etc
Land surface	Hydro-geological maps inclusive of: contour, drainage, Digital Elevation Models (DEM), soil type, depth, texture and physical characteristics (composition of silt, sand, clay, rocks), drainage network, watershed boundary, Hydraulic conductivity, LRDP (land resource development plan) , etc

Hydrological	Water level and discharge, river cross section, Glacial retreat , Aquifer-type, depth, extent, lithological variation, information, transmissivity, hydraulic conductivity, specific yield, storage coefficient, well-location, well type, well depth, water table data, groundwater consumption etc
Agriculture, Horticulture, and Livestock	A detailed cropping zone wise inventory on planting date/ method/distribution, agriculture/ horticulture management practices, diseases incidence, incidence of livestock diseases, invasive species inventory, fertility factor percentage organic carbon and nitrogen content, area under cultivation, yield and types of variety cultivated is important
Socio economic Profile	Socio economic information inclusive of information on the institutions and governance. This includes vital statistics (total population, male female ratio, adult dependency ratio, crude death rate, crude birth rate, average life expectancy at birth, etc.); education information, essential for vulnerability assessments and also for socio economic scenario building both of which are critical for responding to climate change and for designing efficient occupational structure – formal and informal.
Forest and Biodiversity	Geographical distribution of vulnerable habitats and species, information about invasive species
Health related Data	Health statistics including morbidity/mortality data, distribution/ risk maps for climate sensitive diseases like diarrhoea and malaria, health infrastructure, prevalence of malnutrition, etc.
Energy	Energy information on consumption patterns and conservation potential. It should include information on urban infrastructure like transport and buildings.

- Weak and fragmented knowledge base for impact assessment and selection of technology choices
- Knowledge gaps in respect to the impacts of climate change in different sectors of economy
- Absence of a system of technology watch
- Lack of institutional mechanisms for collating, synthesizing and delivering knowledge products for decision making
- Lack in organized multidisciplinary research capabilities
- Inventory of traditional knowledge



The proposed approach for addressing the knowledge gaps and mobilization of strategic knowledge in the areas related to climate change are identified as follows:

- Strengthen and prioritize ongoing and planned programmes in respect of developing adaptation and mitigation activities
- Increase the spatial and temporal coverage and resolution of regional impact of climate change in the State
- Develop the State level capacity in distributed form but networked through the activities and programmes identified as a part of the mission
- Widen the scope and activities of knowledge generation for observation, monitoring, assessment and actions relating to the management of climate change induced risk
- Use existing delivery structures for knowledge dissemination and application
- Create knowledge networks with selected core knowledge generating and applying institutions as nodes that are linked and involved in the development of activities through a wide range of knowledge partners
- Use extramural research system to undertake the widening of activities of knowledge generation and delivery
- Create new knowledge institutions by leveraging and supplementing existing strengths as far as possible when

needed

- Develop and provide knowledge and information services and products for use at specific and different levels, for example, develop internal knowledge alert system, risk assessment reports, regular reports on base line information and indicators, policy briefs, discussion papers on scenarios and choices, etc.
- Undertake vulnerability analysis of most sensitive populations / occupation groups and areas in the State of Jammu and Kashmir.
- Activities are to be identified and undertaken for ensuring that practical knowledge gaps in respect of risk management are also bridged in collaboration with the expertise and knowledge available with the vulnerable groups.

### 14.3. Key Priority

#### 1. Map & Analyze knowledge sharing process, flow, protocol and priority

The impact of climate change could jeopardize economic development and livelihood if not dealt with a collaborative approach. Knowledge about the possible impact is the key step towards developing a climate resilient society and climate proofing of the livelihood sector. It is therefore needed that all agencies working in the field of climate resilient development come together for sharing learning and knowledge. It is therefore essential to promote sharing

of experiences, best practices and lessons learned in mainstreaming climate change concerns into development policies and practices. The climate change cell will undertake the task of mapping and analyzing the existing channel of sharing of knowledge on climate change. The mapping will help to frame policy intervention towards developing strategic alliances and partnerships in streamlining knowledge sharing related to the climate change agenda.

## 2. Compile currently available information for assessment frameworks, methods and tools for climate impacts, decision support tools and good adaptation practices

Activities towards mapping of the knowledge base and data resources relevant to climate change for taking up research studies as well as mobilization of State specific strategic knowledge are required to be implemented and institutional support need to be provided for the formation of State wide knowledge network and networking of the State level institutions. The activities will also identify the knowledge gaps at the State level with regard to the areas of climate change impacts on important socio-economic sectors like agriculture, health, natural resources, ecosystem, health, biodiversity, etc. On the basis of the above baseline information mapping an integrated consultation process will be conducted so as to identify the best assessment frameworks, methods and tools for climate impacts study, decision support tools and good adaptation practices. Similar intervention will help in generation and

development of knowledge base needed for the development of foresight, assessment and decision making activity with a view to undertake improvement and elaboration of climate resilient and sustainable development pathways in the light of responsible climate change related actions

## 3. Establishment of weather and climate data and easy access of data to climate researchers and end users of vulnerable community as well as livelihood sector

There are several databases that are relevant for climate research, available with respective agencies of the Government which are highly essential for climate research and modeling. It is therefore important to review the restriction over the data access and create a platform and provide access of data information to registered users useful for research on basic phenomena of climate science, assess of key climate and biogeochemical variables including changes in eco-systems and land use change & land cover change so as to analyze the possible feedbacks on climate change, determine region specific modeling to understand the future effects of climate change on different types of ecosystems. It therefore important that the climate change cell be made the repository of all climate and weather related information and empowered of creating databases and registered users. Registered user from amongst the government departments and organizations including climate researchers and end users of vulnerable community as well as livelihood

sector will be provided access to the climate related information.

#### 4. Capacity building including developing of Training module and imparting knowledge through regional workshop

Considering that climate change is a relatively new challenge, the focus of the Climate Change Action Plan will be on generating awareness and building capacity. This will be done across all levels of the Government and external stakeholders involved in the different sectors. Enhancing awareness levels and understanding of CCA approaches will help in mainstreaming SAPCC and achievement of objectives through convergence with other department. In this context training need analysis will be carried out and module will be developed to impart knowledge amongst the administrative departments. This strong drive towards building capacity will result in empowering people and organizations to be able to better address, manage and respond to climate change concerns.

#### 5. Develop & maintain online portal website

Climate change related knowledge is very limited at the State level. It is therefore essential to develop a web-based communication approach whereby the website carrying all the climate related

information will be integrated as part of the State level climate change Knowledge Management System. These websites will be designed as part of the programme to serve the needs of the key officials and would also reach out to the wider community.

#### 6. Organize annual forum, learning seminar, workshop and dissemination of knowledge based product

Future actions need to focus on widening the awareness and understanding of the issue of climate change in the State, including their contribution to ecosystem protection and supporting sustainable development, and especially their value to vulnerable communities. Such action will help enhancing livelihood resilience and adaptive capacities of rural and vulnerable people in State. Popularized publications, issue based features on climate change at the State level, through targeted Opinion Editorial Pieces and other media forms will be pursued. The issues will also be deliberated in annual forum, learning seminar and workshop conducted at the grass root level. The concerted communication effort will also be focused on the value of sustainable development reduction of GHG emission and low carbon lifestyle. The initiative will be super headed by the climate change cell of the Govt of J&K.





## 14.4 List of Key Priority Action

Table 67: List of Key priority action Strategic Knowledge Mission

Sl. No.	Title	Organiz-ations	Budget (INR in Million)			Source of Funding
			Existing	Additional	Total	
1	Map & Analyse knowledge sharing process, flow, protocol and priority	Climate Change Cell Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	Nil	3.00	3.00	GoI, MoEF, EFA
2	Compile currently available information for assessment frameworks, methods and tools for climate impacts, decision support tools, good adaptation practices	Climate Change Cell Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	Nil	15.00	15.00	GoI, MoEF, EFA
3	Establishment of weather and climate data and easy access of data to climate researchers and end users of vulnerable community as well as livelihood sector	Climate Change Cell Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	Nil	15.00	15.00	GoI, MoEF, EFA
4	Capacity bbuilding including developing of Training module and imparting through regional workshop	Climate Change Cell Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	Nil	1.50	1.50	GoI, MoEF, EFA
5	Develop & maintain online portal website	Climate Change Cell Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	Nil	1.50	1.50	GoI, MoEF, EFA
6	Organize annual forum, learning seminar, workshop and dissemination of knowledge based product	Climate Change Cell Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	Nil	4.00	4.00	GoI, MoEF, EFA
<b>Total (INR in Million )</b>			Nil	<b>40.00</b>	<b>40.00</b>	





## 15. Cross-Cutting issues to tackle Climate Change in the State

There are several cross-cutting issues in the climate change debate. It requires multi-sectoral coordination and commitment of multiple stakeholders. Although not new, collaboration across the sectors private, public and civil society has traditionally been complex. 'Convergence' is a more complex form of collaboration involving multi-

stakeholder coalitions, seeking to affect systemic change on wide-ranging issues, focused on outcomes rather than inputs to deliver scalable and sustainable change. To understand the cross cutting issues the following process was adopted. The following diagrams give the details.



While looking at the environmental effectiveness in choosing a key priority, one has to see whether the cost is localised (area specific, State-wide, national or global). However if the State has to opt for a clean technology then the additional costs have to be considered and additional investment need to be negotiated with non-local stakeholders. This would strengthen factors like equity, flexibility or effective

environmental cost. The State also has to address the issue of complementarities to avoid duplication of efforts or resource deployment. It has to negotiate with multiple players and decide on the implementation agenda based on the development priority of the State. The priority actions where such dilemma exists have been treated as cross-sectoral issues.

*Table 68: Cross cutting relevance of some contemplated actions*

Cross-sectoral challenge	Sectors-Involved	Actions	Typology of action	Anticipated conflict
Containing Damage to the housing and storage infrastructure in flood prone areas	Agriculture, Water, Housing	Change in crop storage structure and raised plinth	Adaptation	Medium
Containing Food Insecurity during extreme weather conditions	Agriculture, Horticulture, Rural Development	Food preservation, seed bank, homestead garden	Adaptation	Low
Alternate livelihood during flooding conditions	Agriculture, Animal Husbandry, Fishery	Livestock rearing, seed storage, horticulture cultivation	Adaptation	Low
Basin/Flood Plain Management	Water, Agriculture, Energy	Integrated water resource management at basin level should determine the apportionment of water in different sectors taking into account the international treaty	Adaptation	High
Promoting sustainable agricultural practices	Agriculture, Rural Development,	Promoting of better water use efficiency and development of carbon responsive varieties	Adaptation	High
Preserving the bio diversity	Forest,	Requires a holistic action to preserve the flora as well as the fauna including the aquatic ones of a specific area	Adaptation	Medium



Institutionalising Energy use efficiency	Energy, Industry, Works, Agriculture	A multi-layered approach to change the mindsets, methods and appliances to improve end-use efficiency and process efficiency	Mitigation	Medium
Promoting green infrastructure	Energy, Works, Urban, Transport	Green topped road, promotion of renewable and energy saving measures in the housing sector	Mitigation	Medium

### 15.1. Common Cross-cutting needs and capabilities

The following are the common crosscutting needs and capabilities that have emerged from the working group deliberations. Government of J&K understands the common needs that emerge across sectors and has proposed several institutional mechanisms to address the issues. This

includes formation of the Governing Council, Executive council and expert committee and also capacity building of the District level administration, Program Monitoring and Impact Assessment. Sensitizing Entrepreneurship Development Institute would be involved to promote skill building in general with a special emphasis on green skills.

*Table 69: Strategies for addressing cross sectoral issues*

Strategies	Local	State level	Linkages to national programmes/missions
Awareness	Creating local level awareness is a first step, e.g. barefoot workers, framer field schools may promote descaled climate change concerns	Building awareness of legislators, policy makers on socio-economic and socio-political cost of climate change	Participation in national networks, interface with the national knowledge network and research systems
Capacity	Monitoring, observation Awareness/ assessment at state/ district/ community levels	Scientific assessment, measurement, models, with State level technical institutions like PCB, Watershed Mission, Regional Centers of National Institution, Universities	Special regional modeling and assessments, best practices study and resource leveraging from various missions and mission resource centers and technical secretariats

Generation of Knowledge/ Information	Locale specific databases, scenarios and assessment, local monitoring networks, rapid assessment for input to State inventory	Research networks, Compilation of State level GHG inventory and input to National databases(e.g. NATCOM), scientific and policy models, State-wide and area specific scenarios, technology inventory	Interface with IPCC assessments, interfacing with regional/global databases, scenarios and assessments, technology inventory database
Institutions/ Partnerships	Community initiatives, Early warning networks, Disaster management teams	Stakeholders networks, public/ private programs	Standardized Climate impacts assessment both academic as well more applied ones for result based management and programming
Policy/ Instruments	Local specific adaptation plans, community based adaptation programs	Science-policy linkage, mainstreaming climate change agenda in sectoral policies of the State (agriculture, energy, water, forestry, Himalayan ecosystem etc.) economic instruments (e.g. insurance, R&D funds), integration with national development/ planning process	Adaptation funds, Interface with private sector participants for fund under market mechanisms like CDM, REDD/REDD+
Technology	Locale specific technology adaptation	Targeted R&D, Technology transfer protocols, demonstration/ pilot projects	Scientific exchange, technology transfer



## 16. Conclusion

The State Action plan on Climate Change is a dynamic and strategic document largely aligned with the National Action Plan on Climate Change to help in implementation of NAPCC measures at the State level. At the same time, the SAPCC has also considered particular regional and local characteristics and specific concerns of vulnerable sectors and communities within the State. The SAPCC through vulnerability and risk assessment provides a scientific basis for decision making at the highest level of policy making. The sub national plan is developed to address the gap between global scenarios and local risk assessments through a locally grounded approach towards the issues relevant to climate change in the State. The plan had emerged out of contributions from the experts and various stakeholders in the State. SAPCC (J&K) takes into consideration the vulnerability and challenges faced by the State due to the topography, terrain, poverty, international borders, dispersed population, complex geological structure, dependence on natural resources, limited energy sources and other geographic, climatic and

demographic factors exclusive to the State.

### 16.1. Key Outcome

The State has undertaken massive exercise for identifying key priorities in each sector. The State Climate Change Action Plan has taken into consideration both mitigation and adaptation issues in a holistic manner. However adaptation actions have been recognized to be of greater significance while prioritizing. About 229 actions have been identified across eleven sectors. Out of which 122 actions have been prioritized. Institutional Arrangement has been worked out and notified. The cross-sectoral working groups have successfully produced these drafts by working together and moderating the different contested positions.

### 16.2. Financial Budget

The budget for the Climate Change Action Plan presented below is purely indicative at this stage. The budget only pertains to priority actions to be undertaken in the short term.

Table 70: Budget proposed under SAPCC

Sl No	Sector	No of high Priority Actions	Total No of Action Proposed	Indicative Budget (INR in Million)	
				Existing	Additional
1	Sustainable Energy mission	9	15	1,470.10	3,970.40
2	Enhanced Energy Efficiency	16	16	1,572.00	5,548.40
3	Sustainable Habitat	12	29	0.00	2,188.50
4	Green India Mission	16	24	0.00	<b>1,276.00</b>
5	Water Mission	11	24	0.00	45,676.00
6	Sustainable Agriculture	20	45	0.00	3,184.70
7	Disaster Management	10	21	0.00	223.50
8	Tourism	7	18	0.00	697.50
9	Health	8	22	0.00	1,047.00
10	Himalayan Mission	10	10	0.00	<b>500.00</b>
11	Strategic Knowledge	6	11	0.00	40.00
		125	235	3,042.10	64,352.00

The total budget for the State Climate Change Action Plan works out to be approximately INR 67,394.10 million .

### 16.3. Governance

Governing Council on Climate Change constituted under the chairmanship of the Chief Minister of the State will be the apex body to take decisions on the finalization of strategy and action plan for the State. Executive Council under the chairmanship of the Chief Secretary will guide the process. An Expert Committee under Director, Department of Environment and Remote Sensing will function as the nodal body for the Climate Change Action Plan. The implementation of the action plan will be through the proposed Climate Change Cell (detailed institutional arrangement will be worked out in form of a detailed project report) that would function under the

direction of Governing Council and Executive Council in consultation with the Executive committee.

### 16.4. Institutional Arrangement

The institutional arrangement for formulation of Climate Change Cell has to be enshrined through notification with approval by the Cabinet. J&K Climate Change Cell will be the operating body for coordinating the climate change related work. There will be a Project Management Agency or PMU to be supported by experts to develop the implementation guidelines in each sector and work with departments and agencies to develop baseline, emission inventory, adaptation and mitigation proposals for funding and have consultation across departments and networks and to undertake awareness and capacity building exercises.



This will help in building the capacity of line department staff. This proposed PMU under SAPCC will support J&K Climate Change Cell in implementation of SAPCC in the following issues:

1. Supporting development of the project proposal and DPR for the priority actions proposed under the SAPCC and support J&K Climate Change Cell in sourcing funding from Government Institutions or External Funding Agency
2. Supporting preparation of Annual Plan and budgeting for the climate change actions proposed under SAPCC.
3. Supporting the preparation of progress report and coordinating with Nodal Department of SAPCC of other states.
4. Coordinating with the Working Groups and State Missions for planning and convergence.
5. Monitoring project input, activities and impact.
6. Maintenance of MIS, supporting preparation of participatory micro planning.
7. Promote Knowledge Management and policy advocacy through workshop, seminar and participatory village level programme.

## 16.5. Change in policies and practices

Analysis of the key priorities reveals that climate change orientation needs to be

provided at the levels of framing the policy, at organizational level and at the practice level. Policies need to integrate the climate change considerations. At the organizational level, the awareness, skills and capacity have to be developed. Strategic bodies like J&K Climate Change Cell shall be established. At a practice level, line department's implementation initiatives should be shifted towards a more climate friendly development path. Marginal incremental actions will not suffice and significant actions are required at all levels to move on a climate-friendly, inclusive and sustainable development path.

## 16.6. Low Carbon Inclusive Growth

The various mitigation initiatives planned under the proposed missions will ensure that the J&K proceeds towards low carbon inclusive growth.

## 16.7. Building Climate Resilience

The different adaptation initiatives being planned will ensure better preparedness to climate-induced changes, including extreme events. For a climate sensitive State such as J&K, climate change adaptation is an integral part of good governance & development.

## 16.8. Staffing and engagement with stakeholders

From the range of issues / concerns, it is quite clear that even though climate change

is an environmental challenge, the response requires both environment experts as well as involvement of non-environmental professionals. Resolution of climate change issues cannot be done in isolation by the environmental or climate change fraternity alone. The issues/problems are so fundamental and deep in the sectoral context that the respective sector professionals have to address these problems. Policy-makers, economists, planners, engineers, scientists, development programme specialists and others have to be encouraged to contribute towards resolving climate change problems in a structured way.

In order to ensure successful implementation of SAPCC it is important to ensure involvement of stakeholders, particularly community, in a more proactive way in the CCA planning (micro level and participatory) implementation. This involvement will relate to:

- (i) Promoting much greater climate change awareness within community,
- (ii) Identifying problematic issues relevant to climate change,
- (iii) Support in monitoring of climate-induced problems and
- (iv) Ensuring greater accountability to the people on climate change issues.

Stakeholder involvement will be an effective tool in bringing out the solutions in a more holistic manner. If stakeholder involvement as described here is not initiated, then stakeholders are bound to look at government as an Adversary and not as a partner.

## 16.9. Capacity Development

Climate change and its possible impacts on the lives and livelihoods of the people, scope for adaptation and undertaking of mitigation initiatives are relatively new concepts in the State. Consequently, the limited awareness on the broader issues relating to concept of vulnerability, climate proofing, climate resilience across all implementation levels, line department will be unsuccessful unless the critical targeted and need based capacities are developed in regard to the above issues. The outcome of SAPCC is largely dependent on developing the required capacities at different levels of administration and implementation, including the grass root level.

Adequate training programme should therefore be planned as part of strategic knowledge mission. Moreover, J&K Climate Change Cell should organize awareness workshops at the regional level to promote similar initiatives. Even participatory micro level CCA planning can be encouraged towards promotion of traditional knowledge and adaptation practices. Capacity building of the CBOs and NGOs should also be a part of the planned programme. Following action can be implemented and organized through J&K Climate Change Cell and its PMU with subject matter specialist.

## 16.10. Monitoring and Evaluation

Monitoring and evaluation is a critical part of programme implementation. A

programme level MIS will be developed and ensured that information are routinely collected, imputed and analyzed during the programme period. As a part of the monitoring framework baseline studies will be conducted during first year and follow up assessment will be carried out depending upon the length of the programme. Inputs and activity monitoring will be based on information routinely gathered at different levels using the programme MIS; (e.g. numbers and quantities of different activities and investments carried out and their costs). On an annual basis, the programme review processes will involve comparison of what was planned and what actually achieved. This will provide an annual assessment of the progress and will assist in the early identification of the problem areas to be addressed during the subsequent years. As part of the project proposal developed for sourcing of funding and implementation of the SAPCC an indicator based frame will be developed and will be reviewed on a periodic basis. The structure of the MIS is given below:

## 16.11. Key Conclusion

A multidisciplinary, integrated and coordinated convergence approach will be adopted in implementing the SAPCC. J&K Climate Change Cell under the guidance of the Governing as well as the Executive Council and in consultation with Expert Committee will adopt a proactive, preventive and preparedness oriented approach rather than a reactive approach. Different sectors have different key priorities to be addressed through different initiatives over different timeframe. J&K Climate Change Cell will implement its initiatives relevant to their key priorities within themselves and in close coordination with different departments and stakeholders involved. During this SAPCC implementation, J&K Climate Change Cell will demonstrate, promote and encourage different initiatives through policy changes and implementation actions as a response to climate change.

Following the implementation of this first SAPCC, awareness and knowledge on climate change issues / concerns would

Area	Key impacts to monitor	Targets to monitor	Key programme to evaluate	Frequency	Feedback loop

be developed across the State. Therefore, the overall capacity of both Government staff across all levels as well as those of the external stakeholders will be considerably higher. Once built, this capacity should be collectively and gainfully used in a consultative, participatory and inclusive manner in determining the focus areas of attention in the next version of the SAPCC. While all sectors were directly or indirectly covered in preparing the SAPCC, there were

some departments that were not actively engaged, e.g. Education department, Rural development etc. The overall focus on capacity building addresses an educational goal/target but this is not implemented through the formal systems of the Education department. It is therefore proposed that these departments that have not been directly engaged should be encouraged to be involved so that new perspectives and approaches emerge.





# 17. Annex I: Mission wise Comprehensive List of Actions proposed under SAPCC

## 17.1 Sustainable Energy Mission

Table 71: Comprehensive List of Actions proposed under Sustainable Energy Mission

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	<b>Promotion and implementation of solar city project by</b>	JAKEDA, LREDA,	H				
A)	Preparation of a master plan for all district HQs under the “Solar City project”	KREDA, Housing & Urban		MI	A	PS	ST
B)	Set-up of institutional arrangements for implementation of the master plan	Development Department - J&K		AD	A	CB	ST
C)	Awareness generation and capacity building activities by managing publicity programmes, conducting training programmes/business meets for stakeholders			AD	A	CB	LT
D)	Implementation of pilot solar city project in phase wise- Phase I - Jammu, Srinagar and Katra Phase II - Kupwara&Udhampur Phase III - Rajauri, Poonch, Baramula,			MI	A	IP	LT
2	<b>Promotion and facilitation of Off-grid and decentralized renewable energy generation for electrification, cooking and other thermal energy requirement.</b>	JAKEDA, LREDA, KREDA, Rural Development	H				
A)	Facilitating deployment of 5 MW stand-alone off-grid solar power plant of capacity within 50 - 100 kW for fulfilling the power demand in dispersed locations by 12th plan period.	Dept. -J&K		MI	S	IP	MT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
B)	Installation of 300 kW solar-wind hybrid power plants with capacity of 20 kW in 12th plan period.			MI	S	IP	ST
C)	Maximizing use of stand-alone Solar Home Lighting System (SHLS) in rural household level through distribution of 20,000 SHLS of 40 Wp capacity annually.			MI	S	IP	MT
D)	Implementation of pilot scale 15 nos. bio-digester systems annually for cooking energy generation for 50 -100 people from kitchen waste and other waste in hostels, hospitals, small scale industries and institutions etc.			MI	S	DP	MT
3	<b>State Govt. by amendment of building bye-laws suitable to state condition will promote and mandate use of solar water heating systems and/or lighting.</b>	JAKEDA, LREDA, KREDA, Housing & Urban	H				
A)	Amendment of building bye-law considering state demographic profile for mandatory use of solar water heating systems in <ul style="list-style-type: none"> <li>All District Head Quarters of the state by year 2015</li> <li>All commercial and institutional buildings of urban and semi urban areas by 2017</li> <li>All private residential houses of urban areas with more than 1000 sq. ft. area by 2018</li> <li>By 2020, in all towns and small cities; solar water heating systems usage by the private households and commercial buildings.</li> </ul>	Development Department - J&K, Govt. of J&K, Dept. of Health, Dept. of Higher Education -J&K,		AD	S	PA	ST
B)	Promotion & Facilitation for setting up of Solar water heating (SWH) systems in all Govt. establishments. By undertaking pilot projects in <ul style="list-style-type: none"> <li>Primary Health Centre's - 10 Nos.</li> <li>Hospital - 10 Nos.</li> <li>Govt. Higher Secondary School - 10 Nos.</li> <li>District Collectorate Building and other govt. establishments -20 Nos.</li> </ul>			MI	S	DP	ST

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
4	<b>Institutional development and strengthening of JAKEDA, LREDA and KREDA for promotion of Renewable Energy applications</b>	JAKEDA, LREDA, KREDA, State Climate Change Cell, J&K	H				
A)	Training of the working group members and their representatives from JAKEDA including LREDA and KREDA and other concerned departments and organizations on sector specific climate change issues and enhance the knowledge about the policy measures.			AD	S	CB	ST
B)	Introduction of e-governance system and enabling IT based operation in the JAKEDA, LREDA and KREDA and capacity building of all officers at district level.			AD	S	CB & IP	ST
C)	Development of Project Management Cell at JAKEDA for identification of projects, development of Pre-Feasibility Report, Detailed Project Report, Arrangement of fund, Monitoring of project implementation and operation.			AD	A	CB	LT
5	Harnessing renewable energy potential scenario of the state for power generation	JAKEDA, Housing & Urban Development Dept. -J&K	H				
A)	Assessment of Biomass potential and availability for energy generation in the state and demarcation of biomass potential sites in the map.			AD	S	RS	ST
B)	Assessment of Solar irradiation, temperature, wind speed at district level across the state for solar mapping.			AD	S	RS	ST
C)	Assessment of Wind Energy potential of the state, wind mapping and identification of wind project sites.			AD	S	RS	ST
D)	Detailed Assessment of Waste to Energy projects from Municipal Waste, Industrial and other wastes in the state.			AD	S	RS	ST
E)	Undertake R&D work to improvise the performance of biogas plants in low temperature condition and with reduced livestock waste in high temperature zones.			AD	A	RS	ST

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
6	<b>Strengthening of technical competency of various stakeholders of renewable energy which includes O&amp;M persons, technicians, installers, manufacturers and other relevant service providers as per international standard</b>	JAKEDA, Technical Education Dept. -J&K, Industry & Commerce Dept.	H				
A)	Introduction of subject or paper on RE system installation, O&M, repair, etc.in all ITIs of the state to meet a local demand.	-J&K		AD	S	CB	ST
B)	Introducing technical course on Renewable energy technology and Energy management at Poly-technic /Engineering colleges of the state to achieve increase in availability of technically qualified manpower.			AD	S	CB	ST
C)	Conducting certificate courses for strengthening of technical competency of the existing solar and other renewable energy technology service providers.			AD	S	CB	ST
D)	Supporting state level entrepreneurs to become RESCOs, Channel Partners under JNNSM scheme and renewable energy device manufacturers, distributors, installers, etc.			AD	S	CB	MT
7	<b>Enhancing state's own power generation capacity through hydro power plant set up and provides support to private/public investors in project implementation and undertakes micro/mini hydro projects for remote area's to meet up local demand.</b>	JAKEDA, JKSERC, JKSPDC, LREDA, KREDA, PHE, Irrigation & Flood Control Dept. -J&K	H				
A)	Detailed reconnaissance study on water availability and hydrology data evaluation for identification of new hydro projects and demarcation of hydro power sites with specific capacity mapping.			AD	S	PS	MT
B)	Promotion & facilitation of hydro power project implementation by providing adequate support from the state government in terms of clearance, land acquisition, power transmission network development and funding. Encouragement of greener construction technologies in new Hydro power project implementation.			MI	S	PA	MT



Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
C)	Declaration of water policy and mandate siltation and pollution control in water bodies of hydro power projects.			AD	S	PA	ST
D)	Implementation of 10 MW mini, micro hydro project in already identified project sites by next 5 years through PPP mode and 50 MW through IPP mode.			MI	A	IP	MT
8	<b>Promotion of grid connected Rooftop and Small Solar Power projects in the state of J&amp;K</b>	JAKEDA, JKSERC, JKSPDC, LREDA, KREDA	H	MI	S		MT
A)	Implementation of 25 MW grid connected Rooftop and small solar power plant up to 2 MW capacities across the state within 2017-18 by Independent Power Producers (IPP) and also through PPP mode.			MI	S	IP	MT
B)	Declaration of policy measures for proper decommissioning and recycling of all solar panels installed across the state.			MI	S	PA	ST
9	<b>Promotion of green buildings in the state</b>	JAKEDA, LREDA, KREDA, PHE, Irrigation & Flood Control Dept. -J&K, Housing & Urban Development Dept. -J&K, Public Works (R&B) Department	H				
A)	Development of policy framework on green building considering state geographical location, prevailing climatic condition.			AD	S	PA	ST
B)	Introducing mandatory norms for undertaking green building measures in all new govt. buildings and residential buildings of more than 1500 sq. ft. in cities of Jammu & Srinagar. Mandatory compliance of energy efficiency measures, rain water harvesting measures, recycling measures of water and wastes in all big hotels.			MI	A	PS & DP	LT
C)	Capacity Building of authorities (Housing & Urban Development Department, PHE, Irrigation & Flood Control Department, Public Works (R&B) Department, JAKEDA) on green building policy and its requirement.			AD	S	CB	LT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
10	<b>Promotion of Waste to Energy projects by utilizing municipal and industrial wastes</b>	JAKEDA, JKSERC, JKSPDC, LREDA, KREDA, Housing & Urban Development Dept. -J&K	M				
A)	Development of Policy framework			AD	S	PA	ST
B)	Facilitate project implementation through support in project clearances, Arrangement & management of project implementation fund			MI	S	PA	MT
C)	Identification of projects and preparation of 3 Nos. Detailed Project Report			MI	S	PS	ST
D)	Facilitation and implementation of 3 nos. demonstration projects in major cities of the state			MI	A	DP	MT
11	<b>Maximizing use of solar energy application for minimizing the grid power shortage by installation of 100 MW grid connected solar power plants through IPP mode and 10 MW through PPP mode by 12th plan period.</b> a) Identification of project sites. b) Bankable DPR preparation. c) Identification and selection of project investor and fund. d) Undertake project clearances, grid connectivity. e) Implementation of solar power plant.	JAKEDA, JKSERC, JKSPDC, LREDA, KREDA	M	MI	S	IP	LT
12	<b>Reducing grid power dependency and fossil fuel savings through replacement of diesel generators by promoting &amp; facilitating setting up Off-grid Rooftop solar power systems in all Govt. establishments including –</b> <ul style="list-style-type: none"> <li>• Health Centre's - 300 Nos.</li> <li>• Educational Institutions - 200 Nos.</li> <li>• District Collectorate Building and other govt. establishments - 100 Nos.</li> </ul>	JAKEDA, LREDA, KREDA, Dept. of Health -J&K, Higher Education Dept. -J&K, Technical Education Dept. -J&K, Govt. of J&K	M	MI	S	IP	LT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
13	<b>Promotion and facilitation in setting up 10 MW biomass based power projects with capacity of 1 MW and above through single window procedure.</b> a) Preparation of Bankable Detailed Project Report. b) Arrangement & management of project implementation fund. c) Single window clearance for setting up biomass power plant d) Dedicated plantation activity for biomass generation. e) Implementation of pilot power projects of total capacity of 10 MW	JAKEDA, JKSERC, JKSPDC, LREDA, KREDA, Industry & Commerce Dept. -J&K	M	MI	A	IP	LT
14	<b>Promotion of community based solar cooker system / solar concentrating system use to suffice 100 people cooking energy requirement at schools/education centers through policy mechanism and also demonstration project implementation.</b>	JAKEDA, LREDA, KREDA, Education Dept. -J&K	L	MI	A	PA & DP	MT
15	<b>Creating solar energy and other renewable energy technology supply chain by incorporation of Mini RE Park or RE Valley for production of Solar PV, thermal devices and other RE technology devices etc. in SEZ mode by the Government of J&amp;K.</b> a) Land identification, development and allocation for RE park. b) Development of RE park as a PPP initiative. c) Allocation of area to RE manufacturers under SEZ scheme.	JAKEDA, LREDA, KREDA, Industry & Commerce Dept. -J&K	L	AD	A	PA, IP & CB	LT

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term

## 17.2 Mission on Enhanced Energy Efficiency

Table 72: Comprehensive List of Actions proposed under Mission on Enhanced Energy Efficiency

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
01	Policy development for mandatory Energy Audit in Govt. Building;	JKPDD, PWD, Dept. of Industry	H	MI	S	PA, DP	ST
02	Undertaking Training Need Analysis Study for the department, preparation of manual and carrying out pilot workshop.	PDD,PWD	H	MI	S	CB/RS	ST
03	T & D Loss reduction	JKSERC&JKPDD	High	AD	S	IP	MT
04	Development of policy for mandatory use of efficient light particularly for commercial organizations in the state.	JKPDD, PWD, Dept. of Industry	High	MI	S	PA	ST
05	Conversion of conventional street lights to solar LED/CFL street lights.	JKPDD, PWD, Municipality, UDD	High	MI	S	DP	ST
06	Encourage use of Solar Gadgets in Industries	Dept of Industry, PDD, Science & Technology Department	High	AD	S	PA	ST
07	Awareness and implementation for use of CFL and replacing incandescent lamp under Bachat Lamp Yojana, and Umbrella program of BEE.	JKPDD, UDD, Municipality, PWD.	High	MI	S	IP	MT
08	Development of policy to mandate ECBC adoption in state.	PDD, S&T Department, PWD, Industry, UDD	High	MI	S	PA	ST
09	Formulation of DSM project.	PDD, JKSERC, Dept. Of Science & Technology.	H	MI	S	IP	MT



Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
10	Development of comprehensive scheme for promotion of energy efficient pumps in agriculture sector.	PDD, Irrigation Dept., Agriculture Dept.	H	MI	S	PA, DP	MT
11	Promotion of use of star rated domestic appliances may be encouraged. The shops selling TV, Refrigerators or Washing Machines, Fans etc. may be asked to keep only star rated products.	PDD, Dept of Industries	H	MI	S	PA	MT
12	For proper energy monitoring, capacity building of energy auditors, formation of energy conservation Cell supported with manpower and infrastructure.	PDD, UDD	M	MI	S	CB	ST
13	To maximize harnessing biomass potential in the state through co-gen/thermal/power plant/ gasification to feed the grid as green power. Increase in application of CPP both in grid and standalone mode	PDD, JKREDA, Dept. of Industries	H	MI	S	PA/PS/DP	MT
14	Energy Audit of Generating Stations & Renovation and modernization of the existing hydro power station	JKSPDC, JKSERC	H	MI	S	IP	LT
15	Promotion of low emission vehicles, electric vehicles	Dept. of Transport, Dept. of Urban Dev.	H	MI	S	PA & PS	LT
16	Introduction to concept of mass rapid transit	Dept of Transport, Dept. of Urban Dev.	H	MI	S	PA & PIS	LT

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term

## 17.3 Mission on Sustainable Habitat

Table 73: Comprehensive List of Actions proposed under Mission on Sustainable Habitat

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Promotion of battery operated (charged from solar power) transport systems in tourist places, battery driven motor boats instead of diesel engine boats (battery charged from solar module mounted on the boat) and use of alternative fuel instead of diesel to drive Barges and other diesel driven equipments used for maintenance purpose in the lake	H&UD Dept.	H	MI	S	PA, IP	MT
2	Capacity building of all levels of stakeholders to make them understand their role on their regards and maintain proper environment management system	H&UD Dept.	H	AD	S	CB	ST
3	GHG accounting study on emission by transport vehicles	H&UD Dept.	H	AD	S	RS	ST
4	Establishment of intelligent transport system	H&UD Dept.	H	AD	A	IP	MT
5	Policy framework in transport sector	H&UD Dept.	H	AD	S	PA	ST
6	Promotion of public transport and mass transport & Promotion of water transport	H&UD Dept.	H	MI/AD	S	PA/IP	MT
7	Reallocation of the hotels or application of STP near Dal lake & DPR preparation on STP	H&UD Dept.	H	AD	A	PA/IP	LT
8	Establishment of end-to-end solid waste management system	H&UD Dept.	H	MI	A	PA	MT
9	Base line study on solid waste and industrial waste generation and DPR preparation & four pilot project implementation	H&UD Dept.	H	MI	A	RS	MT
10	Capacity Building/ Awareness Generation Program on segregation of solid waste at household level	H&UD Dept.	H	MI	S	CB	ST
11	Establishment of segregation mechanism of bio-medical waste in urban hospitals and in rural PHCs	H&UD Dept.	H	MI	A	IP	MT
12	Application of methane capture technology and preparation of fertilizer from weeds generated in Dal lake	H&UD Dept.	H	MI	A	IP	MT
13	Establishment of Rail based transport system	H&UD Dept.	M	MI	A	IP	LT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
14	Establishment of transport development authority	H&UD Dept.	M	MI	S	PA	MT
15	Establishment of Unified Metropolitan Transport Authority	H&UD Dept.	M	MI	S	PA	LT
16	Develop control rules and regulations in master plan	H&UD Dept.	L	MI	S	PA	ST
17	Dedicated cell with Directorate should be established for tourism sector	H&UD Dept.	M	MI	S	PA	ST
18	Establishment of State level observatory for climate change	H&UD Dept.	M	MI, AD	S	PA, IP	LT
19	Internal link roads to avoid traffic jam	H&UD Dept.	M	MI, AD	S	IA	ST
20	Increase density of habitats to save agricultural land	H&UD Dept.	M	AD	S	PA, IP	MT
21	Reallocation of the people living in houseboats with employment alternatives for livelihoods	H&UD Dept.	M	AD	S	PA	MT
22	Implementation of common STP for houseboats	H&UD Dept.	M	MI	S	IP	LT
23	Reallocation of Dal lake surrounding markets or incorporation of end-to-end Solid waste management system	H&UD Dept.	M	AD, MI	A	PA, IP	MT
24	Development of water transfer system from Dal lake to the Jhelum in case of rise in water level and other wet lands	H&UD Dept.	M	MI, AD	A	PA, IP	LT
25	Establishment of STP at the disposal site	H&UD Dept.	M	MI	A	IP	MT
26	Education to entrepreneurs by private sector	H&UD Dept.	L	AD	S	CB	ST
27	A subject paper on Climate change should be in course structure of Poly-technique Institutes	H&UD Dept.	L	AD	S	CB	MT
28	Study on climate change should be added in study curriculum at lower level	H&UD Dept.	L	AD	S	CB	ST
29	Institutional support	H&UD Dept.	M	AD	S	CB	MT

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project,

CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term

## 17.4 Green India Mission

Table 74: Comprehensive List of Actions proposed under Green India Mission

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Implementation of J&K State Forest Policy	Department of Forest	H	AD	S	PA	ST
2	Capacity building and awareness for all levels of stakeholders	Department of Forest and CAMPA Division	H	AD	S	CB	LT
3	Gene bank development for climate adaptable species	Department of Forest	H	AD	S	IP	LT
4	Eco-restoration through afforestation and Climate oriented eco-restoration plan	Department of Forest and CAMPA Division	H	MI	S	IP	LT
5	Phenological Studies of Forest and other Tree Species	Department of Forest	H	AD	A	RS	ST
6	Flora and Fauna vulnerability study	Department of Forest	H	AD	S	RS	ST
7	Studies of carbon influxes/ out fluxes of various forest types / trees and their role in carbon sequestration	Department of Forest	H	MI	S	RS	ST
8	Study on per capita fuel wood consumption and alternative livelihood	Department of Forest	H	AD	S	RS	ST
9	Climate impact study in undisturbed/ protected forest areas.	Department of Forest	H	AD	S	RS	ST
10	E-green portal with geo-reference	Department of Forest	H	AD	S	IP	LT
11	Nursery development for climate adaptable species	Department of Forest	H	AD	S	IP	LT
12	REDD+ feasibility study for carbon sequestration	Department of Forest	H	MI	S	RS	ST
13	Study of climate change impact on wild life species	Department of Forest and wildlife Division	H	AD	S	RS	ST
14	Climate change impacts on undisturbed forest area like national parks	Forest and wildlife Division	H	AD	A	RS	ST
15	Forest Fire management	Department of Forest	M	AD	S	IP	LT



Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
16	Valuation of existing forest wealth of J & K	Department of Forest	M	AD	S	RS	LT
17	GIS based Monitoring and Evaluation of the program	Department of Forest	M	AD	S	IP	ST
18	Study on soil organic carbon of forest area	Department of Forest	H	AD	S	RS	ST
19	Study on water and forest linkage and forest composition	Department of Forest	M	AD	S	RS	ST
20	Climate Change impact on fruit species/horticultural species and conservation, protection and monitoring strategy	Department of Forest	L	AD	S	RS	ST
21	Strengthening JFM and afforestation activity	Department of Forest and CAMPA Division	L	MI	S	IP	LT
22	Study of impact of climate change on rotational forest species	Department of Forest and wildlife Division	L	AD	S	RS	ST
23	Increasing plantation activities on outside forest land (Plantation Activities and Supporting natural Regeneration)	Department of Forest	L	MI	S	IP	LT
24	Studies of impact of managed watershed under different management system on sustained water availability	Department of Forest	H	AD	S	RS	ST

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term

## 17.5 Water Mission

Table 75: Comprehensive List of Actions proposed under Water Mission

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Generate baseline data with terrain analysis (contour/slope/ gradient/aspect, etc.), with comprehensive land classification with catchment demarcation, river networks, lakes and water bodies, forest coverage, etc	PHE, Irrigation and Flood control department	H	AD	S	RS	ST
2	Promoting and implementing water use Efficiency measures	PHE, Irrigation and Flood control department , Housing and Urban Development Department, MOWR, CWC, CGWB , Agriculture	H	Ad, MI	S	RS, PA, DP, IP, CB, OM	MT
3	Develop hydrological models for different seasons and calibration with the existing data	PHE, Irrigation and Flood control department , MOWR, CWC, CGWB	H	AD	S	RS	M
4	Comprehensive water budgeting in lieu of the current and future demand from domestic supply, irrigation, industry, tourism and for other sectors	PHE, Irrigation and Flood control department, Industry and Commerce department	H	AD	S	RS	M
5	Monitoring river flows and mapping of flood and drought zones	PHE, Irrigation and Flood control department	H	AD	S	RS	L
6	Formulate comprehensive rejuvenation plan for Dal Lake, Mansar Lake, Manasbal Lake, Pangong Lake and all other major lakes	Lake Development authority, Housing and Urban Development Department	H	AD	A	RS, PS	L
7	Assessment and Implementation of rain water harvesting and artificial recharging of ground water	PHE, Housing and Urban Development Department, Rural development Department	H	AD	S	RS,PS, DP, IP, CB, OM	M

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
8	Emphasize the awareness and capacity building for conservation, concern and co-management of water	PHE, Housing and Urban Development Department	H	AD, MI	S	RS, CB	M
9	Dealing with flood in the changing climate scenarios.	PHE, Irrigation and Flood control department, MOWR, CWC, CGWB, Revenue and Relief department	H	AD	S	RS, DP	M
10	Reducing impact of increased erosion and sedimentation	Irrigation and Flood control department, NIH, Agriculture Production Department	H	AD	S	RS, IP	M
11	Creation of Storage facilities on Distributaries of River Chenab and Jhelum As per Indus Water Treaty	Irrigation and Flood Control Department MOWR, NIH	H	AD	A	PS, IP	L
12	Generation of baseline data on the rainfall pattern and its futuristic changes in view of climate change including trend analysis on temperature, snowfall and extreme events on the basis of meteorological data with IMD and CWC	Irrigation and Flood control department	M	AD	S	RS	L
13	Evaluation of the changes in permanent snow line and glaciers in this region	Climate Change Cell, Science and technology department	M	AD	S	RS	L
14	Develop the climate change scenario in terms of water resources	Climate change cell , Irrigation and Flood control department	M	AD	S	RS	L
15	Study of temperature change to assess the present day evaporation loss and its futuristic scenario	Climate change cell , Irrigation and Flood control department	M	AD	S	RS	L
16	Study on seepage loss	Irrigation and Flood control department, PHE	M	AD	S	RS, PS	M
17	Assessment of possible canal lining to minimize seepage	Irrigation and Flood control department, PHE	M	AD	S	RS, PS	M

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
18	Set up a fully equipped water analysis laboratory for all possible parameters of water quality	PHE	M	AD	S	IP	L
19	Comprehensive assessment and zonation of level of water pollution defining their specific source like type of industry, domestic, tourism, agriculture and also excess sedimentation through natural processes	PHE, Housing and Urban Development Department , Agriculture Production Department	M	AD	S	RS, PA	L
20	Regulate land use conversion to restrict the congestion in natural water infiltration for groundwater recharge	PHE, Revenue and Relief department	M	AD	S	RS, PA	M
21	Explore and adopt the water efficient farming techniques and crop varieties	Irrigation and Flood control department, Agriculture Production Department	M	AD	S	RS, DP, IP	M
22	Zonation of the districts in terms of water availability	PHE, Housing and Urban Development Department, Agriculture Production Department, Irrigation and Flood control department,	L	AD	A	RS, DP, IP	L
23	Evaluate the potential waterways for transportation/ communication	Tourism Department , Housing and Urban Development Department	L	AD	A	RS, DP	L
24	Community training for basic water quality estimation with simple test kits	PHE	L	AD	S	CB	M

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term



## 17.6. Sustainable agriculture mission

Table 76: Comprehensive List of Actions proposed under Water Mission

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Planning of cropping system and crop varieties through Crop diversification, drought tolerant crops and water saving crops	Dept. of Agri. and Horti.	H	AD	S	DP	ST
2	Capacity building of Planners farmers and extension workers and dissemination of new and appropriate technology:	Dept. of Agri. and Horti.	H	AD	S	CB	ST
3	Integrated nutrient management (INM)	Dept. of Agri. and Horti.	H	AD	A	IP	ST
4	Promoting Zero Tillage	Dept. of Agri. and Horti.	H	AD	A	PA	ST
5	Introducing Trash mulching in agriculture 5000 ha are to be covered under mulching practice for Kashmir Division	Dept. of Agri. and Horti.	H	AD	A	DP	ST
6	Combating climate related risk through Micro Irrigation programme	Dept. of Agri. and Horti.	H	AD	A	IP	ST
7	Management of climate change risk for sustainable productivity	Dept. of Agri. and Horti.	H	AD	S	IP	ST
8	Weather based Crop insurance	Dept. of Agri. and Horti.	H	AD	S	PA	ST
9	Enhancing capacity for livestock disease management and forecasting monitoring and management	Dept. of Animal Husbandry	H	AD	S	CB	ST
10	Conservation of water bodies and fish stock augmentation in natural water bodies and promotion of fish farming	Dept. of Fisheries	H	AD	S	IP	ST
11	Resource mapping (Agriculture) by using GIS and RS technology and Strengthening of agro advisory services by using Android Technology	SKUAST	L	AD	S	IP	ST

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
12	Screening of crops for moisture/heat/disease/pest tolerance and nutrient use efficiency.	SKUAST	H	AD	S	RS	ST
13	Crop yield and weather modeling for future projections	SKUAST	H	AD	S	RS	ST
14	Carbon pool assessment /sequestration in forest and agricultural ecosystems	SKUAST	H	AD	S	RS	ST
15	Conservation of pollinators, pollination and plant phenology mismatch	SKUAST	H	AD	S	RS	MT
16	Grass Land Management / Forage/ Fodder production.	Dept of Floriculture	H	AD	S	IP, PA,	ST
17	Developing Cold-Chain Infrastructure	Dept. of Horticulture	H	AD	S	IP	MT
18	Root-Stock & Progeny Plant Material	Dept. of Agri, Dept of Horticulture	H	AD	S	DP	MT
19	Protected cultivation and Precision Farming under Hi-tech Green Houses, Poly Green Houses & Shade Nets	Dept. of Horticulture	H	AD	S	DP	MT
20	In-situ moisture Conservation through Roof-top water harvesting (2500 RTWH Units with assistance of Rs 6000/ Per Unit), Storage tanks (291 Low cost storage tanks of 20x20x20 m <sup>3</sup> @ Rs 1.03 lac/ tank assistance, Ponds/Trenches, Check-Dams (250 no @ Rs 2.00 Lac/CD), Land levelling by Laser leveller (100 units with Rs 1.5 lac/ Unit assistance)	Dept. of Agriculture, Horticulture	H	AD	S	IP	MT
21	Establishment of two number of Bio-Diversity Parks (one in Jammu division and second in Kashmir division)	Dept. of Horticulture	H	AD, MI	S	DP, PA, CB	MT
22	5000 roof top rain water harvesting units to be constructed under Kashmir Division	Dept. of Agri. PHE	M	AD	A	IP	MT
23	Promoting farmer industry partnership as well as seed industry linkage	Dept. of Agri.	M	AD	A	PA, DP,IP	MT
24	Socio economic surveys and knowledge net working	Dept. of Horti.	M	AD	S	RS	ST

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
25	Development and promotion of Integrated pest management (IPM) as pest/insect control technique.	Dept. of Horti.	M	AD	S	RS	ST
26	Developing inventory of Green House Gases emission and sequestration	Dept. of Agri.	M	AD	S	RS	ST
27	Nutritional management in livestock, animal health issues and breeding of disease and heat resistant varieties.	Dept. of Animal husbandry	M	AD	S	DP	LT
28	Sensitivity analysis of fish species to impacts of climate change	Dept. of Fisheries	M	AD	S	RS	ST
29	R&D activities in the evaluation of various mulberry varieties and silk worm breeds with changing climatic scenario	Dept. of Sericulture	M	AD	S	CB	ST
30	Promoting Organic cultivation and setting up of vermicompost unit 10,000 Ha of area under Kashmir division is proposed under the action Plan	Dept. of Agri.	M	MI, AD	S	IP	MT
31	Development of drought resistant, low chilling varieties, development of farming procedure in light of the projected weather pattern in a particular region	Dept. of Agri.	M	AD	S	RS	MT
32	50000 units are proposed under Protected cultivation in Kashmir division	Dept. of Agri.	M	AD	S	IP	MT
33	Implementation of 50000 bamboo greenhouse structure is proposed for Kashmir division	Dept. of Agri.	M	AD	S	IP	MT
34	To introduce solar driven mechanized agricultural inputs to reduce GHG emission	Dept. of Agri.	M	AD	S	PA, DP	MT
35	Evaluation of new approaches for paddy cultivation like aerobic rice and SRI 2000 ha of area are to be proposed under SRI in Kashmir division	Dept. of Agri.	M	AD	A	IP	MT
36	Sustainable management of Range lands/ grass lands	Dept. of Agri.	L	AD	S	IP	LT
37	Establishment of micro-level handling units in production zone for storage of farm produce	Dept. of Horti.	L	AD	A	DP	LT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
38	Promotion of use of high yield fruit varieties without depletion of gene pool	Dept. of Horti.	L	AD	A	CB	LT
39	Promotion of Strip and terrace plantation in hilly areas	Dept. of Horti.	L	AD	A	DP, PA, CB	LT
40	Plantation of apricot and pomegranate in forest areas	Dept. of Horti.	L	AD	A	IP	LT
41	Development of check dams	Dept. of Agri. PHE, RDD	L	AD	A	IP	LT
42	Promotion of rare and minor fruits	Dept. of Horti.	L	AD	S	DP	LT
43	Development of preparedness for protecting crops against climate extremes, like introduction of anti-hail nets, Shade nets	Dept. of Horti.	L	AD	S	DP	LT
44	Conservation of genetic diversity of crop plant	Dept. of Agri.	L	AD	S	PA, IP	LT
45	Developing food and nutrition garden	Dept. of Agri.	L	AD	S	PA, DP	LT

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term



## 17.7. Disaster Management

Table 77: Comprehensive List of Actions proposed under Disaster Management

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Hazard risk mapping using GIS and Remote sensing	SDMA, SEC and DDMA	H	AD	S	RS	ST
2	Risk reduction through implementable planning and policy development	SDMA, SEC and DDMA, Department of Home affairs and Revenue	H	AD	S	RS,PA, DP	ST
3	Strengthening Communication Networks and Disaster Management Facilities	SDMA, SEC , DDMA and NIC	H	AD	S	RS,PA, DP, CB	MT
4	Hazard specific multi-parameter vulnerability assessments and societal impacts assessments at the regional and local levels for preparing contingency plan	SDMA, SEC , DDMA, NIC, Department of Home affairs, Irrigation, Revenue and PWD	H	AD	S	RS	MT
5	Developing and promoting concept of Climate Smart Disaster Risk Management (CSDRM)	SDMA, SEC , DDMA, NIC, Department of Home affairs, Irrigation, Revenue, Agriculture and PWD	H	AD	S	RS,PA, CB	MT
6	Preparation of disaster rescue and rehabilitation plan.	SDMA, SEC , DDMA, Department of Home affairs, Irrigation, Revenue, Agriculture and PWD	H	AD	S	PA, CB	ST
7	Awareness/ Sensitization/ Capacity Building as DRM strategy	SDMA, SEC , DDMA, Department of Home, Irrigation, Revenue, Agriculture and PWD	H	AD	S	CB	MT
8	Community based disaster management in the Disaster Management Plan at all levels	SDMA, SEC , DDMA, Department of Home affairs, Irrigation, Revenue, Agriculture and PWD	H	AD	S	PA, CB	MT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
9	Disaster response training at the community level to build infrastructure and human resources for medical preparedness and emergency medical response to manage mass casualties during extreme events	SDMA, SEC and DDMA	H	AD	S	CB, RS	ST
10	Institutional development and operationalisation of the regulatory framework for effective management of disaster under State Disaster Management Act 2005 for preparation of Disaster response and management plan	SDMA, SEC , DDMA, Department of Home affairs , Irrigation, Revenue, Agriculture and PWD	H	AD	S	PA, CB	ST
11	Monitoring River Flows and mapping flood zones	SDMA, SEC , DDMA and Department of Irrigation,	M	AD	S	RS, PS	LT
12	Developing linkages between SDMA and disaster risk reduction component of sectoral development plans	SDMA, SEC , DDMA and Department of Irrigation, Home affairs and Revenue	M	AD	S	PA	ST
13	Disaster management and risk reduction committees to oversee monitoring of disaster response and mitigation programmes	SDMA, SEC , DDMA and Department of Irrigation, Home affairs and Revenue	M	AD	S	PA, CB	ST
14	Maintenance of critical facilities such as health care services and water supplies	SDMA, SEC , DDMA and Department of Irrigation, Home affairs, Revenue and Health and Medical Education	M	AD	S	IP, OM	LT
15	Land use/land cover change studies	SDMA, SEC , DDMA and PWD	M	AD	S	RS, PS	LT
16	Landslide and environmental risk assessment	SDMA, SEC , DDMA and Department of Forest	M	AD	S	RS	MT
17	Assessment of the impact of natural disasters upon masses, particularly women	SDMA, SEC and DDMA	M	AD	S	RS	MT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
18	Study of the impact on natural resources and livelihoods of people due to changing weather patterns and extreme weather events	SDMA, SEC and DDMA	M	AD	S	RS, PS	MT
19	Documentation of best practices in traditional coping methods, possible interventions to meet current disaster risk and promotion of the same	SDMA, SEC and DDMA	M	AD	S	RS	MT
20	Collaboration with insurance providers to insure infrastructure, mainstreaming disaster risk reduction into Sarva Shiksha Abhiyan, Jawaharlal Nehru National Urban Renewal Mission and Indira Awas Yojana	SDMA, SEC , DDMA and Department of Revenue	L	AD	S	PS,PA	LT
21	Organize fire response training, mock drills and enhance fire services	SDMA, SEC , DDMA	L	AD	S	CB	LT

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project,  
CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term

## 17.8. Tourism

Table 78: Comprehensive List of Actions proposed under tourism

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Undertaking carrying capacity studies and developing EMP for ten tourist locations	Dept of Tourism	H	AD	A	RS	ST
2	Construction of Bio-toilet	Dept of Tourism, Urban Development Dept and PWD	H	AD, MI	A	DP	MT
3	Implementation of solid and liquid waste management facility at six locations	Dept of Tourism, Urban Development Dept and PWD	H	AD, MI	A	DP	MT
4	Improve climate change related knowledge base of tourism operators	Dept of Tourism,	H	AD	S	RS	ST
5	Undertake study on tourist-related transport emissions	Dept of Tourism	H	MI	S	RS	MT
6	Undertake study to identify new environmental friendly natural tourist destinations for their full-fledged operation as tourist spots	Dept of Tourism,	H	AD	S	RS, PA	ST
7	Strategizing Restoration of Dal Lake	Dept of Tourism, Lake Development Authority	H	AD	A	RS, OM	MT
8	Developing Tourism policy and linking it with climate change issue	Dept of Tourism, Educational institute	H	AD	S	PA	ST
9	Promoting use of Solar thermal and solar PV system in hotels and resorts	Dept of Energy, Dept of Tourism	M	MI	S	PA, DP, IP	MT
10	Identifying and establishing eco-tourism	Dept of Tourism, Dept of Forest	M	AD	A	RS, PA, PS	LT



Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
11	Develop and disseminate emission management tools	Dept of Tourism , Research institute/ enterprise	M	MI	S	RS	ST
12	Research on existing measures/mechanism adopted by private sector service providers for minimizing environmental impacts	Dept of Tourism, Research institute/ enterprise	M	AD	S	RS	ST
13	Undertaking capacity building and awareness workshop on climate change	Dept of Tourism	M	AD	A	CB,PS	ST
14	Framing & Adoption of Sustainable Tourism Development Guidelines for the State with active participation through cell	Dept of Tourism	L	AD	S	PA, PS	MT
15	Distribute best practices guide on emission management tools to tourism business organizers and operators Promote alternate fuel/means for transportation particularly in new tourist destinations	Dept of Tourism	L	MI	S	RS, CB	MT
16	Inland waterways to be identified for Jhelum in Srinagar city	Dept of Tourism	L	MI	A	PS	LT
17	Monitor changing consumer perception and behavior in relation to climate change /undertake consumer Market research	Dept of Tourism	L	AD	A	RS	MT
18	Facilitating ropeway at Verinaag	Dept of Tourism	L	AD, MI	A	IP	LT

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project,  
CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term

## 17.9. Health Mission

Table 79: Comprehensive List of Actions proposed under Health Mission

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	District wise inventory on water born and vector borne diseases with respect to weather variability	Department of Health	H	AD	S	RS	ST
2	Capacity building of all stakeholders on preparedness and rapid action on health context in situations of flash flood and earthquake	Department of Health	H	AD/MI	S	CB	ST
3	Research and study on impact of climate change on human health	Department of Health	H	AD	A	RS	MT
4	Construction of new hospitals with modern infrastructure and equipment's to cope up with climatic impacts on human population	Department of Health	H	AD	A	IP	MT
5	Modernization of existing hospitals and PHCs	Department of Health	H	AD	S	IP, OM	LT
6	Increase of surveillance – <ul style="list-style-type: none"> <li>• Systematic collection and analysis of data about vector borne diseases</li> <li>• Systematic collection and analysis of data about water borne diseases</li> <li>• Systematic collection and analysis of data about zoonotic diseases</li> </ul>	Department of Health	H	AD	S	RS	MT
7	Integration of GIS mapping for collection, analyze and share data and identification of spatial areas of high concern	Department of Health	H	AD	S	RS	MT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
8	Monitoring system - <ul style="list-style-type: none"> <li>to understand changes in pattern of diseases</li> <li>to deal with new diseases from emigrants (H1N1, H7N9 etc.)</li> </ul>	Department of Health	H	AD	S	PS, RS	ST
9	Facilitation of secured supply of water and electricity in the hospitals in extreme weather conditions / disaster	Department of Health	M	AD	A	IP	MT
10	Capacity building of Anganwadi and ASHA workers on health related issues of climate change	Department of Health	M	AD	S	CB	MT
11	Identification of high risk disaster zones	Department of Health	M	AD	S	RS	MT
12	Strengthening approaches to manage vector borne disease that have worsened due to climate change impacts	Department of Health	M	AD/MI	S	IP, CB	MT
13	Strengthening approaches to deal with the physical and psychological impacts due to extreme weather conditions caused by climate change	Department of Health	M	AD/MI	S	IP, CB	MT
14	Addressing drought, nutrition & food security due to increased risk of drought, consequent decline in agriculture and increased malnutrition & food security	Department of Health	M	AD	S	RS/PA	MT
15	Undertaking measures to manage water borne disease that have worsened due to climate change impacts	Department of Health	M	AD/MI	S	IP	MT
16	Establishment/ Up gradation of pathological laboratories for disease identification caused due to climate variations	Department of Health	M	AD	S	IP, OM	ST
17	Development of institutional framework and infrastructural facilities for early detection of vector borne diseases, including managing outbreaks	Department of Health	M	AD	S	RS/IP, PS	MT
18	Establishment of mobile health centre to provide medical facilities in far off areas during extreme climatic events	Department of Health	M	AD	S	DP/IP	MT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
19	Studying the inter linkages between air quality and climate change, and implications on health	Department of Health	L	AD/MI	S	RS	MT
20	Formulating Adaptation strategies to reduce the impact of climate change issues affecting human health	Department of Health	L	AD	S	PA/CB	ST
21	Research initiatives for changed patterns of diseases by region and by climate parameters	Department of Health	L	AD	S	RS	ST
22	Assessment of health impacts due to malnutrition- Research study on malnutrition of vulnerable groups due to food insecurity caused by climatic variations	Department of Health	L	AD	S	RS	ST

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term



## 17.10. Sustainable Himalayan Mission

Table 80: Comprehensive List of Actions proposed under Sustainable Himalayan Mission

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Baseline study of climate change impact on flora, fauna species and on glacial ecology	Department of Env. and forest	H	AD	S	RS	ST
2	Study on vulnerability of mountain ecology	Department of Env. and forest	H	AD	S	RS	ST
3	Community participation on protection and conservation of mountain ecology, terrestrial ecology and aqua-ecology	Department of Env. and forest	H	MI	S	IP, CB	LT
4	Capacity building and awareness for all levels of stakeholders	Department of Env. and forest	H	MI	S	CB	LT
5	Institutional development on biodiversity conservation and protection.	Department of Env. and forest	H	MI	S	CB	LT
6	Identification of climate grids and effect on forest and ecological resources	Department of Env. and forest	H	AD	S	RS	ST
7	Study on terrestrial and aquatic ecosystem	Department of Env. and forest	H	AD	S	RS	ST
8	Study on anthropogenic intervention on ecological hotspot	Department of Env. and forest	H	AD	S	RS	ST
9	Study of climate impact on migrated birds and their timings	Department of Env. and forest	H	AD	S	RS	ST
10	Identification of current status of Himalayan ecology and Climatic trend analysis for Himalayan ecology	Department of Env. and forest	H	AD	S	RS	ST

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term

## 17.11. Strategic Knowledge mission

Table 81: Comprehensive List of Actions proposed under Strategic Knowledge mission

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
1	Map & Analyze knowledge sharing process, flow, protocol and priority	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	H	AD	S	RS, CB	ST
2	Compile currently available information for assessment frameworks, methods and tools for climate impacts, decision support tools, good adaptation practices	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	H	AD	S	RS, CB	ST
3	Establishment of weather and climate data and easy access of data to climate researchers and end users of vulnerable community as well as livelihood sector	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	H	AD	S	RS, CB, DP	ST
4	Capacity building including developing of Training module and imparting through regional workshop	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	H	AD	S	RS, CB	MT
5	Develop & maintain online portal website	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	H	AD	S	RS, DP	ST
6	Organize annual forum, learning seminar, workshop and dissemination of knowledge based product	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	H	AD	S	RS, CB	MT
7	Develop and disseminate knowledge management tools ( like knowledge maps, electronic yellow page dictionaries, apprenticeship programmes, communities of practice, lectures and case studies, videos on best practices and web based learning	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	M	AD	S	RS, CB, DP	MT

Sl. No.	Title	Organizations	Priority	Type	Scale	Nature	Time Frame
8	Piloting training course for participating institutions and knowledge networks	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	M	AD	S	DP, CB	LT
9	Provide advisory services to knowledge network portals & participating institutions and to improve their access to adaptation finance mechanisms	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	M	AD	S	RS, DP, CB	LT
10	Establish Village resource and Village Knowledge Centers	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	L	AD	A	RS, DP, CB	LT
11	Promoting traditional adaptation knowledge and practices	Govt of J&K, SKUAST, J&K, University of Jammu, University of Kashmir,	L	AD	A	RS, DP, CB	LT

Priority H – High, M – Medium, L – Low;

Type MI - Mitigation, AD – Adaptation;

Scale S – State-wide, A – Particular / Focused Area

Nature RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance;

Timeframe ST – Short-term, MT - Medium Term, LT – Long term









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