BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI
Original Application No. 533 of 2024

IN THE MATTER OF:

NEWS ITEM TITLED "GANGES BRAHMAPUTRA BASINS TO FEEL IMPACT OF CLIMATE CHANGE: REPORT APPEARING IN THE MILLENIUM POST DATED 21.03.2024

N.D.O.H. – 18.03.2025

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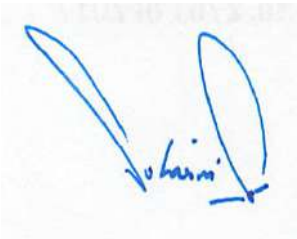

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New Delhi
Date: 17.03.2025

IN THE HON'BLE NATIONAL GREEN TRIBUNAL
AT NEW DELHI
IN
ORIGINAL APPLICATION No. 533 of 2024

IN THE MATTER OF:

NEWS ITEM TITLED "GANGES BRAHMAPUTRA BASINS TO FEEL IMPACT OF CLIMATE CHANGE: REPORT" APPEARING IN THE MILLENIUM POST DATED 21.03.2024

ADDITIONAL AFFIDAVIT ON BEHALF OF RESPONDENT NO. 3 THE MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE IN COMPLIANCE TO THE ORDER DATED 20.11.2024 PASSED BY THIS HON'BLE TRIBUNAL.

I, Mukesh Balodhi, S/o Shri D N Balodhi, aged about 42 years, currently working as Scientist 'E', having office at Ministry of Environment, Forest and Climate Change, New Delhi-110003 do hereby solemnly swear and affirm as follows:

1. That in my official capacity as stated above, I am aware of the facts and circumstances of the present case and am competent to swear to the contents of the present affidavit. I state that my knowledge in this regard is based on the official records available with the Ministry of Environment, Forests & Climate Change.
2. That in addition to the reply affidavit dated 19.11.2024 already filed on behalf of answering respondent, liberty was sought to place a copy of GIM and NAPCC through an Additional Affidavit. The same was granted vide

NOTARY KAVITA RAWAT DELHI Regd. No. 42999 Exp. Date : 19-02-2030 GOVT. OF INDIA

order dated 20.11.2024. Accordingly, the present Additional Affidavit is filed.

3. That vide order dated 20.11.2024 this Hon'ble Tribunal was pleased to *inter-alia* direct as follows:

> *4. Respondent no.3-MoEF&CC has also filed a reply affidavit dated 19.11.2024 disclosing the action that is being taken/proposed to mitigate the impact of climate change and the responsibility of MoEF&CC for National Mission for Green India (GIM) and the National Action Plan on Climate Change (NAPCC) has been prepared.*
>
> *5. Learned Counsel for MoEF&CC seeks short adjournment to place on record a copy of GIM and NAPCC.*

4. That the present affidavit is filed in respectful compliance to the above order of this Hon'ble Tribunal dated 20.11.2024. It is submitted that National Mission for a Green India (GIM) is one of the eight Missions outlined under the National Action Plan on Climate Change. It aims at protecting, restoring, and enhancing India's forest cover and responding to Climate Change by undertaking the Eco-restoration activities in the forest and non-forest areas. Accordingly, the Mission Document was prepared and the same has undergone periodic revision and updating. Further, following an exhaustive consultative process with the Chief

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Secretaries of the various States/Union Territories, detailed implementation guidelines were prepared by the Government of India and GIM activities were started in the FY 2015-16. A true copy of the Mission Document for the Green India Mission is annexed hereto as **ANNEXURE A-1.** A true copy of the Implementation Guidelines are annexed hereto as **ANNEXURE A-2.**

5. Further, as per the directions of the Sixth Executive Committee on Climate Change (ECCC) under the chairmanship of Principal Secretary to Hon'ble Prime Minister, the alignment of Missions under National Action Plan on Climate Change (NAPCC) with the NDCs commitment under the Paris Agreement was carried out and accordingly the revised Mission Document for GIM has been prepared by the Ministry with an ultimate objective to contribute towards creating additional carbon sink of 2.5 to 3.0 billion tonnes of CO_2 eq. A true copy of the updated Mission Document for the Green India Mission is annexed hereto as **ANNEXURE A-3.** A true copy of the National Action Plan on Climate Change is annexed hereto as **ANNEXURE A-4.**

6. Under the revised Mission emphasis is being laid on Reclamation/ Restoration Forestry to treat Open Forest and Non- Forest areas through focus on Soil and Moisture Conservation activities, Micro-ecosystems approach with prioritized intervention areas under the landscape, through adoption of regionally conducive best practice models, with an emphasis

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on saturating the landscape in synergy with the other afforestation schemes of the Central and the State Government.

7. That the present affidavit may kindly be taken on record to assist this Hon'ble Tribunal to pass appropriate orders in the present matter as deemed fit. That it is respectfully submitted the Respondent No.3 undertakes to file a further affidavit if so directed by this Hon'ble Tribunal.

M Balodhi

DEPONENT

Delhi D4240/23
I Identify the Deponent who has Signed/Put T.I. Before me

(मुकेश बलोधी)
(MUKESH BALODHI)
वैज्ञानिक 'ई'/Scientist 'E'
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
Min.of Environment,Forest and Climate Change
भारत सरकार, नई दिल्ली
Govt. of India, New Delhi

VERIFICATION

17 MAR 2025

Verified at on this day of 2025 that the contents of this affidavit based on official record(s) maintained and information available in the office are true and correct, no part of it is false and nothing has been concealed there from.

CERTIFIED THAT THE DEPONENT
Shri/Smt ..... Mukesh Balodhi
S/o W/o .....
R/o .....
Identified by Shri/Smt. .....
has Solemnly affirmed before me at delhi
on.....at Sl. No.....
that the contents of the affdavit which have been read & explained to me are true and correct to his/her knowledge.

NOTARY DELHI

NOTARY
KAVITA RAWAT
DELHI
Regd. No. 42999
Exp. Date : 19-02-2030
GOVT. OF INDIA

M Balodhi

DEPONENT

(मुकेश बलोधी)
(MUKESH BALODHI)
वैज्ञानिक 'ई'/Scientist 'E'
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Min.of Environment,Forest and Climate Change
भारत सरकार, नई दिल्ली
Govt. of India, New Delhi

17 MAR 2025

Annexure A-1

सत्यमेव जयते

जहाँ है हरियाली ।
वहाँ है खुशहाली ।।

Ministry of Environment and Forests
GOVERNMENT OF INDIA

NATIONAL MISSION FOR A GREEN INDIA

(Under The National Action Plan on Climate Change)

सत्यमेव जयते

GOVERNMENT OF INDIA

National Mission for a Green India

(Under The National Action Plan on Climate Change)

Ministry of Environment & Forests

जयंती नटराजन
Jayanthi Natarajan

सत्यमेव जयते

राज्य मंत्री (स्वतंत्र प्रभार)
पर्यावरण एवं वन मंत्रालय
भारत सरकार
नई दिल्ली–110 003
MINISTER OF STATE (INDEPENDENT CHARGE)
ENVIRONMENT & FORESTS
GOVERNMENT OF INDIA
NEW DELHI-110 003

Foreword

The National Mission for Green India (GIM) is one of the eight missions under the National Action Plan on Climate Change (NAPCC) launched in order to safeguard the country's biological resources and associated livelihoods against the perils of climate change, recognizing vital impacts of forestry on ecological sustainability, biodiversity conservation and food, water and livelihood security to the nation.

The Mission envisages taking a **holistic view on greening** that goes beyond tree planting to achieve carbon sequestration targets, and to take within its ambit a wide spectrum of activities encompassing biodiversity enhancement, ecosystems restoration and economic security of local communities at landscape level in the context of climate change adaptation and mitigation. The overarching objective of the mission is to increase forest/tree cover in 5m ha of land and improve quality of forest cover in another 5 million ha of lands. Thus, the mission will help in improving ecosystem services from 10 million ha of these lands, increase forest based livelihood income of about 3 million forest dependent households and enhance CO_2 sequestration by 50 to 60 MT in the year 2020. The mission proposes to have a decentralized participatory approach with involvement of grass root level organizations in planning, decision making, implementation and monitoring.

I am confident that the National Mission for Green India will go a long way in proving to be useful tool in the context of climate change adaptation and mitigation, encouraging people's participation in caring for the environment and forest resources of the nation and enabling them to improve the quality of life of the people living in and around forests of India.

Jayanthi Natarajan

(Jayanthi Natarajan)

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Executive Summary

A. Background

The National Mission for a Green India, as one of the eight Missions under the National Action Plan on Climate Change (NAPCC), recognizes that climate change phenomena will seriously affect and alter the distribution, type and quality of natural biological resources of the country and the associated livelihoods of the people. Mission for a Green India (henceforth referred to as Mission) acknowledges the influences that the forestry sector has on environmental amelioration though climate mitigation, food security, water security, biodiversity conservation and livelihood security of forest dependant communities.

GIM puts "greening" in the context of climate change adaptation and mitigation. Greening is meant to enhance ecosystem services such as carbon sequestration and storage (in forests and other ecosystems), hydrological services and biodiversity; as well as other provisioning services such as fuel, fodder, small timber and non-timber forest products (NTFPs).

The Mission aims at responding to climate change by a combination of adaptation and mitigation measures, which would help:

- enhancing carbon sinks in sustainably managed forests and other ecosystems;
- adaptation of vulnerable species/ecosystems to the changing climate; and
- adaptation of forest-dependant communities.

B. Mission Objectives

The objectives of the Mission are:

a) *Increased forest/tree cover on 5 m ha of forest/non-forest lands and improved quality of forest cover on another 5 m ha (a total of 10 m ha).*

b) *Improved ecosystem services including biodiversity, hydrological services and carbon sequestration as a result of treatment of 10 m ha.*

c) *Increased forest-based livelihood income of about 3 million households living in and around the forests.*

d) *Enhanced annual CO_2 sequestration by 50 to 60 million tonnes in the year 2020.*

C. Mission Targets (Outputs)

The Mission will have clear targets for different forest types and ecosystems which will enable achievement of the overall objectives of the Mission. The Mission targets 10 m ha of forest/non-forest lands and includes: a) qualitative improvement of forest cover/ecosystem in moderately dense forests (1.5 m ha), open degraded forests (3 m ha) , degraded grassland (0.4 m ha) and wetlands (0.1 m ha); b) eco-restoration/afforestation of scrub, shifting cultivation areas, cold deserts, mangroves, ravines and abandoned mining areas (1.8 m ha); c) bringing urban/ peri-urban lands under forest and tree cover (0.20 m ha); and d) agro-forestry /social forestry (3 m ha). The Mission also targets improvement of forest- based livelihoods for about three million households living in and around forests.

D. Key Elements of Mission Strategy

The key highlights of the Mission strategy are listed below:

- **Holistic view to "greening" (broader than plantations):** The scope of greening will go beyond trees and plantations to encompass both protection and restoration. Emphasis will be placed on restoration of degraded ecosystems and habitat diversity, for example, grasslands and pastures (more so in arid/ semi-arid regions), mangroves, wetlands and other critical ecosystems. The greening will not only strive to restore degraded forests, but will also contribute to protection and enhancement of forests with relatively dense forest cover.

- **'Vulnerability' and 'Potential' as criteria for intervention: Criteria for selection of project areas/ sublandscapes/sub-watersheds under the Mission will include projected vulnerability to climatic change, potential of areas for enhancing carbon sinks and the significance of the area from ecosystem services angle, such as biodiversity and hydrological services.**

- **Integrated cross-sectoral approach to implementation:** The Mission will foster an integrated approach that treats forests and non-forest public lands as well as private lands simultaneously, in project units/ sublandscapes/ sub- watersheds. Livelihood dependencies, for example firewood needs and livestock grazing, will be addressed using inter-sectoral convergence (e.g., animal husbandry, forest, agriculture, rural development and energy)

Key role for local communities and decentralized governance: Local communities will be required to play a key role in project governance and implementation. The Mission will bring primacy to Gram Sabha as an overarching institution to oversee Mission implementation at the village level. The committees set up by the Gram Sabha, including revamped JFMCs, CFM groups, Van Panchayats, Committees set up under Forest Rights Act, Biodiversity Management Committees etc., will be strengthened as the primary institutions on the ground for nested decentralized forest governance in rural areas. Similarly in the schedule VI areas, the traditional village level institution/Village Councils will be supported. The Mission will also support revamping/strengthening of the Forest Development Agencies to support the field institutions.

- **Cadre of Community Foresters: The Mission will invest in the development of a cadre of community-based change agents from amongst educated community youth. These community foresters will facilitate planning, implementation and monitoring of the Mission activities at the local level. This will provide skilled employment opportunity to about one lakh educated community youths.**

- **Robust and effective monitoring framework:** A comprehensive monitoring framework at four different levels is proposed. In addition to on-the-ground self-monitoring by multiple agencies, including communities, the Mission will support the use of modern technology like Remote Sensing with GPS mapping of plot boundaries for monitoring at the input /output/ outcome level. The Gram Sabha will carry out the social audit of the Mission activities at the village level.

- The Mission will identify research priorities in support of the Mission aims and objectives. The Mission will set up a cell under the overall guidance of MoEF to link to REDD Plus activities in the country.

The Mission will implement its strategy through a set of five Sub Missions and cross-cutting interventions.

E. Mission Organisation

At the national level, the Mission will be set up as an autonomous Society under the aegis of the MoEF to facilitate smooth implementation of the Mission.

The Governing Council of the Society, Chaired by the Minister for Environment and Forests, Government of India, and drawing upon cross-sectoral representation, will provide overall guidance. The Mission will be subjected to the highest degree of financial accountability and transparency.

A revamped State Forest Development Agency will act as the State Mission Directorate and will be chaired by the Chief Minister/ Forest Minister. It will solicit cross-sectoral representation and will guide the Mission activities at the State level.

At District level, the Mission implementation will be facilitated by revamped Forest Development Agencies (FDAs) and will link with District Planning Committee. The Gram Sabha, and the various Committees set up by it, will be the key institution for planning and implementation at the village level. A federation of these Committees along with a federation of self-help groups (SHGs)/ User Groups (UGs) at the cluster level will be represented in the revamped FDA at the district level. In urban areas, the ward level committees /RWAs linked to Municipality/Municipal Corporations will facilitate planning and implementation under the Mission.

F. Timeframe

The actual implementation period of the Mission will spread over 10 years, coinciding with the 12th and 13th five year plan periods. The preparatory phase of the Mission envisages institutional reforms, setting up of the Mission organisation, to get state action plans in place, identification of sub-landscapes/ areas for the Mission interventions, identification of partners, and awareness and capacity building in advance etc.

G. Resources

The total mission cost is estimated to be Rs 46,000 crores.

1.0 The Context

The National Mission for a Green India was announced by the Prime Minister as one of the eight Missions under the National Action Plan on Climate Change (NAPCC). It recognizes that climate change phenomenon will seriously affect and alter the distribution, type and quality of natural biological resources of the country. The NAPCC addresses the urgent and critical concerns of sustainable development and identifies the close linkage of the economy with its natural resource base, and cautions that climate-sensitive sectors such as forestry and agriculture may face a major threat because of the projected changes in climate. This will have repercussions on livelihoods of people in general, and forest-dependant communities in particular.

The Green India Mission therefore puts the "greening" in the context of climate adaptation and mitigation, aiming to enhance ecosystem services like carbon sequestration and storage (in forests and other ecosystems), hydrological services and biodiversity; along with provisioning services like fuel, fodder, timber and NTFPs.

2.0 Significance of the Mission

2.1 Significance of forests in relation to climate change

The Green India Mission recognizes the influences and potential that the forests and other natural ecosystems have on climate adaptation/mitigation, and food, water, environmental and livelihood security of tribal and forest dwellers specifically, and the nation at large, in the context of climate change. The Mission is therefore in a unique position to significantly contribute to sustainability of other missions for the following reasons:

2.1.1 Ameliorating climate: Over the past decades, national policies of conservation and sustainable management have transformed the country's forests into a net sink of CO_2 . From 1995 to 2005, carbon stocks stored in our forests are estimated to have increased from 6245 million tonnes to 6622 million tonnes thereby registering an annual increment of 37.68 million tons of carbon or 138.15 million tonnes of CO_2 equivalent[1].

2.1.2 Food security: Forests are essential for maintaining favourable and stable conditions needed for sustained agricultural productivity. In Nayagarh, Orissa, maintaining agricultural productivity is one of the key reasons for forest protection by the community[i]. According to a study by Nadkarni[2], as much as 50% of the productivity of paddy fields in the Western Ghats is actually attributed to leaf litter collected from the forests. Organic matter is essential to maintain the fertility, structure and water-holding capacity of soils in the high rainfall region. Forests provide food directly in the following categories: fruits, flowers, leaves, stems, seeds, roots, tubers, mushrooms, etc.,

2.1.3 Water security: Forests are vital for maintaining the hydrological cycle and regulating water flows and sub-soil water regimes, recharging the aquifers and

[1] Jagdish Kishwan, Rajiv Pandey and VK Dadwal. 2009. India's Forests and Tree Cover : Contribution as a Carbon Sink , Technical paper. Indian Council of Forestry Research and Education, Dehradun,

[2] MV Nadkarni with SA Pasha and LV Prabhakar. 1989. The Political Economy of Forest Use and Management. Sage Publications, New Delhi.

maintaining the flow of water in rivers and rivulets. However, the relationship between forests and water flows, especially the low base flows, is not always as straight forward as often believed. [ii]Forest ecosystems are the source of a large number of rivers and rivulets in the country. The forested watersheds have better availability as well as quality of water than watersheds under alternative land uses. For example, the Shimla catchment forest was established in the early 20th century exclusively for securing the catchment and to protect 19 springs and streams that provided drinking water supply for Shimla town, the summer capital of British India. It comprises more than 1000 ha of very dense forest.

2.1.4 Livelihood security of local communities: Forests provide a range of provisioning services, particularly fuel wood, fodder, small timber, NTFP and medicinal plants, and artisan raw material like canes and bamboo, that are crucial to livelihood security of forest-dependant communities. Nearly 27% of the total population of India, comprising 275 million rural people, depends on forests for their livelihoods. This number includes 89 million tribal people, who constitute the poorest and most marginalized section of the country. NTFP sector with an annual growth rate between 5-15% also contributes to 75% of the forest sector export income.

2.2 Forests and Climate Change: Key challenges

The Mission acknowledges challenges on account of the demand and supply gap of various provisioning services from forests, particularly fuelwood, fodder/grass/grazing, timber, cane/ bamboo, NTFP etc., creating unsustainable pressure and contributing to degradation of forests and ecosystems. The productivity of Indian forests is low as compared to the world standards, worsening the gap between demand and supply of various forest products.

Through the scientific modeling done using RCM (Regional Climate Model) and BIOME model (BIOME 4), it is projected that nearly 77% and 68% of the forest grids are likely to be impacted by climate change leading to shifts in forest types in A2 and B2 scenario[3]. Use of the dynamic global response model IBIS (Integrated Biosphere Simulator) predicts the percentage of forested grids expected to undergo vegetation change range from 3.5% in the North-Eastern states to 73% in Chhattisgarh[4]. Already challenged forest eco-systems[iii] will become much more vulnerable to the adverse climatic conditions. The forests would be vulnerable on account of the altitudinal and latitudinal shift of the species of the forest ecosystems and also on account of increased occurrences of fire, pests/diseases, invasive species, change in species assemblage/forest type, forest die-back and loss of biodiversity.

As a result, forest-dependant livelihoods may get severely affected, especially of women who depend on fuel, fodder and food from forests, thus enhancing vulnerability of forest-dependant communities.

3.0 Mission Goal, Objectives and Outputs

3.1 Overall Goal:

The Mission aims at responding to climate change by a combination of adaptation and mitigation measures, which would help enhancing carbon sinks in sustainably managed forests and other ecosystems, adaptation of vulnerable species/ecosystems, and adaptation of forest-dependant communities.

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[3] NH Ravindranath, NV Joshi, R Sukumar and A Saxena.2006. Impact of Climate Change on forests in India, Current Science, Vol. 90: 354-361.

[4] RK Chaturvedi, ,Ranjit Gopal Krishnan, Mathangi Jayaraman, G Bala,, NV Joshi, R Sukumar and NH Ravindranath. (in print) , Impacts of climate change on India's forests : a dynamic vegetation modeling approach, Mitigation and Adaptation Stratagies of Global Change

3.2 Mission Objectives

3.2.1 Increased forest/tree cover on 5 m ha of forest/non- forest lands and improved quality of forest cover on another 5 m ha of non-forest/ forest lands (a total of 10 m ha)

3.2.2 Improved ecosystem services including biodiversity, hydrological services, carbon sequestration from the 10 m ha of forest/non-forest lands mentioned above at 3.2.1

3.2.3 Increased forest-based livelihood income of about 3 million households , living in and around the forests

3.2.4 Enhanced annual CO_2 sequestration by 50 to 60 million tonnes in the year 2022 .

3.3 Mission Targets (Outputs)

3.3.1 The following targets will contribute towards achievement of the overall goal/outcomes of the Mission:

- Improvement in quality of forest cover and ecosystem services of forests /non-forests, including moderately dense, open forests, degraded grassland and wetlands (5 m ha).
- Eco-restoration/afforestation of scrub, shifting cultivation areas, cold deserts, mangroves, ravines and abandoned mining areas (1.8 m ha).
- Improvement in forest and tree cover in urban/peri-urban lands (0.20 m ha)
- Improvement in forest and tree cover on marginal agricultural lands/fallows and other non-forest lands under agroforestry /social forestry (3 m ha)
- Management of public forest/ non-forests areas (taken up under the Mission) by the community institutions[5].
- Adoption of improved fuelwood-use efficiency and alternative energy devices by project-area households.
- Diversification of forest-based livelihoods of about 3 million households living in and around forests.

4.0 The Core Principles

4.1 The first charge on the forest/ecosystem goods and services would be that of the local communities, as mandated in the National Forest Policy (NFP) of 1988. Public forest lands which serve as the life-sustaining resource base for the rural communities shall remain in the public domain so that the benefits accrue to all sections of society.

4.2 The Mission would contribute to empowerment of communities and strengthen the decentralized local governance of forests. The Mission would support revamping of the existing institutions and working with plurality of institutions at the local level to strengthen decentralized forest governance.

[5] Community institutions refer to institutions mandated by Gram Sabha at the the village level (see section/para 5.4.1 for details)

4.3 Traditional Ecological Knowledge of communities, along with forestry science and state-of-the-art technology would improve the Mission interventions.

4.4 The scope of greening will not be limited to just trees and plantations; emphasis will be on restoration of ecosystems and habitat diversity, for example grasslands and pastures, degraded forest ecosystems, mangroves, wetlands and other critical ecosystems.

4.5 The Mission will provide for adaptation/ mitigation measures that enhance ecosystem goods and services, particularly carbon stocks, water, and meet biodiversity conservation and livelihood security needs. While attempts will be made to synergize adaptation and mitigation needs, local communities will be required to play a key role in prioritizing the range of ecosystem goods and services, that they value most, through a process of informed decision-making.

4.6 Monocultures and habitat fragmentation are known to increase vulnerability. The Mission will therefore focus on restoration of native biodiverse species mix at the landscape level.

4.7 The Mission acknowledges the forces of de-greening operating across the country. It will be critically important that the Mission relates with processes that halt "de-greening".

5.0 Mission Strategy

5.1 Overall Strategy

5.1.1 Livelihood dependencies of local communities such as livestock grazing, firewood and NTFP collection from forests are best addressed in an integrated manner that treats forests and non-forest public lands as well as private lands simultaneously in a given bio-physical unit, for example, landscape[vi]/ sub-landscapes/ sub-watershed/ micro-watershed/clusters etc. For instance, livestock grazing in forests could be effectively addressed by securing enhanced fodder availability, using integrated approach across forests/ grasslands/ agro-ecosystem, along with provision of rotational and deferred grazing in forests as per their carrying capacity. This would require engagement of the Forest Department, Animal Husbandry, Agriculture and Rural Development Departments, and marketing federations, working in tandem with the community and farmers.

5.1.2 The Mission will promote integrated actions at a) the village level, b) at a cluster of villages in and around contiguous forest/ sublandscape/ sub-watershed, and c) the landscape level. Securing overlap of

Box 1 Adaptation Measures across Sub-Missions

Some of the key adaptation measures that would be factored in across various Sub Missions include: Effective fire prevention and fire management, weed management, sustainable harvesting of timber and non-timber products, securing corridors for species migration across Protected Areas (PAs), reduced forest fragmentation by conserving contiguous forest patches (use of landscape/sub-landscape approach), anticipatory planting of species across latitudinal and longitudinal gradient, adoption of short-rotation species, promotion of natural regeneration and mixed species planting, development of drought and pest resistance in tree species and improving overall hydrological regime.

watershed units like micro-watershed/ sub-watershed over forest cover would help maximize opportunities for convergence with the watershed program. However, village- or hamlet-based integrated planning and implementation will be the basic unit of operation, supported by planning at higher spatial level, that is, the cluster/sub-watershed/sub-landscape level.

Development of the micro-plans will be central to the Mission activities at the village level. Preparation of the Micro Plan will be facilitated by a planning support team .Such support will be available at the level of a cluster of villages/ sub-watershed/ sub- range level.

5.1.3 Criteria for selection of project areas/ sub-landscapes/ subwatersheds under the Mission would include projected vulnerability to climate change. Indian Institute of Science has defined seven vulnerability classes by spatially combining information on forest diversity (monoculture versus natural forest), forest density (an indicator of degradation) and IBIS vegetation type change estimates for the forest grids under A2 scenario[vii]. The vulnerability maps thus prepared will provide useful criteria for selection of areas under the Mission. The other equally important criteria for area selection would include corridors, critical biodiversity habitats and ecosystems, important groundwater/ spring recharge catchments, and potential of areas for enhancing carbon sinks etc. The State of Forest Report[6] provides statewise details of forest area that is devoid of forest cover and could be brought under green cover. This could be an added criterion for area selection. Rural poverty and scheduled areas could be taken as additional criteria while prioritizing the areas under the Mission.

5.1.4 Measures to support adaptation of species and ecosystem to climate change variability would be factored in across the various Sub-Missions.

5.1.5 The Mission will add "value" to ongoing programs/schemes on "greening" being taken up by multiple agencies. Such value addition will come through a) technical inputs on species mix from climate adaptation/mitigation angle, b) improved policy regime to help multiple agencies plant, protect and manage forests and tree growth, and c) advisory services for benefits under REDD Plus/ CDM and would include support in outcome-level monitoring.

5.1.6 The Mission will provide incentives to communities and other agencies to protect and manage forests sustainably, through enhanced tenure security and benefit-sharing arrangements. Creating community stake in regeneration of forests/restoration of ecosystems under the Mission will require that communities have sufficient stake in terms of enhanced biomass, NTFPs and environmental services like water recharge and surface flows, biodiversity and carbon benefits from such areas. Community driven innovative/adaptive silviculture[viii] is of critical importance to successfully implement mitigation/adaptation strategies in restoration of forest/ecosystem.

The Mission would strengthen local level planning and management for forest/ecosystem restoration across Sub Missions.

5.1.7 The Mission acknowledges the crucial role of women in forest conservation, its sustainable use and equitable benefit sharing. The Mission will not only seek greater role of women in planning and execution of various Mission interventions, more importantly, it will engage women in decision making at various level.

5.2 Sub Missions

The following five Sub Missions, integrating adaptation/mitigation measures and corresponding to the Mission targets outlined in section 3, are detailed below. Sub Mission 1 and Sub Mission

[6] Forest Survey of India, State of Forest Report, Ministry of Environment and Forests, Dehra Dun.

5, with an estimated area of 5 m ha, would lead to a qualitative improvement of forest/other ecosystems (including quality of forest cover in case of forest ecosystem); Sub Missions 2, 3 & 4, adding another 5 m ha, would contribute to increasing the forest cover. However, the Mission interventions will enhance ecosystem services, particularly biodiversity, CO_2 sequestration and hydrological services across all five Sub Missions. The physical targets under various Sub Missions are indicative which may change based on the State Action Plans and State-level specificity. Eco-restoration/afforestation of public lands will have a maintenance component of seven years.

Ravindranath and Murthy (personal communication, 2010) have estimated the incremental annual mitigation potential of the Mission interventions to about 55 $MtCO_2$ in the year 2020, using moderate to conservative carbon accumulation rates. Sub Mission-wise details have been shown in Annex-2. These estimates exclude emissions resulting from harvest and disturbance. Thus the forest sector can significantly contribute to reducing GHG emissions in India in the coming years.

Sub Mission 1: Enhancing quality of forest cover and improving ecosystem services (4.9 m ha)

Ecosystems/landscapes prioritized under this Sub Mission will include a mosaic of forest/non-forest areas representing diversity in forest density, tenure and ownership. Assuming that within prioritized landscapes the total area under open forests would be twice that of moderately dense forests, an estimated area of 4.5 m ha (1.5 m ha of moderately dense forest and 3 m ha of open forests) will be treated under the Sub Mission. Another 0.4 m ha of grasslands will also be covered under the Sub Mission. Canopy density class/ecosystem- wise details are provided below:

a) Moderately dense forest cover, but showing degradation: 1.5 m ha

Though recorded as moderately dense cover[ix], many of these forests/ecosystems are subjected to degradation on account of recurrent fire, unregulated grazing, invasive species, shifting cultivation and illicit felling etc. Conservation and sustainable management of these forests has the potential to provide both mitigation (by reducing emissions from degradation) as well as adaptation benefits. Better protection, fire management (both prevention and detection and control), regulated grazing, invasive species eradication, management of insects and other pathogens, improving hydrological regime through infiltration zone identification and protection, soil/ moisture conservation (on ridge to valley basis) would form some of the key interventions. Sustainable management of these forests would lead to increase in stocking density, enhanced biomass and carbon stocks, along with flow of forest goods like NTFPs, fuelwood, small timber/timber for direct livelihood benefits to dependant local communities.

b) Eco-restoration of degraded open forests: 3 m ha

Presently open forests, mostly on the fringes of villages, with crown density between 10-40%, constitute 28.84 million ha (State of Forest Report 2009)[7] . Most of these forests are subjected to intense biotic pressure and unsustainable removals. These lands have immense potential for meeting the fodder, fuelwood, small timber, NTFP requirements of the dependent village

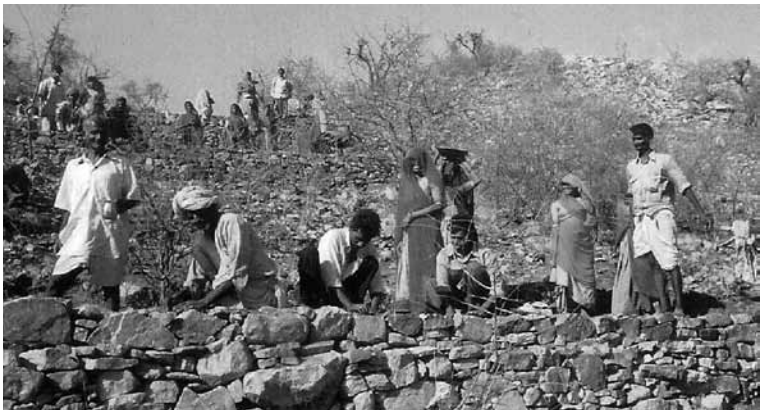
[7] Forest Survey of India. State of Forest Report 2009, Ministry of Environment and Forests, Dehra Dun.

communities while enhancing water recharge and the carbon sinks substantially.

Broadly, three types of open degraded forests are envisaged: i) Type A with plenty of root stock, with little or no scope for planting, ii) Type B with open blanks having limited root stock, and iii) Type C largely open areas with sparse undergrowth

Type A area (1.80 m ha): Closure to grazing on rotational basis, soil and moisture conservation (SMC) works on ridge to valley basis, Cut Back Operations and very limited planting in gaps during second / third year may be possible. Management of these areas, as per approved Micro Plan, would be vested with community institutions. Multiple shoot cutting, singling, thinning in successive years has the potential to benefit local communities on a regular basis. These areas are meant to meet local needs of firewood, small timber, grass /fodder, bamboo, NTFPs, etc. Species like bamboo are known to provide huge benefits from both the mitigation and adaptation angles[8]. Regeneration and sustainable management of these forests would allow the creation of carbon sinks, would lead to an improvement in the water regime and to the restoration of biodiversity.

Type B areas (0.60 m ha): Closure to grazing, soil and moisture conservation works; focus on in-situ moisture conservation, rainwater harvesting, and run-off reduction activities on ridge to valley principle; regeneration of root stock and planting of indigenous grasses and shrubs will be priority agenda. Plantation of species of: fuelwood (short rotation), fodder, NTFPs, artisanal raw material and small-timber-yielding species will be promoted on *multi layered basis*. Planting of bamboo in suitable areas will be encouraged. The ecological status and carrying capacity of the site, and the need to maintain a balance between evapotranspiration and run off, and recharge of downstream aquifers by percolation, will be factored in.



Type C (0.60 m ha): These are largely open areas with sparse undergrowth.

In addition to SMC work as per Type B areas, these areas are suitable for afforestation of native fast-growing species. Investment in site preparation would be higher compared to type A and B areas. Initially it may be useful to plant leguminous species to improve the site quality which can subsequently pave the way for multipurpose species. Current examples of a such model use up to 1100 plants /ha.

In all, 3 m ha under open degraded forests will be taken up under the Sub Mission within prioritized landscapes/sub-landscapes, across bio-geographic zones with varying degrees of productivity This would include 1.4 m ha proposed under fringe forest/ non-forest land development project[9].

c) Restoration of Grasslands: 0.4 m ha

Grasslands are often highly degraded ecosystems, and are recognized primarily as a resource for promoting animal husbandry. Native palatable species of grasses grown either by themselves or in combination with shrubs/trees of fodder value could restore these ecosystems. These lands, though predominantly located in arid or semi-arid zones, are also found in wet areas. Eco-restoration of

[8] Bamboo: Roles in climate change, carbon sequestration and poverty alleviation under the Clean Development Mechanism of the Kyoto Protocol; International Network for Bamboo and Rattan, available at http://www.inbar.int/Board.asp?BoardID=331

[9] A Project of National Rainfed Authority of India (2009), prepared in consultation with MoEF, titled "Simultaneous Treatment of Fringe Forest and Adjoining Non Forestlands for Conservation of Water, Bio-diversity, and Poverty Alleviation".

these grasslands would render them as a good resource for animal husbandry. Effective protection, soil and moisture conservation work, seeding/slip-planting of native grasses and legumes, and good management practices such as deferred/ rotational grazing (within the carrying capacity) would be of great value in restoration of such ecosystems. This could be supported by improved animal health services and, where feasible, improvement of livestock quality based on indigenous improved breeds, and reduction in the number of nondescript animals, improvement in marketing of animal products etc.

Sub Mission 2: Ecosystem restoration and increase in forest cover (1.8 m ha)

a) Rehabilitation of Shifting Cultivation areas: 0.6 m ha

The total area under shifting cultivation, or *jhum*, is 1.2 m ha, of which current *jhum* constitutes 0.56 m ha and abandoned *jhum* constitute 0.46 m ha (Wasteland Atlas of India 2010)[10] . The area under *jhum* cultivation had come down from 1.87 m ha in 2003 to 1.2 m ha in 2005-06. This is further corroborated by an increase in forest cover in three states in the North East (SFR 2009) on account of management of shifting cultivation areas under different agrohorti-forest systems. A combination of socio-cultural, legal and bio-physical characteristics of shifting cultivations in a given location lends uniqueness to shifting cultivation. Although Alder based agro-forestry in the shifting cultivation areas in Nagaland has been successful, monocultures need to be guarded against pest attack and vulnerability to market risk. Optimum utilization of indigenous knowledge based on multiple species must be factored in any jhum management[11].

The Mission will support fallow land management within the overall framework of socio-culturally valued, fast-growing species managed by the community. Services of agronomy and silvicuture experts along with community indigenous knowledge will be put to maximum use for fallow-management under the Mission. Learnings from existing *jhum* management models, both community-driven and those supported by the project/ agencies, will be used.

b) Restoring Scrublands: 0.8 m ha

These are highly degraded forest/non-forest areas with scrub vegetation recording less than 10% forest density. Currently these areas are virtually devoid of vegetation. Most such areas serve as grazing grounds after the monsoon and are prone to soil erosion.

Soil and moisture conservation measures including ridge to valley check dams, Continuous/ Staggered Contour Trenches (CCTs), closure to grazing and seeding of native grasses/legume species helps in eco-restoration of such areas. Afforestation of such areas through multipurpose native species should be considered after two to three years of closure and improvement in soil/ moisture regime. Once rejuvenated, these areas can become an important source of grass/fodder, fuelwood, bamboo, small timber, medicinal plants, recharge of streams and groundwater, and carbon sinks. The Sub Mission will ensure community management of such areas.

c) Restoring/Planting Seabuckthorn: 0.1m ha

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[10] Government of India. Wasteland Atlas of India 2010., , Ministry of Rural Development, Department of Land Resources, New Delhi, & National Remote Sensing Centre, ISRO, Hyderabad

[11] MoEF (2008) Report of National Task Force for Rehabilitation of Jhum (Shifting Cultivation) Area; Ministry of Environment and Forests, Government of India, New Delhi.

Seabuckthorn (Hippophae rhamnoides L.), popularly known as Leh berry, indigenous to the high altitudes it grows widely in the Himalayan region. The plant is hardy, can withstand extreme temperatures from -43°C to +40°C, and is considered to be drought resistant. The potential of Seabuckthorn in combating global warming, environmental conservation of high altitude areas of the Indian Himalayas, in health care and poverty alleviation has led to its declaration as a priority species for afforestation on marginal forest landsx. Being a nitrogen-fixing deciduous plant, it can be used for commercial purposes as well as for environmental protection, especially through afforestation.

Afforestation of Seabuckthorn in suitable areas in the States of Himachal, J & K, Uttarakhand and Sikkim will be taken up under the Mission. A pilot project on development of the value chain of Seabuckthorn would be taken up for further research, extension, technology intervention and establishment of a National Initiative on Seabuckthorn. The Defence Institute of High Altitude Research (DIHAR), Leh, will be the nodal laboratory for R&D activities on Seabuckthorn.

d) Restoration of Mangroves: 0.10m ha

Mangrove vegetation is spread over 4,639 sq km or approximately 0.4 m ha, of which 30% is categorized as very dense; 35% as dense and 34% as open mangrove forest. Mangrove and coastal ecosystems deserve special conservation efforts as these ecosystems save lives and property from natural calamities such as cyclones, storm surges and erosion, and are the breeding, feeding and nursery grounds for many estuarine and marine organisms. Unfortunately, these areas are used for captive and culture fisheries often to the detriment of the mangrove ecosystem.

Andaman and Nicobar Islands present a unique situation where following the tsunami of 2004, upliftment of land in the northern islands and sinking of land in the southern islands has taken place. As a result some luxuriant mangroves in north Andamans are drying up on exposed lands which lack inundation by sea water. These areas therefore will need to be treated in a different manner. Planting of littoral species and mangrove associates to restore vegetation cover of indigenous species will be taken up. Development of artificial channels in uplifted areas to facilitate inundation by sea water and restore mangrove through planting of mangrove species along the channels will be taken up. These measures will not only restore mangrove ecosystem but will help immensely in boosting the local economy which is based primarily on fishing and collection of marine resources in the mangrove areas.

The target of 0.10 m ha of mangrove restoration will primarily involve lands which were mangroves historically but are not under mangrove vegetation now. Along with protection/restoration of mangrove ecosystems, patches of biodiversity-rich habitats in the coastal, riverine and deltaic belt would also get protection.

e) Ravine Reclamation: 0.10 m ha

The total area under ravines is 2.75 m ha (Wasteland Atlas, 2010) in four states, namely, Uttar Pradesh, Madhya Pradesh, Gujarat and Rajasthan. Ravines eat into farms and villages affecting the poorest the most as they have no wherewithal to move out of these areas. These hapless people continue to suffer and become victims of ecological privations in the region.

Priority should be to stop further ingress of

ravines into the non-ravine farmland by using the time-tested method of *dor bandi*[xi] (closing the ravine head). This should be matched with tackling the shallow gullies (2 to 5 meters in depth) by resorting to earthen bunds. Farmers' collective quest to reclaim the land lost to shallow gullies needs to be supported by the Mission. Ravines on revenue and forest land abutting the farmlands could best be tackled by a building a relatively big Bund at the tail end to serve as a percolation dam as well as, to a limited extent, for water storage. The bunds could be stabilized by using a range of indigenous and useful grasses of high economic value. A higher moisture regime around earthen dams would allow good growth of Vetiver species as well as enhanced density of medicinal climbers like Asparagus, Giloy and conservation of the wild population of Guggal (Commiphora wightii). Planting of indigenous species of Acacia, Dalbergia etc., are known to give encouraging results.

f) Restoration of abandoned mining areas: . 0.1 mha

It is estimated that the total land under mining in India is 7,548,61 ha, of which 6,20,372 ha is being mined for major minerals, involving 9131 mining leases; and 0.13 m ha is being mined for coal by the public sector. While minor minerals sector is dominated by small and medium mine leases, mining of fuel mineral is dominated by large-scale public sector mines, and of metallic minerals by large-scale private sector mines. Mines are often abandoned before proper closure. There are 296 abandoned mines (orphan mines) of major minerals and 214 abandoned coal mines taking the total number of abandoned mines to 510. Mine closure plan was made a statutory requirement only in 2003, but a review of 36 closure plans has brought out its gross inadequacy.

The Mission will therefore work in tandem with Ministry of Mines to ensure eco-restoration of abandoned mines based on the polluter pays principle, and will use lessons from some of the best practice cases.

Sub Mission 3: Enhancing tree cover in Urban and Peri-Urban areas (including institutional lands): 0.20m ha

India has been experiencing an unprecedented pace of urbanization since the 1990s. Today, with 310 million people living in India's cities, every fourth Indian is a city dweller. It has been estimated that by 2030, more than 40% of India's population will be living in urban areas, and by 2045, India's urban population would be 800 million. Urban forests have been providing ecological services as well as supplying fuelwood to the urban poor. The National Sample Survey, in 2006, estimated that 21% of urban households use fuelwood as their primary source of cooking. Increase in urbanization, however has also meant deterioration of air quality, increase in air temperature, noise level, and water and land pollution. Urban forests emerge as an exciting opportunity to help a) mitigate climate change, b) ameliorate air pollution c) improve the overall water regime, d) nurture urban biodiversity and e) provide shade and reduce ambient temperatures and the heat-island effect. It is estimated that the total carbon stored by trees in urban areas is 23.89 million tonnes from an estimated 7.79 million ha urban area.[12] Thus, there is ample scope to increase the contribution of urban forests to overall carbon stocks.

[12] Saibal Das Gupta , Rajesh Kumar & Prakash Lakhchaura. 2008. Urban Trees for Combating Climate Change, Geography and You, Vol 8, Sep- Oct; Special Issue on Climate Change in India

The Mission will support urban greening by various interventions, categorising urban forests in the following broad categories:

i **Recorded or notified forest patches** which are threatened by expanding urban/industrial development. Such notified forest patches in urban and especially in peri-urban zones will be secured by appropriate fencing (wall or a combination of wall and wire mesh); restoration of representative ecosystems and plantation of biodiverse species mix to supplement natural regeneration. Special care will be taken to retain the natural local mix of grasses, herbs and shrubs along with tree species.

ii **Open spaces/green spaces like parks/wood lots** set up on municipal land will be supported to enhance their biodiversity status.

iii **Diffused planting such as on avenues and in households:** The Mission will support plantation of multiple species.

iv **Institutional lands,** especially lands belonging to or allotted to business/industrial houses and educational institutions will be supported for taking up planting of native species having multiple values for users.

Overall Strategy: It is recognized that due to high real-estate values, existing open patches of vegetation face extraordinary threats in urban and peri-urban areas. Thus, identifying and marking boundaries coupled with zoning of such areas is of utmost importance. Such high threat and vulnerable areas should be secured. Other measures will include encouraging the setting up of local users' or citizens' groups to oversee maintenance, regulation of access etc.; linking green spaces, including urban wetlands, and environment education programs by development of outreach initiatives, nature trails and interpretation activities wherever possible; making development of additional green spaces an essential and integral component of programs and schemes aimed at urban renewal and redevelopment; increasing manpower for watch and ward, setting up of mobile forces and legal services to combat encroachments, waste dumping, land grab and other threats.

The Mission will solicit the engagement of an array of institutions to support greening in urban/ peri-urban areas for which detailed guidelines will be developed. Corporate sector/business houses will be encouraged to support such endeavors.

Improved amenities for urban dwellers, soil and water conservation, biodiversity conservation and improved habitats for resident and migratory wildlife would be some of the significant benefits.

Sub Mission 4: Agro-Forestry and Social Forestry (increasing biomass and creating carbon sink): 3 m ha

India is estimated to have between 14,224 million to 24,602 million trees outside forests, spread over an area equivalent of 17 m ha, supplying 49% of the 201 million tonnes of fuel wood and 48% of the 64 million m^3 of timber consumed annually by the country (Pandey D.N., 2007). Total non-forest land in the country is 255 m ha, which includes fallow land (both current and permanent fallow). Non-forest land provides ample opportunity to increase forest cover, meet the needs for forest produce and create carbon sink. Non-forest lands to be supported under the Mission will include marginal farming lands/ fallow lands, trees on non-agricultural rural lands like homesteads, school yards, compounds of various offices, and private/public establishments, public spaces, roadsides, along canals, etc. The Mission will support a massive program of forestry on non-forest lands with participation of the community, farmers, NGOs, private sector, institutions, government agencies and the Forest Department. The Mission will not support any diversion of productive agricultural

land under this component. Moreover, the species selection for agro-forestry/social forestry would be centered around farmers preference for multipurpose species

Reliable and sufficient data is available to indicate that a) there are sharp variations in productivity of plantations of agro-forestry species across the length and breadth of the country and b) productivity of tree crops on agricultural lands in India is much lower than the same achieved in many other countries (e.g., Brazil and Indonesia). This seriously undermines the real potential of agro-forestry/tree farming in India to the detriment of the farmers as well as to efforts to divert pressures away from areas under natural forest cover.

The Mission will support a program of nurseries for raising of "quality seedlings" to meet the demands of farmers, including transportation to villages to provide easy reach and supply in an energy efficient manner. Quality Seedling Production(QSP) and transportation could be taken up by the private sector/farmers/women's SHGs on a competitive basis, with backup support from the Forest Department, research institutions and private sector agencies currently engaged in this field. The quality seedling so produced would be provided to farmers at a subsidized price for which the Mission will provide the subsidy. The Mission may also consider dovetailing institutional financial support to farmers to go in for farm-forestry on their fallow lands/unproductive lands.

Backed by the Forest Department or the private sector, farmers have proved to be the best extension agents. The Mission will provide support for setting up of Farmers Field Schools or models on farmers' fields for a cluster of villages as learning and demonstration units.

Agro-forestry systems can continue to act as sinks even after harvesting, if harvesting is accompanied by regeneration. The sink is further improved if the life of wood is further increased by proper treatment, leading to substantial increment in the locking period. The Mission would examine the possibility of providing support to such post-harvest practices. The Mission will also support putting in place a system for certification of seed and genetically improved clonal planting stock and/or registration of clones and nurseries in India. Accreditation of the nurseries will be accorded high priority. The Mission will help in revamping /supporting the Social Forestry directorates/wing of the State Forest Department.

In all, 2.30 m ha of private land, 0.10 m ha of shelter belt and 0.60 m ha on the side of roads, canals and on other institutional lands including areas available in schools and colleges will be targeted under the Sub Mission.

Sub Mission 5: Restoration of Wetlands: 0.10m ha

India has a total of 67,429 wetlands, covering an area of about 4.1 million hectares[13]. Of these, 2,175 are natural and 65,254 are manmade. Of the 1,712 wetlands declared globally as protected Ramsar sites, 25 are in India and cover 677,131 hectares in 14 states.

Wetlands provide livelihoods to local communities; more importantly, the ecosystem services which they provide, such as recharge of groundwater, are of great significance to local communities.

[13] Ministry of Environment and Forests (MoEF), 1990.

Wetlands host hundreds of species of migratory and local birds, fish, amphibians, insects, plants and trees. With the capacity of wetlands to store large quantities of water after heavy rainfall and release this gradually in a stable flow, wetlands, like marshes and lakes, have proved to be key areas to help the world to adapt to climate change impacts. Moreover, they help control floods, stabilize shorelines and mitigate climate change.

Wetlands today are a threatened ecosystem owing chiefly to encroachments, change of land use, infrastructure development, pollution, growth of invasive species and over-fishing.

Wetland ecosystems are high on soil carbon (peat). Loss of wetlands means losing carbon-rich organic peat soil, loss of biodiversity and of livelihood opportunities for local communities.

The Mission will provide support in developing systematic wetland inventories at desired spatial and temporal scales. In addition, wetland catchment conservation including treatment of catchment areas, support to compatible land-use practices, fencing of strategic areas to protect wildlife and control encroachments, control of invasive weeds, pollution control measures, water quality monitoring, and community-based ecotourism enterprises would be some of the key interventions.

Restoration measures will be so carried out that they will cause least disturbance to wetland habitats, more so at the margins that provide transition zones or ecotones. Efforts will be made to restore the drainage system and links across neighboring wetlands, in order to recreate natural flow for recharge of the wetlands. Carefully selected aquatic species will be planted on the banks and islands. Local communities would be encouraged to continue with compatible use of wetlands and seek new opportunities for livelihood enhancement (e.g., ecotourism). Coastal wetlands will also be identified for protection.

Priority will be given to those wetlands that have a high value as habitats for animal, bird and plant life, in order to achieve biodiversity conservation along with livelihood improvement and carbon benefits.

5.3 Cross-cutting Interventions:

5.3.1 Improving fuel-use efficiency and promoting alternative energy sources: The energy security and carbon emission reduction objectives will be through energy efficient devices and alternative energy sources. Primary targets will be areas burdened with unsustainable harvesting and use of fuelwood. Promotion of alternative energy devices such as biogas, solar devices, biomass-based energy and expansion of services for cleaner cooking fuels like LPG in rural areas, improved fuel-efficient stoves etc. would help in reducing pressure on forests, gaining carbon benefits, along with health and other associated benefits.

The sub-component would be technically and financially strengthened in convergence with MNRES and other partner agencies. The program will be implemented in all areas where forest/ecosystem conservation/restoration work is undertaken under the Mission.

5.3.2 Community Livelihood Enhancement: The Mission interventions outlined above will create both wage employment and skilled employment opportunity for households. It is estimated that the interventions

under various Sub Missions will generate 2400 million person days of wage employment costing about Rs 24,000 crores. Additionally, over one lakh community youths will get skilled employment opportunities, costing approximately Rs 4800 crores.

The Mission is expected to substantially enhance forest-based biomass in the form of food, fuelwood, grass/fodder, timber, bamboo, cane and NTFPs[xii] to help community augment their livelihoods. The augmented ecosystem services like water flows, biodiversity and carbon pools would further provide opportunity for augmenting incomes. Rich, biodiverse and cultural landscapes could provide the potential to build up community-based eco tourism enterprises.

Lack of sustainable harvesting practices and problems of productivity are some of the main barriers in NTFP management in most parts of the country. The Mission will support technology for value-added products, certification and marketing of NTFP, which would support bridging the knowledge gap. Institutional architecture engaging national research institutions, state level/ district level agencies, and the federations of NTFP collectors at the cluster level, will be crucial to support a two-way flow of knowledge and information for sustainable NTFP management and improved marketing[14] .

The Mission will support village /cluster/sub-landscape-based planning for livelihood enhancement. The villages falling in the identified area under the Mission will be given adequate financial support to plan for the livelihood support activities, based on sustainable resource-use principles. Lessons from projects like Tamilnadu Afforestation Project (TAP) and other such interventions elsewhere have demonstrated that the financial resources to the tune of Rs. 15-25 lakhs made available to the village institutions could significantly contribute to livelihood support activities on one hand while securing larger community engagement in forest conservation on the other.

5.3.3 Corridors for connectivity: Habitat fragmentation would be a constraint to climate-change-induced migration, especially in species with limited dispersal abilities. "Corridors" are needed for effective dispersal and establishment of species. Both plant and animal species need to adapt through migration along latitudinal and altitudinal gradients. Assisted migration of species would be possible through connecting corridors. While prioritizing the areas to be taken up under various SubMissions, corridor consideration would be taken on board along with other key criteria.

The Mission will support the setting up of a Task Force to identify/prioritize critical corridors; and will support working with an array of stakeholders including district business houses, farmers, schoolchildren, resort owners etc. to maintain corridors; working with farmers and local communities to regulate change of land-use, maintaining cover through agro-forestry, preventing crop raiding in corridors through fencing. Other key interventions would be rapid agency response in case of crop raiding and livestock loss, crop and livestock insurance, and simplified, hasslefree compensation.

5.3.4 Community Conserved Areas and Sacred Groves: Community Conserved Areas (CCAs) are defined as "Natural ecosystems (forest/ marine/ wetlands/ grasslands/ others), including those under minimum to substantial human influence, containing significant wildlife and biodiversity value, being conserved by communities for culture, religious, livelihood, or political purposes, using customary laws or other effective means"[15]. Examples of CCAs from across the country include many sacred groves.

Sacred groves are scattered all over the country, from scrub forests in the Thar Desert of Rajasthan maintained by the Bishnois, to rain forests in the Kerala Western Ghats, and are referred to by

[14] Singh KD, NTFP Management in India, Workshop Proceedings , JFM in India, IIFM, 2006

[15] N Pathak, (2009). Comunity Conserved Areas in India: A Directory. Kalpavriksh, Pune

different names in different parts of India. Around 14,000 sacred groves have been reported from all over India, however their total number could be much higher. Sacred groves act as reservoirs of rare fauna, and more often of rare flora, amid rural and even urban settings.

The Mission will support CCAs, including sacred groves, through institutional, policy and legal measures. The CCAs, as part of various landscapes/sub-landscapes prioritized under the Mission, would be given support for protection and conservation using institutional diversity represented by the CCAs.

5.3.5 Understanding, identifying and protecting areas/catchments of hydrological importance: Forests play a key role in groundwater recharge and maintaining water quality. By moderating the hydrological cycle, native species forests and grasslands can often moderate monsoon peaks and enhance lean season flows in streams and rivers. On the other hand, certain exotic and invasive species can have adverse effects on both local biodiversity as well as the hydrological regime. Increased variability in rainfall patterns and more extreme events will enhance the importance of the hydrological function of forests and other landscapes in adapting to climate change. What is clear is that a combination of vegetation and the underlying hydrogeology promotes infiltration and groundwater recharge.

Thus the Mission will promote research to understand the linkage between vegetation, groundwater and surface flows, and encourage the identifying and protecting areas of hydrological importance within the various sub-missions. In such identified areas, priority will be given to protection and activities that enhance recharge. These could range from small spring recharge zones in mountain areas, to larger landscape elements. The key here will be to identify and prioritize the high recharge zones at multiple scales and then provide protection and appropriate interventions using the zoning approach. The Mission will support activities at the village level to identify vulnerable hill slopes and to take up protection and soil/water conservation measures backed up with plantation of suitable indigenous species. Protecting and enhancing the watershed services of forests and other ecosystems will be a key element of enhancing the adaptation potential for local communities. Incentivizing communities to protect such areas over time in their own local interest and broader societal interest would also be considered.

5.4 Strengthening Institutions for Decentralized Forest Governance

5.4.1 *Strengthening local community institutions*

a) *Strengthening decentralized governance through Gram Sabha and its committees/ groups*: Local institutions have a significant bearing on forest conservation and its sustainable use, more so at a time when market forces are putting tremendous pressure on natural resources. The institutions at the local level to deal with forests include: Joint Forest Management Committees[xiii] (JFMC), Community Forest Management groups (a large number in Orissa), Van Panchayats (Uttarakhand), traditional village level institutions/ Village Councils (schedule VI area), Biodiversity Management Committees, Forest Committees set up under rule 4 (e) of FRA etc., Self Help Groups /Common Interest Groups have also been set up at the village level to promote forest-based livelihood activities.

The spread of Joint Forest Management, despite several limitations and uncertainties in terms of tenurial insecurity, inadequate silvicultural development, and restricted harvesting and market access, has helped in regenerating forests and meeting local needs (Milne, 2006)[16].

Panchayati Raj Institutions (PRIs) are constitutionally mandated bodies for decentralized development planning and execution at the local level. The Scheduled Tribes and Other Traditional Forest Dwellers

[16] "Unlocking Opportunities for Forest Dependant People in India Report No. 34481 – In Volume 1 2006, World Bank"

(Recognition of Forest Rights) Act, 2006, in addition to individual rights, provides for Community Forest Rights, including the right to protect, regenerate and manage Community Forest Resource[17]. It is obvious that this right also places a great deal of responsibility on the community which it has to fulfil. The Gram Sabhas have been authorized to set up institutions to ensure this (4 (e) of Rules).

Strengthened Gram Sabhas[xiv] hold the key to decentralized governance of forests and natural resources. Informed Gram Sabhas would mean better coordination and linkages across different institutions at the local level, and improved accountability of such institutions.

The Mission would therefore help strengthen Gram Sabhas as the overarching institutions. Village-level institution dealing with protection and management of forests will need to be set up by the Gram Sabha. This would not only help in strengthening the GS, but would also help in necessary convergence of resources and integrated planning at the village level. Leadership provided by the committees of the GS and the UGs/SHGs would contribute to strengthening of Gram Sabha.

Livelihood activities and enterprises as well as protection of forests have often been effectively addressed at the cluster level/sub-landscape level, led by federations of SHGs/Common Interest Groups (CIGs) and federations of forest committees. The Mission would therefore encourage federations of thematic committees/groups such as JFMCs/CFM/VPs/FRA committees etc, as well as livelihood promotion groups like SHGs/CIGs to plan for forest protection, conservation and livelihood activities. However, making of such federations needs the decision of communities and their respective Gram Sabha.

Larger landscape-level governance/management needs to emerge over time, engaging a diversity of institutions, depending on the local context and learning from the successes and failures of initiatives at the landscape/sub- landscape level. These learnings need to come from an array of initiatives initiated by Government and Non-Government Organizations.

b) *Revamping JFMCs*: The Mission will provide an opportunity to reform the JFM. As an institution the JFMC must conform and contribute to decentralized forest governance , empowering the community on the one hand while securing sustainable forest management on the other. To allow greater decentralization of decision making , devolution of power, and adequate support, the following steps would be helpful:

1. The JFMC will be set up by Gram Sabha, its constitution and processes needs to be in tune with the provisions as laid out in the State Panchayat and PESA legislation.The JFMC, as a committee of the Gram Sabha, must be given power to protect and manage as well as derive benefits from forests. The Mission will examine provisions of the Indian Forest Act, 1927 to provide power of a forest officer to such a committee. Provisions in the Panchayat Raj legislations in the States would need to acknowledge the role of JFMC as a committee of the Gram Sabha.

2. The JFMC must be provided resources (on a regular basis) and necessary skills to carry out its mandate.

3. Silvicultural management of the area assigned to JFMC must be as per the plan approved by the Gram Sabha, following the technical approval by the Forest Department.

[17] The Scheduled Tribes and Other Forest Dwellers (Recognition of Forest Rights) Act, 2006 Section 3 (i)

4. Forest Department's role would be to provide demand-based support to the Gram Sabha and its mandated committees to strengthen decentralized forest governance leading to sustainable management of the forests.

Similar provisions with necessary modifications could be made applicable to other committees of the Gram Sabha as well as to Village Councils (in North Eastern states) entrusted with the responsibility of managing forests and natural resources.

c) *Revamping FDA*: The current FDA structure and its role would be revisited so as to make the FDA a leading institution in contributing to decentralized forest governance and providing valuable services for forest conservation and improved livelihoods of people living in and around the forests.

1. The FDA at the district/division level may be chaired by the elected representative, such as the Zila Parishad president which would help in program convergence with the Panchayati Raj institutions.

2. The executive body of the FDA will have elected representatives from clusters/wards, comprised of revamped JFMCs. Such clusters could be formed at sub-block, sub-range, range or sub-landscape/ landscape level.

3. Committees of Gram Sabha dealing with forest protection and development (other then revamped JFMCs) and their federations would also be represented at the district /division level.

4. SHGs/UGs and their federations engaged in forest-produce-based enterprise would be represented at the division level/district level FDA.

5. Representation of civil society organizations would be ensured.

6. Representation of line agencies particularly Rural Development, Agriculture, Animal Husbandry, Fisheries, Horticulture, Revenue, Drinking water, Health, Tribal Welfare and Education will be secured. All the Government officials will be ex-officio members and would not have voting rights.

7. The CEO of the FDA will be the DFO.

The key role of the FDA will be to facilitate demand-based planning and implementation of forest conservation and community development by the local bodies mandated by Gram Sabha . It will need to forge partnerships with local NGOs/CBOs; academicians, PRIs, research and training organization, people's representatives, media and Government line agencies to carry out the role.

In order to carry out the functions as outlined above, the FDA as an institution would need to be strengthened with skill/ knowledge support, sourced on contractual basis. Adequate infrastructural support will be provided for this.

d) *Building Capacity of Local Institutions:* The Mission will support capacity building of the local community institutions as a longterm measure to help them effectively protect, regenerate and manage forests and undertake forest-based livelihood enterprises. Sustainable forest management and utilization will require sound knowledge in inventorization (including growingstock enumeration, regeneration surveys, biodiversity and carbon assessment etc), adaptive silvicultural practices, sustainable NTFP harvesting, value addition and marketing; and monitoring of impacts. Traditional Knowledge, forestry science and

Information and Communication Technology will provide the building blocks of the capacity-building endeavour.

e) *Building a cadre of Community Foresters*: The Mission is meant to nearly double the ongoing efforts of greening the country. This will necessitate developing extra hands from within the community, namely youths from the community who on one hand would provide service to the community, and on the other hand would link to a large number of other service providers, including the Forest Department and other agencies.

Given the fast changing rural scenario with an increasing number of educated unemployed/ underemployed youth, the Mission will support development of youth cadres as Community Foresters to lead the charge at the local level. Support of the Forest Department, research institutions, universities/colleges from local area and NGOs would help develop this cadre of Community Foresters as self-employed change agents. *The Mission has the potential to develop about one lakh skilled local community youths who would provide support in community-based forest conservation, community livelihood enhancement and change monitoring etc., these youth will also act as a bridge between the community and the service providers like the Forest Department*.

The example of the Carbon assessment under " Project Kyoto: Think Global Act Local in Uttarakhand", 2009 in Lamgarha block in Uttarakhand proves the point that rural educated youth are quick to pick up skills, and have a huge potential to provide support to the community in planning, implementation and monitoring of the greening program at the local level. The Mission will learn from such examples and develop innovative and cost-effective models that would be replicable with ordinary resources and by building the capacity of community youths.

5.4.2 Role of NGOs: The Mission envisages the role of NGOs as partners in furthering the Mission mandate specially in community mobilization, strengthening of the Gram Sabha and its myriad bodies, in facilitating community ownership and management of natural resources, developing the cadre of skilled community youths etc. NGOs and as Process Support Groups would help in strengthening of institutions at various levels, from village level institutions to the State bodies. The Mission will ensure representation of NGOs in decision making bodies at different levels. The Mission will set the process guidelines for engagement of NGOs with proven track record. The State Mission organization, by using the guidelines, will be able to identify such NGOs and provide them with necessary support to help achieve the Mission objectives.

5.4.3 Strengthening the Forest Department: The Mission envisages a new role for the Forest Department. The engagement of community institutions in facilitating field actions will require sensitization of the Forest Department officials and front-line staff. The new role in no way will diminish the relevance of the department; on the contrary getting community institutions to play a leading role under the Mission would put the department in the role of an "enabler "in addition to its statutory role in protection and management of forests . The Forest Department will also need to ensure compliance with technical prescriptions spelt out in the Mirco Plan. It would be required to respond to the call of community institutions in providing greater support in "protection" in case of sensitive areas. The technical knowledge of the department will come to the fore to help develop quality planting material, designing eco-restoration programs, pilot testing of climate change adaptation measures, creating an enabling regime that helps farmers and communities to plant, protect and harvest trees/forests without having to incur huge transaction costs.

The frontline formation of the department currently suffers from serious limitations. A large number of vacancies currently exist at the level of frontline staff. Of the total sanctioned frontline positions of 1,37,000, there are 22,880 vacancies (MoEF, 2008) and more then 40% of the staff are in their late 40s and early 50s.

A time-bound program of the State Forest Departments to fill the vacant posts and prepare a perspective plan for a continuous inflow of personnel will be of utmost importance. The Mission will support the recruitment process by focused advocacy and even provide financial support for salaries of frontline staff for a limited period.

Capacity building of frontline staff, on a regular basis, to carry out the emerging role will be given high priority. Teams of Subject Matter Specialists at the level of revamped FDAs (on contractual basis) could bring in new knowledge and skills. The arenas include Information and Communication Technology (including RS/GIS capabilities), community mobilization, watershed management/ soil moisture conservation/water harvesting, hydrogeology, finance, ecological restoration/REDD issues etc. The Mission will support strengthening of the Range Offices inter alia developing them as forest and wildlife resource centres (with library, documentation, map room, GIS and MIS cell facilities). This support could also be availed of by the partner agencies working in the sub-watershed /sub-landscape.

Infrastructure support in terms of enhanced mobility and communication at forest Range and Section level will enhance the rapid response needed for forest protection, fire protection, control of crop-raiding wildlife, etc.

5.4.4 Engaging Schools and Colleges

School-children and college students are a valuable and enthusiastic group to help further the Mission objectives, while in turn receiving real-life learning by their involvement. India has about 1 million recognized schools[18] and some 10,000 colleges. Programs such as the National Green Corps (NGC) coordinated by MoEF, NCC and NSS, and many other initiatives taken by NGOs have shown a great deal of potential to engage school and college students and teachers in monitoring natural and restored forests and other landscapes as well as in actual "greening" activity. Working in tandem with these programs/initiatives and organisations, the Mission would help put more meaning into such programs/ initiatives while also scaling them up. One of the key handicaps in rural schools is inadequate fencing of the school plantation and its maintenance during the summer holidays. The Mission will provide support to enhance protective fencing and after-care of the plantations taken up under such initiatives.

5.5 Convergence with Cross-sectoral Programs; Adding value through support activities and relations with other Missions

a) Convergence with programs and schemes

The Mission would link with other ongoing land-based greening/restoration programs and schemes of different agencies. While working with existing programs/schemes, it would add "value" to them through a) technical inputs on species from climate mitigation/adaptation angle, b) improving policy regime/investment climate to help different agencies plant, protect and manage forests for multiple benefits, and c) providing services for improved monitoring at the outcome level to avail benefits under REDD Plus, CDM and other carbon market mechanisms.

Key ongoing programs/schemes (and those in the pipeline) include Integrated Wasteland Management Program; Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) under MoRD; schemes of Animal Husbandry Department, programms on renewable energy by

[18] MHRD.2001. Annual Report 2000-01, Ministry of Human Resource Development, Government of India. New Delhi.

the Ministry of New and Renewable Energy (MNRE). Similarly, ongoing programs/schemes of MoEF include National Afforestation Program, Intensification of Forest Management Scheme, Compensatory Afforestation Management and Planning Authority (CAMPA), schemes under the 13th Finance Commission, Capacity Development for Forest Management and the Personnel Training Project of MoEF under Japan International Cooperation Agency (JICA) collaboration, etc.,

Various Mission interventions would seek convergence and learn from already ongoing Missions such as JNURM, National Watershed Mission, Horticultural and Bamboo Mission.

The convergence with ongoing program/ schemes will be secured by getting representation of the concerned department/ministry in the organizational structure of the Mission at different levels. At district level, it will be further reinforced through linkages with the District Planning Process. Finally at the village/cluster/sub watershed/ sub landscape level, the planning process will be taken up using the convergence route.

From a cursory assessment, it is estimated that treatment under different schemes/programs would target about 10 m ha over the next 10 years, at a cost of approximately Rs 37,000 crores. It is presumed that the current level of investment in real terms in the 12th Five Year Plan will continue, whether under the existing schemes or under the Mission umbrella.

b) Convergence with other Missions

Other Missions of the National Action Plan on Climate Change are crucially relevant to the Greening India Mission and vice versa. The Mission will seek synergy with strategy and actions of related missions. For example, the ones related to energy, if moulded towards achieving local energy security through renewable/alternative sources, can considerably reduce fuelwood collection pressure on forest ecosystems. The Mission will actively engage with other related Missions under NAPCC during the preparatory phase so as to ensure convergence and synergy across the Missions.

5.6 Improving the Investment Climate to help Engagement of Multiple Stakeholders/ Agencies to plant, protect and manage forest and tree cover

a) Improving investment climate for farmers

Trees on private holdings can play an important insurance role in rural economies, provided their harvesting is not hindered by any and under regulatory procedures. When regulations are complex, however, farmers in need suffer substantial losses by distress selling of their trees to agents. In effect this problem may be considered a regulatory barrier to conducting the business of growing trees, thus reducing the likely returns on investment and acting as a constraint to farmers investing in growing trees. For example, trees on private lands, especially the so-called 'forest species' in most states are governed by several regulations. Permissions are required for harvest, commercial use, own use, transit of forest produce as well as conversion of land use. In combination, these regulations pose diverse types of controls, multiple points of regulation, and considerable regulatory burden on farmers as well as on the implementing agencies[xvi]. Implementing regulation for trees outside forests rigorously places an enormous regulatory burden on the implementing agencies, with limited benefits. A review of regulations pertaining to trees on private lands in MP led to the passing of the Lok Vaniki Act, although its implementation has not been hassle-free. [xvii]

In the private sector, tall claims and lack of regulation of plantation companies led to the teak plantation investment scams of the 1990s. Creating appropriate regulatory safeguards could help in creating a partnership of retail investors with farmers and communities that could lead to large-scale financing and planting. The key here would be in developing working financing models and providing regulatory oversight for longer-term investments.

The Mission will provide support in assessing the investment climate to help identify good practices, constraints, and regulatory lacunas/ vacuums, and to address the same through appropriate policy and legal frame work . This would increase investment by a variety of stakeholders and improve outcomes.

b) Certification

Certification promotes and assures Sustainable Management of Forests , taking explicit account of environmental, economic, social and cultural dimensions of forest management, conservation and development in a holistic manner. It is also required for eco-labelling and related chain-of-custody (CoC) and legality verification, thereby promoting ethical trade and market for timber and non-timber forest products as well as socially responsible procurement policies and green consumerism. In addition, certification can help in securing local biodiversity and watershed services as well as social benefits of fair trade that benefit communities. Community-oriented carbon sequestration projects typically require forest certification of some sort.

India's forestry sector faces the dilemma of an increasing demand for timber owing to burgeoning urbanization and economic growth on the one hand, and the need to conserve, preserve and restore forest resources for their ecosystems services, on the other. As such, there is an ever-growing gap between demand and supply of wood and products. India has a huge untapped potential for export of its processed wood and non-wood products with valorization and benefit sharing among the various stakeholders, including local communities, forest custodians and owners, producers and processors, traders and retailers. That is possible only if forest certification system is in place for requisite CoC ecolabelling and for assuring the legality and sustainability of the source of the products and thereby enable unbridled access to ethical trading and market arenas with price premiums.

The MoEF has constituted the National Forest Certification Committee (NFCC), a multi-stakeholder committee for the purpose. NFCC has prepared a report for developing and designing a national forest certification system and installing an Indian Forest Certification Council. [xviii]

The Mission will provide a sufficiently large corpus fund for setting up an independent certification organization with the support of different stakeholders.

5.7 Research & Development

5.7.1 Research to support Mission aim and objectives:

The Mission will identify research priorities in support of the Mission aim and objectives. Some of the key research areas would include long-term research to study vegetation response to climate change; silvicultural and management response to achieve the Mission objectives; pilot adaptation projects to develop adaptation options, strategies and practices; benchmarking carbon capture potential of ecosystems and economic evaluation of ecosystem goods and services; measuring degradation within density class ranges; social and economic research and studies, etc. The scientific and technical capability of forestry research institutions including Indian Council of Forestry Research and Education (ICFRE) would be significantly enhanced for ecological research and modelling of climate change impacts, mitigation and adaptation aspects. The Mission would support the strengthening of the research institutes under ICFRE and the State Forest Departments, including financial support for increased strength of scientists and their support staff, better infrastructure, equipment, etc.

Since many of the proposed interventions are innovative, it would require an unprecedented level of collaboration of research institutions and the implementation agencies. ICFRE collaboration with

academic scientific institutions of repute, both in country and overseas, joint research programs, exchange visits, capability building etc would be strongly supported under the Mission.

5.7.2 REDD Plus[xix] Cell

The Mission will set up a REDD Plus Cell under the overall guidance and supervision of the Ministry of Environment and Forests . The Cell will have the task of creating awareness/capacity building on the REDD Plus process for all stakeholders, including the community institutions. A comprehensive REDD Plus strategy would be worked out through an inclusive process. The Cell will design and formulate appropriate REDD Plus projects/strategy as consistent with the objectives of this Mission and propose, as necessary, for implementation/funding support to the designated bodies in accordance with the policies and decisions of the relevant authorities/bodies at the national and international level. Consistent with the architecture and rules agreed under UNFCCC for setting up REDD Plus mechanism, the Cell may also be required to provide technical advice to the appropriate national authorities on development and implementation of Monitoring Reporting & Verification (MRV) protocols and fair benefit-sharing mechanisms in the forestry sector. This will be done through improved capacity and comprehensive methodology design for forest carbon inventory as per internationally and domestically agreed rules for Measurement, Reporting and Verification System (MRV).

The Mission will improve capacity of multiple stakeholders, particularly forest-dependant communities, to implement REDD Plus at decentralized levels. A majority of interventions under the Mission have potential to qualify under REDD / REDD Plus.

5.8 Monitoring and Auditing the Greening Mission

5.8.1 Monitoring at outcome/output level

The Mission will focus beyond input level/activity to outcome level over time by a combination of impact assessment at the field-unit level and application of modern technology like Remote Sensing and GIS. Monitoring under the Mission will help in timely information for planning and feedback to multiple agencies/ stakeholders. In addition to on-ground self- monitoring by multiple agencies and communities, the Mission would support use of Geomatics (remote sensing with GPS mapping of boundaries) for monitoring at the output/ outcome level. This service will be available for both Mission-financed activities as well as those undertaken and financed by other agencies/ stakeholders.

Monitoring is proposed at four levels-

Level 1: On-ground self-monitoring of the region by the local community, implementing organization and the Forest Department. Building community capacity to monitor Carbon and other services is envisaged using lessons from pilot projects.[19]

Level 2: Field review by an external agency of randomly selected sites. This will be primarily for Mission-financed activities.

Level 3: This will use remote-sensing-based forest cover monitoring by the Forest Survey of India, supplemented by boundaries of areas covered under the Mission. The Mission will work in close collaboration with Forest Survey of India, National Remote Sensing Agency and Indian Institute of Remote Sensing for developing a countrywide mosaic of high resolution satellite images (LISS IV, Cartosat) and overlaying polygons of areas taken up for interventions under the Mission to help develop a centralized spatial data base in the GIS domain. Density slicing could be used to gauge migration within density class.

This service will be available for both Mission-financed activities as well as those undertaken and financed by other stakeholders. The real-time, web-based monitoring system being developed for CAMPA by National Informatics Centre (NIC), will be taken as the starting point for the system.

Level 4: In addition, a few pilot areas will be intensively monitored to assess the impact and efficacy of different old and new practices, in tandem by the implementing agency, the Forest Department, and a support organization. In addition to growing stock and forest cover, other parameters will include monitoring environmental services and associated factors: ground cover, soil condition, erosion and infiltration, run-off, groundwater levels to develop water

Box-2 : The Reform Agenda

The following reforms would contribute to improved forest governance in line with democratic decentralization, community driven forest management and strengthening of forestry sector as a whole.

Centrality of Gram Sabha for improved forest governance

- The Gram Sabha and the bodies set up by it to be the key institutions to plan and implement the Mission activities at the village level.
- Revamping of JFMCs as bodies of the Gram Sabha.
- Legal empowerment of the bodies of the Gram Sabha, including the revamped JFMCs to protect, regenerate and sustainably manage forests. This could be done under Indian Forest Act. Provisions to acknowledge such bodies of the Gram Sabha would need to be made in Panchayat Act by respective States.

Revamped FDAs to strengthen decentralized forest governance

- The FDAs would be revamped as institutions contributing to decentralized forest governance.
- The FDAs, at the district /division level, would be positioned as democratic and inclusive institutions, chaired by an elected representative instead of a Government official. Representatives of federations of local bodies including revamped JFMCs/ forest committees of Gram Sabha and SHG federations to be represented in decision-making body in the FDA at division level

Strengthening FRA implementation

- The areas where the Mission activities are proposed need to ensure that the FRA compliance has been made.

Easing out the regulatory framework on felling and transit of forest produce

- Promotion of Agro-forestry /Social Forestry, based on multiple species including those nationalized, would require that regulatory framework currently in place is eased out, so that farmers and others can harvest and transit the trees in a hasslefree manner.

Strengthening front line formation in Forest Department

- The existing vacancies of the front line staff (FG to RFOs) need to be filled on a priority basis during the preparatory phase of the project. A 10-year perspective plan of recruitment and capacity building must be put in place to ensure continuous inflow of new recruits.

  Different States have different local-level governance institutions to manage forest and natural resources. Subject to overarching reforms indicated above, the States may exercise flexibility in carrying out the institutional revamping.

budgets, as well as the provision of locally relevant fuelwood, fodder, and other NTFPs, and basic biodiversity analysis. This would facilitate review of different regulatory conditions in the future. This analysis would require extensive support for communities and could form the basis for REDD-based monitoring methodologies.

All the interventions under the Mission will be assessed for the climate change adaptation/ mitigation angle, as well as for the provisioning services critical to community livelihoods.

5.8.2 Social Audit by Gram Sabha

The Mission will learn from best practices on social audit, particu larly the one designed for MNREGA. Section 17 of the NREGA Act empowers the Gram Sabha to carry out a social audit of all the works carried out by the Gram Panchayat. It requires that the Gram Panchayat make available all relevant documents, including the muster rolls, bill, vouchers, measurement book, copies of sanction orders and other connected books of account and papers to the Gram Sabha for the purpose. Taking a cue from the MNREGA, the Mission will similarly require that the Gram Sabha carries out a social audit of all expenses incurred by the Committees constituted by the Gram Sabha and these reports would be shared in the public domain.

5.8.3 Audit by Government bodies

The Mission accounts will be subjected to audit by Comptroller and Accountant General (CAG) at Centre and by Accountant General (AG) in the States. Achievement of annual targets will be governed by the local conditions/site- specific planning in each State covered under the Mission, and may at times be at variance with the overall Mission targets. The CAG and the AG will need to be taken on board from the very outset to understand such variations

5.9 Making Green India Mission a People's Program

5.9.1 Mission Outreach

The Mission seeks to unlock people's energy and solicit their engagement with the greening program. It will strive to secure participation of multiple agencies/ organizations/ individuals (community, farmers, Panchayat bodies, Government/Non-Government, Private institutions/agencies, academia, business houses, children especially in rural communities, media, etc.) in greening activities. The Mission will develop a communication strategy to engage an array of stakeholders. It will provide support to various agencies/organizations to undertake Mission interventions through provision of knowledge and knowhow, monitoring support, planting material and financial models for participation, as well as engage in decentralized monitoring.

5.9.2 Innovation Fund

The Mission will provide a demand-driven window for innovative initiatives and small scale projects to a range of stakeholders. The innovation funds would be available at national, state and district level Mission organization. At State level the innovation fund could be used for cross-cutting research/action research studies. At district level, the innovation fund can be used for initiatives by the local-level organization to try out things in consonance with the overall Mission goals and objectives.

6.0 Mission Organization

The Ministry of Environment and Forests will be responsible for operationalizing the Mission activities at the national level through an autonomous institutional architecture.

National level:

At the national level the Mission will be set up as a Society to facilitate smooth implementation of the Mission.

The Governing Council of the Mission, Chaired by the Minister of Environment and Forests, will provide overall guidance and synergy of actions. The Council will have representation from Ministries/Department namely Environment & Forests, Planning Commission, Tribal Welfare, Rural Development, Panchayati Raj, Agriculture, Finance, Ayush etc. Eminent experts, research institutions, State Forest Department (by rotation), community representatives, civil society organisations, corporate sector etc. will be represented in the Council.

The Mission Director will be the Member-Secretary of the Governing Council.

The Mission will be adequately staffed with experts and office support/infrastructure for carrying out the Mission mandate. The Mission will exercise the highest degree of financial accountability and transparency. All the rules, financial codes and procedures, including procurement of goods and services, will generally follow procedures as laid out in the Government. The accounts of the Mission will be subjected to CAG audit. To maintain the highest standards in financial transactions, the Mission will have services of a Financial Advisor on deputation from the Finance Ministry. A clear devolution of administrative and financial powers will be made for the Mission to facilitate smooth and timely implementation of the Mission activities.

State level

To avoid multiplicity of agencies, a revamped State Forest Development Agency (SFDA) will act as the State Mission Directorate. States will be advised to revisit the constitution of the SFDA to ensure representation of all key interests as spelt out in the Mission organisation at the national level. The revamped SFDA would be chaired by the Chief Minister/ Forest Minister.

District and village level

The Mission activities at the district level will be facilitated though a revamped Forest Development Agency. The planning process will be suitably linked with the District Planning Committee.

At the village level, planning and implementation will be vested with the local-level institutions of the Gram Sabha, i.e., revamped JFMCs, CFM groups, Van Panchayats, Village Council, Biodiversity Management Committees, or any new institution set up by the Gram Sabha for CFR provisions under Forest Rights Act, 2006. The institutions at village level would link to the cluster level, subwatershed/sub-landscape level.

In urban areas, the ward-level committees/ Resident Welfare Associations linked to Municipality/ Municipal Corporations will facilitate planning and implementation under the Mission.

7.0 Timeframe

7.1 The actual implementation period of the Mission would spread over 10 years, coinciding with the 12 th and 13 th Five Year Plan period. 2011-12 will be taken as the preparatory phase of the Mission. Thus, the Mission will have a preparatory phase, a first phase (five years) and a second phase (five years).

The preparatory phase of the Mission will be utilized for carrying out the reforms, setting up the Mission organisation, leveraging resources for the Mission, identification of sub-landscapes/ areas for Mission interventions, identification of partners, creating awareness across multiple stakeholders, setting up/ revamping and strengthening of institutions to improve decentralised forest governance, sensitization of Forest Department/ multiple agencies, and forest-dependent communities, capacity building of staff and the communities, commissioning of research/ assessment, etc. The Mission would consider getting many of these actions in the preparatory phase as "conditionality" (refer to Box-2), before funding could flow for implementation. Actual field operations will take place from 2012-13. for Mission interventions, identification of partners, creating awareness across multiple stakeholders, setting up/ revamping and strengthening of institutions to improve decentralised forest governance, sensitization of Forest Department/ multiple agencies, and forest-dependent communities, capacity building of staff and the communities, commissioning of research/assessment, etc. The Mission would consider getting many of these actions in the preparatory phase as "conditionality" (refer to Box-2), before funding could flow for implementation. Actual field operations will take place from 2012-13.

7.2 State Action Plans

The Mission document is meant to provide strategic intent for getting the States to put up the State Action Plans over the next six months. The State Action Plans could dwell on State-specific details for Mission interventions. These Action Plans will also be required to propose a clear roadmap for forest governance reforms. The State Action Plan will need to be developed using an inclusive process, engaging the Forest Department, line agencies, civil society organisations, community groups, academia, etc. The State Action Plans will draw convergence with overall State Climate Action Plans.

7.3 Operational Guidelines

To facilitate development of State Action Plans, operational guidelines will be issued by the MoEF on selection of areas/sublandscapes, interventions under Sub Missions, planning at the level of local bodies, cluster and sub-landscape level, on the process of carrying out institutional reform, identification of partner organisations, etc. Operational guidelines will stress sitespecific bottom-up planning at the level of Gram Sabha and its Forest Committees. It will specify linkages of such village-based plans with Forest working plans, which will be based on sound silvicultural prescriptions, blending both traditional knowledge and scientific forest management to ensure sustainable management of forests and natural resources.

8.0 Mission Costs

The total mission cost is Rs 46,000 crores (details at Annex-1) for treatment of 10 million ha over the next 10 years. This is an indicative cost for the country as a whole. The costs would vary according to the State-specific situation, including wage rates, specificity of intervention, etc. The Mission expects the State Action Plans to bring such specificity in the costs and interventions when these plans are drawn up. Cost escalations on account of wage rate revisions and other exigencies have not been factored in.

These resources will be mobilized as additionality from the Planning Commission. The gaps, if any, will be met by external support.

Finally, the Mission recognizes that by engaging in forest protection, individuals and communities provide a valuable economic in-kind contribution to National and Mission objectives that complement the financial inputs and are thus a critical factor in the success of the Mission.

Abstract of Mission Costs and Resources

Activities	Costs (Rs. crores)
A. Resources needed for the Mission to meet specific objectives and the activities thereof	34,000
B. Resources for Support Activities	12,000
Total Mission costs (A+B)	**46,000**

ANNEX 1

TENTATIVE MISSION COSTS

A. For Sub Missions/Interventions to achieve Mission outputs/targets

Sub Missions	Categories	Type	Area (million ha)	Unit cost per hectare (Rs)	Total cost (Rs Crores)
Sub Mission 1: Enhancing quality of forest cover and improving ecosystem services (4.9 m ha)	a) Moderately dense forest cover, but showing degradation		1.5	15,000	2250
	b) Eco- restoration of degraded open forests	Type A	1.8	16,000	2880
		Type B	0.6	30,000	1800
		Type C & D	0.6	50,000	3000
	c) Restoration of grasslands		0.4	35,000	1400
	Total Sub Mission 1		**4.9**		**11330**
Sub Mission 2 Ecosystem restoration and increase in forest cover (1.8 m ha)	Rehabilitation of Shifting Cultivation areas		0.6	30,000	1800
	Restoring Scrublands (0.4)		0.8	50,000	4000
	Restoring / planting Seabuckthorn		0.1	100000	1000
	Restoration of Mangroves		0.1	70,000	700
	Ravine Reclamation		0.1	70,000	700
	Restoration of abandoned mining areas		0.1	100000	1000
	Total Sub Mission 2		**1.8**		**9200**
Sub Mission 3: Enhancing tree cover in Urban & Peri-Urban areas (including institutional lands): 0.20 m ha			0.2	100000	2000
	Total Sub Mission 3		**0.2**		**2000**

Sub Missions	Categories	Type	Area (million ha)	Unit cost per hectare (Rs)	Total cost (Rs Crores)
Sub Mission 4 : Agro-forestry and Social Forestry (increasing biomass & creating carbon sink): 3 m ha	Farmers' land including current fallows		2.3	20000	4600
	Shelterbelt plantations		0.1	80000	800
	Highways/ Rural roads/Canals/Tank Bunds		0.6	70,000	4200
	Total Sub Mission 4		**3**		**9600**
Sub Mission 5: Restoration of Wetlands: 0.10m ha			0.1	60000	600
	Total Sub Mission 5		**0.1**		**600**
Total Sub Missions			10		32730
Promoting alternative fuel energy	Biogas, solar devices, LPG, Biomass-based systems, improved stoves		3 million house- holds	3300 per house- hold	1000
Grand Total					**33730**
or say 34,000 crores					

B. For Support Activities

Activities Cost	Cost in Crores
Research (2% of A)	680
Publicity/Media/outreach activities (1% of A)	340
Monitoring and Evaluation (1% of A)	340
Livelihood improvement activities, (17% of A)	5780
Strengthening local-level institutions (5 %)	1700
Strengthening FDs (5%)	1700
Mission Organisation, operation and maintenance, contingencies and overheads (4%)	1360
Total	**11,900**
or say 12,000 crores	
Grand Total A+B = 46,000 crores	

ANNEX 2

Mitigation potential of various interventions under GIM is estimated by the Indian Institute of Science. The mitigation potential estimate depends on various factors such as area to be brought under the Sub Missions under GIM and the phasing, species mix and density, different carbon pools (aboveground and belowground biomass, soil organic carbon and litter) considered, rates of change in the carbon pools or mean annual increment, transfer and dynamics of different carbon pools, harvest and extraction of timber, fuelwood etc., and initial stock of different carbon pools. Various models are available for estimating the mitigation potential namely, COMAP, GCOMAP, CO Fix, Roth C and CENTURY (Ravindranath 2 and Ostwald, 2008). The mitigation potential is estimated using the widely used COMAP model for the area proposed under different Sub Missions in the GIM. Table 1 provides the estimates of incremental and cumulative mitigation potential for the different sub-missions.

Incremental annual mitigation potential (MtCO) of different Sub 2 Missions estimated using COMAP model Table 1

Sub Missions Area	(Mha)	Incremental annual mitigation potential 2020 (MtCO2)
Moderately dense forest cover, but showing degradation (MDF)	1.5	6.7
Eco- Restoration of degraded open forests (D/O)	3	27.0
Restoration of Scrublands + Grasslands (S/G)	1.2	5.4
Restoration of Mangroves +Wetland catchment (M/W)	0.2	1.6
Avenue, City forests, Municipal parks/ gardens, Households,Institutional lands+ Agro-forestry on fallows, Shelter belts, Roads, canals , tank bunds, schools etc (AF_SF_UF)	3.2	8.3
Others (Rehabilitation of Shifting Cultivation areas, Restoring /planting Seabuckthorn, Ravine Reclamation and Restoration of abandoned mining areas)	0.9	6.0
	10	**55. 0**

Notes:

Carbon pools considered: Aboveground (AGB) and belowground biomass (BGB), soil and litter pools

Area to be treated: 10 Mha phased over 10 years, starting 2011-12

Biomass carbon pools (Ravindranath and Murthy, 2010) AGB growth rates: MDF: 1.5 t/ha/yr; D/O: 3.56 t/ha/yr, S/G: 1.51 t/ha/yr; M/W: 3.2 t/ha/yr; AF_SF_UF: 0.84 t/ha/yr; Others: 2.5 t/ha/yr; **BGB growth rate:** Computed using the IPCC default value of 0.26 of AGB; Litter (micro and macro litter) growth rate: 0.5 t/ha/yr

SOC growth rate: 0.22 tC/ha/yr.

END NOTES

i Some of the model areas in the Nayagarg district in Orissa are Chadheyapalli, Kendudhipi and Koska, and in Deogarh district is Siarimalia where forest protection and conservation has helped agricultural development.

ii The relationship between forests and waterflows, particularly low-base flows, depend not only on forest cover but also on species , soil health, etc. This has been demonstrated through research in different parts of the world. Therefore to ensure water security, the relationship between forests and water flows needs to be better understood.

iii Forest ecosystems in India are hugely challenged on account of fragmentation, over-extraction, insect outbreaks, livestock grazing, forest fires and "development"- project pressures. Climate change will bring additional stress.

iv The quality of forest cover will include indicators like regeneration status, stand density, canopy density, species and ecosystem diversity, etc.

v Non-forest lands include public lands under revenue department and classified as revenue wastelands/ land with forest growth under various names like Chhote Bade Jhad Ke Jangal, public lands with other government agencies, grazing lands under Panchayats. It also includes private lands, particularly the private wastelands as fallows.

vi The landscapes can be defined, based on a range of attributes, from bio-physical to cultural attributes. The landscape from species conservation point of view may mean contiguity of the habitat to meet need of species/populations. For instance, Tadoba —Andheri landscape of 2000 sq km, including PA, buffers, corridors, non-forests that may meet the requirement of a viable tiger population. From Livelihood-Conservation point of view, Buchnania dominated NTFP landscape of 70 sq km (including forest and non-forest lands) in Seoni district in MP that provides livelihood incomes from NTFPs to over a dozen villages. Landforms like Satpura ranges in Central India are a very large landscape that forms the catchment of many rivers and houses rich biodiversity and cultural diversity.

vii The study by IISc on vulnerability mapping shows that nearly 39% of forested grids in India are vulnerable to climate change. The forests in the central part of India, and especially the north-western part of India, are highly vulnerable. A significant part of the Himalayan bio-diversity hotspot is projected to be highly vulnerable due to higher warming. Northern and central parts of the Western Ghats are also vulnerable to climate change. Thus, vulnerability analysis helps to identify forest types and regions which require adaptation strategies to enable forests to cope with climate change.

viii Some key elements of Adaptive Silviculture:

- The management unit is JFMC /CFM / Community Forest Resource or a cluster of such units.
- Participatory assessment of the condition of forests including growing stock/carbon stock enumeration and regeneration survey of both timber and non-timber species is done at the local level by the community, supported by front-line forest staff, using both traditional ecological knowledge as well as scientific measurements. Similarly, community needs assessment with regard to a range of forest goods and services is done using participatory methodology.
- Micro-plan is governed by participatory objective-setting to meet the need of all sections of the society. Prioritization across a range of goods and services addresses intra-community, inter-community and intergenerational needs vis-à-vis forest goods and services. For instance, balancing needs of the village poor for fuelwood and poles versus the need of the relatively well-to-do farmers for timber. Microplans should dwell both on supply as well as demand management of forest produce and services.

- Silvicultural tools like cut-back operations, singling, thinning, gap planting and regulated harvesting of NTFPs are applied innovatively, taking JFMC/CFR forests as unit, but the option of federating at higher levels for inventory, planning and monitoring.
- Provides for impact monitoring on periodic basis to modify practices as and when required to ensure regular and sustained provisioning of forest goods and services (including carbon, water, biodiverisity) along with continuous improvement of forests.

ix As per the latest Forest Survey of India report (2009), the total area of very dense/dense forests including PAs is 40.25 million ha. Of these, about 15 million ha is under protected area network (National Parks and Wildlife Sanctuaries), thus leaving 25 m ha of the remaining very dense/dense forests.

x Leh declaration ; "National initiative on Seabuckthorn" launched recently by the MoEF & Defence Research and Development Organisation at Leh; 14 July 2010

xi Dor Bandi is the time-tested method being used traditionally by farmers to check ingress of ravines in their farm lands. It uses bunding of various cross sections (depending on the slope) across contours to arrest rapid flow of water from upstream to downstream rivers, thus preventing gully formation in farmlands. Some of these Dor bunds provide elaborate spillways to allow flow of excess water. The dor bunds are generally stablised by planting a range of vegetation, including grasses like Daab Ghass and Moonj.

xii Of the total forest export income, about 75% comes from NTFPs (MoEF, 2008).There is a continuing boom in the trade of NTFPs. According to one estimate, the NTFP enterprises can notch up a growth rate of about 6% and contribute to livelihood enhancement in forested areas, more so for communities vulnerable to climatic variability. Enhanced incomes from NTFP/medicinal plants have the potential to broaden the livelihood basket for the poor. The worldwide market in NTFP and medicinal plants has shown average growth rate of nearly 10%.

xiii There were about 106,482 JFM committees protecting about 22.01 million hectare of forests, a third of the land with the forest departments in the country. (MoEF,2006)

xiv The Gram Sabha has same meaning as specified in 73rd Constitutional amendment and Panchayat Raj Extension in Scheduled Area,1996. "A village shall ordinarily consist of a habitation or a group of habitations or a hamlet or a group of hamlets comprising a community and managing its affairs in accordance with traditions and customs. Every village shall have a Gram Sabha consisting of persons whose names are included in the electoral rolls of the Pachayat at the village level."

xv Such facilitiation role would include awarness and capacity building of the local bodies, of partner NGO/CBOs and of frontline staff for community-led forest protection and management; support in institution building, building and reinforcing opportunity for convergence; providing technical approval of village plan for forest protection and management; support to SHGs/UGs and their federations to carry out forest/NTFP-based livelihood enterprise; support to federation of local bodies for planning at sub-landscape level; develop/facilitate monitoring mechanism as spelt out in the Mission document; application of traditional knowledge and state-of-the-art science and technology in carrying out the Mission intervention.

xvi Simplification of rules governing the harvest, sale and transit of short-rotation trees on private lands such as eucalyptus and poplar and on NTFPs occurring on all lands has helped, though long-rotation tree species such as teak are still highly regulated, as are high value NTFPs such as Tendu (Saigal, 2002, Agarwal 2003). There is considerable scope for regulatory changes and institutional and market development that can empower and incentivise low income producers and collectors. Changes in the legislation and regulations that govern this publicprivate interaction would reduce the regulatory burden on producers, the implementation burden on the regulating agency and thereby likely increase the incentives for small-

scale private participation in generating forest-based incomes, as well as free up scarce (and expensive and valuable) forest department resources for more productive use

xvii Lok Vaniki in MP: Recognizing the constraints to private forestry, an attempt was made in Madhya pradesh to deregulate for long rotation species as well, for farmers willing to get management plans in place for their forests prepared by a chartered forester. Lok Vaniki or People's Forestry is governed by the Madhya Pradesh Lok Vaniki Rules 2002, issued under Section 11 of the Madhya Pradesh Lok Vaniki Adhiniyam, 2001. The rules provide requirements for managing "tree clad" areas on private lands and revenue lands. A key provision of the rules is that farmers who develop management plans to manage their forests under Lok Vaniki are provided a regulatory waiver from the web of pre-existing rules governing harvesting of trees on private lands . Lok Vaniki is designed to motivate farmers to think of long-term forest management and not one time harvest and conversion of land use. In Dewas, on private forests, mean annual increments (MAI) can reportedly be increased from 0.46 to 1.5 m3/ha with scientific management. In the few districts in MP where several hundred forests have been brought under management, farmers have benefited from harvesting their long standing trees, predominantly of teak. The real policy attractiveness of the Lok Vaniki program is that it has the potential to double state timber output without any investment by the state government and also increase returns to farmers, besides contributing to carbon sequestration and other local environmental benefits. Large-scale implementation would also free up scarce government resources as less regulatory oversight would be required. With little streamlining, the Lok Vaniki program can dramatically enhance the investment climate for small-scale private forestry, lead to an increase in planting, sustainable management, and increased supply of timber from extensive forests outside FD forest land.

xviii The National Forest Certicfication Committee report details out a proposal to complete the process of designing and delivering the ab-initio steps of a credible certification system with focus on assessing, monitoring and deploying SFM principles, criteria and indicators and the regulatory framework for ensuring the legality of logging and trade, both regarding imports and exports, also for promoting private-public-people partnership for contributing to SFM, forest restoration, greening initiatives, REDD plus and payment of ecosystems services.

xix REDD Plus: India advocates a comprehensive approach to REDD (Reduced Emissions from Deforestation and Degradation) which has been termed as REDD Plus approach. The approach argues for compensating countries not only for reducing deforestation but also for conservation and sustainable management of forests and increase in forest cover (ICFRE, 2007). In its submission to UNFCCC in August 2009, India has elaborated REDD as Reducing Emissions from Deforestation in Developing countries, Sustainable Management of Forests (SFM) and Afforestation and Reforestation (A/R) which further substantiates its comprehensive approach. (MoEF, 2009).

ACRONYMS AND ABBREVIATIONS

AG	:	ACCOUNTANT GENERAL
CAG	:	COMPTROLLER AND AUDITOR GENERAL
CCA	:	COMMUNITY CONSERVED AREA
CFM	:	COMMUNITY FOREST MANAGEMENT
CDM	:	CLEAN DEVELOPMENT MECHANISM
CIG	:	COMMON INTEREST GROUP
CBO	:	COMMUNITY BASED ORGANIZATIONS
CAMPA	:	COMPENSATORY AFFORESTATION MANAGEMENT AND PLANNING AUTHORITY
COC	:	CHAIN OF CUSTODY
CFR	:	COMMUNITY FOREST RIGHTS
FRA	:	FOREST RIGHTS ACT
FDA	:	FOREST DEVELOPMENT AGENCY
GIM	:	GREENING INDIA MISSION
GPS	:	GLOBAL POSITIONING SYSTEM
GS	:	GRAMA SABHA
GIS	:	GEOGRAPHIC INFORMATION SYSTEM
IFMS	:	INTENSIFICATION OF FOREST MANAGEMENT
ICFRE	:	INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION
JFM	:	JOINT FOREST MANAGEMENT
JFMC	:	JOINT FOREST MANAGEMENT COMMITTEE
JICA	:	JAPAN INTERNATIONAL COOPERATION AGENCY
JNNURM	:	JAWAHARLAL NEHRU NATIONAL URBAN RENEWABLE MISSION
LISS	:	LINEAR IMAGING AND SELF-SCANNING SENSOR
MNRE	:	MINISTRY OF NEW AND RENEWABLE ENERGY
MFP	:	MINOR FOREST PRODUCE
MoEF	:	MINISTRY OF ENVIRONMENT AND FORESTS
MIS	:	MANAGEMENT INFORMATION SYSTEM
MGNREGA	:	MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT
MoRD	:	MINISTRY OF RURAL DEVELOPMENT
MRV	:	MONITORING, REPORTING AND VERIFICATION

NCC	:	NATIONAL CADET CROPS
NGC	:	NATIONAL GREEN CORPS
NSS	:	NATIONAL SERVICE SCHEME
NAP	:	NATIONAL AFFORESTATION PROGRAMME
NFCC	:	NATIONAL FOUNDATION FOR CONSUMER CREDIT
NFCC	:	NATIONAL FOREST CERTIFICATION COMMITTEE
NIC	:	NATIONAL INFORMATICS CENTRE
NTFP	:	NON-TIMBER FOREST PRODUCE
NFP	:	NATIONAL FOREST POLICY
NGO	:	NON-GOVERNMENT ORGANIZATION
NAPCC	:	NATIONAL ACTION PLAN ON CLIMATE CHANGE
PRI	:	PANCHAYATI RAJ INSTITUTION
PESA	:	PANCHAYATS EXTENSION TO SCHEDULED AREAS
REDD	:	REDUCING EMISSION FROM DEFORESTATION AND FOREST DEGRADATION
RCM	:	REGIONAL CLIMATE MODEL
RS	:	REMOTE SENSING
SHG	:	SELF HELP GROUP
SMC	:	SOIL AND MOISTURE CONSERVATION
UG	:	USER GROUP
UNFCCC	:	UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE
VC	:	VILLAGE COUNCILS
VP	:	VILLAGE PANCHAYAT

NATIONAL AFFORESTATION AND ECODEVELOPMENT BOARD (NAEB)

MINISTRY OF ENVIRONMENT & FORESTS
PARYAVARAN BHAWAN, CGO COMPLEX
LODHI ROAD, NEW DELHI – 110003

Annexure A-2

जहाँ है हरियाली ।
वहाँ है खुशहाली ।।

Ministry of Environment, Forests & Climate Change
Government of India

Implementation Guidelines

National Mission for a Green India

November, 2014

About the Guidelines

The implementation guidelines are built upon earlier advisories issued for preparatory phase, the feedback on it, and further development with respect to the appraisal and approval of the Mission. The Mission has been appraised by Expenditure Finance Committee, and approved by Cabinet Committee on Economic Affairs in February 2014.

The need to keep the guidelines minimalistic and simple has been a big challenge. The content of the guidelines have been organised under eight sections and six annexures.

The guidelines draw upon Mission document, "National Mission for a Green India", which was endorsed by the PM Council on Climate Change. These include suggestions received during the meetings held with the Chief Secretaries of various States & UTs and also with concerned departments under Govt. of India and NGOs. As we now look forward to first year of implementation of the Mission, feedback received from field implementation will help in further improvement of the guidelines. Moreover, these guidelines provide ample flexibility for the States & UTs to notify state-specific guidelines and instructions.

Acronyms and Abbreviations

ADG: Additional Director General

AG: Accountant General

APO: Annual Plan of Operation

CAG: Comptroller and Accountant General

CASP: Central Assistance to State Plans

CBO: Community Based Organizations

CCA: Community Conserved Area

CCEA: Cabinet Committee on Economic Affairs

CFM: Community Forest Management

CAMPA: Compensatory Afforestation Management and Planning Authority

DGF&SS: Director General Forests & Special Secretary

EAP: Externally Aided Project

EFC: Expenditure Finance Committee

FDA: Forest Development Agency

GIM: Greening India Mission

GPS: Global Positioning System

GS: Gram Sabha

GIS: Geographic Information System

ICFRE: Indian Council of Forestry Research & Education

IFMS: Intensification of Forest Management

IG: Inspector General

IIFM: Indian Institute of Forest Management

IWMP: Integrated Watershed Management Program JFM: Joint Forest Management

JFMC: Joint Forest Management Committee

JICA: Japan International Cooperation Agency

LISS: Linear Imaging and Self-Scanning Sensor

MoEF&CC: Ministry of Environment, Forests and Climate Change

MGNREGA: Mahatma Gandhi National Rural Employment Guarantee Act

NAPCC: National Action Plan on Climate Change

NCC: National Cadet Crops

NGC: National Green Corps

NSS: National Service Scheme

NAP: National Afforestation Programme

NIC: National Informatics Centre

NTFP: Non-Timber Forest Produce

NFP: National Forest Policy

NGO: Non-Government Organization

NAPCC: National Action Plan on Climate Change

NRLM: National Rural Livelihood Mission

OM: Office Memorandum

PCCF: Principal Chief Conservator of Forests

PMF: Performance Monitoring Framework

PRI: Panchayati Raj Institution

QSP: Quality Seedling Production

REDD: Reducing Emission from Deforestation and Forest Degradation

RS: Remote Sensing

RBM: Results-Based Management

RF: Result Framework

SAPCC: State Action Plan on Climate Change

SHG: Self Help Group

SMC: Soil and Moisture Conservation

UNFCCC: United Nations Framework Convention on Climate Change

Contents

1. Introduction

Climate change phenomena has seriously affected and altered the distribution, type and quality of natural biological resources of the planet. Knowing the facts that the forests have deep influences on environmental amelioration though climate mitigation, food security, water security, biodiversity conservation and livelihood security of forest dependent communities, the need was felt to have a combination of adaptation and mitigation measures which would help in enhancing carbon sinks in sustainably managed forests and other ecosystems.

1.1 Mission Aim and Objectives

The National Mission for a Green India (GIM) was announced as one of the eight Missions under the National Action Plan on Climate Change (NAPCC). GIM is based on a holistic view of greening and focuses not on carbon sequestration targets alone, but, on multiple ecosystem services, especially, biodiversity, water, biomass etc. along with climate adaptation and mitigation as a co-benefit. It has the following broad objectives to be covered over next 10 years:

- Increased forest/tree cover to the extent of 5 million hectare (mha) and improved quality of forest/tree cover of another 5 mha of forest/non-forest lands
- Improved/enhanced eco-system services like carbon sequestration and storage (in forests and other ecosystems), hydrological services and biodiversity; along with provisioning services like fuel, fodder, and timber and non-timber forest produces (NTFPs)
- Increased forest based livelihood income of about 3 million households

1.2 Salient Features

The Mission is meant to nearly double the ongoing efforts of greening the country and would seek convergence with related Missions of NAPCC, as well as with other National Missions, programs and schemes including Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Compensatory Afforestation Management and Planning Authority (CAMPA), National Afforestation Program (NAP), National Rural Livelihood Mission, Integrated Watershed Management Program, Programs of Ministry of New and Renewable

Energy, National Rainfed Area Authority etc. The Mission has the potential to develop about one lakh skilled local community youth who would provide support in community based forest conservation, community livelihood enhancement and change monitoring, etc. These youth as Green Volunteers will act as a bridge between the community and the implementing agencies such as Forest Department.

One of the key differences of the Mission with conventional afforestation program relates to Mission's emphasis on the landscape approach. Selection of the landscapes therefore assumes critical significance. Landscapes as large contiguous areas of forest /non forest land, at different scale /levels provide unique opportunity to meet targets for both, National and State Forest policy. While the contiguous area of forests in different density class (e.g. moderately dense and open/ scrub) provide opportunity for improving the quality of the forest cover; the non-forest areas provide opportunity for increasing the forest cover.

1.3 Overall Mission Targets Envisaged in Mission Document

- Enhancing quality of forest cover and improving ecosystem services from 4.9 mha of predominantly forest lands, including 1.5 mha of moderately dense forest cover, 3 mha of open forest cover, 0.4 mha of degraded grass lands.
- Eco-restoration/afforestation to increase forest cover and eco system services from 1.8 m ha forest/non forest lands, including scrub lands, shifting cultivation areas, abandoned mining areas, ravine lands, mangroves and sea-buckthorn areas.
- Enhancing tree cover in 0.2 mha Urban and Peri-Urban areas (including institutional lands)
- Increasing forest cover and eco-system services from Agro-forestry and Social Forestry on 3 mha of non-forest lands
- Restoration of 0.1 mha of wetlands and the eco system services thereof.
- Improving fuel-use efficiency and promoting alternative energy sources in project area households.
- Enhancing Community livelihood of 3 million households.

1.4 The Mission in the 12th Plan Period and the Targets thereof

GIM has been approved by the Cabinet Committee on Economic Affairs (CCEA**)** in February 2014 with the projected cost of 13,000 crores during the 12th Plan period and one year spill over in 13th Plan. This includes Rs. 2,000 crores from 12th Plan Outlay, 400 crores from 13th Finance Commission grant, and convergence with CAMPA to the tune of Rs. 6000 crores and MNREGS to the tune of Rs. 4000 crores.

The objectives of the Mission during 12th Plan includes increased forest/tree cover in 1.40 mha of forest/non-forest lands and improved quality of forest cover in another 1.4 mha of forest/non-forest land. It envisages to improved ecosystem services including biodiversity, hydrological services, carbon sequestration from the 2.8 mha of forest/non-forest lands as mentioned above and increased forest-based livelihood income of about 0.85 million households, predominantly from tribal community living in and around the forests. It will also achieve additional enhanced annual CO_2 sequestration by 14 to 17 million tonnes. It is expected to generate 670.82 million person days of wage employment at a cost of about Rs.6782 crores, and skilled employment for about 28,000 community youth at a cost of Rs. 1352 crores.

2. Identification of Landscapes

2.1 Criteria for identification

Landscapes need to be identified on the basis of both biophysical and socio economic parameters, with an operation unit (about 4000-6000 ha) often co-terminus with micro/milli watershed. As contiguous area, the operational units within larger landscapes make sense ecologically as well as socio-economically. The criteria for identification of the landscapes may include projected vulnerability of forests to climate change, status of forest cover, significant biodiversity and other ecosystem values, critical habitats, corridors, and potential of area for carbon sink. Overlays of socio economic criteria like poverty and ethnicity (tribal /non-tribal) will further help prioritization of project areas within the candidate landscapes.

2.2 Landscape Levels

At the first step; broad landscapes of importance (L1) will be identified as large contiguous areas of forest and non-forests lands in a given landform / catchment and will narrow down to operational units, usually milli-watershed of approximately 4000-6000 ha (L2) and the working units, usually micro watersheds and villages/hamlets within level 2 landscape for actual implementation of the Mission (L3).

While some criterion may be suitable to one level for e.g. landform or catchment could be useful for identifying landscapes at L1 level, there may be certain criterion that may the relevant for multiple levels, like forest and tree cover mapping may be useful at all 3 levels to identify and prioritize the landscapes. Special criteria may be added for specific sub-missions / cross-cutting interventions – e.g. sea-buckthorn areas in the Western Himalayan States, shifting cultivation area in North-East, areas for agro-forestry, urban landscape and catchments supplying drinking water, etc.

Details of landscape identification at different levels, including dataset requirement is put up at Annexure-I.

3. Planning

3.1 Planning Imperatives

The GIM planning relates to landscapes at different levels i.e. L1 landscapes to L3 Landscapes. In the planning process, the L2 level landscapes and L3 level units remain the key focus. The L3 level landscape i.e. micro watershed and village level planning will relate to L2 level landscape i.e. milli watershed /cluster and vice versa. The Planning process will foster key tenets of landscape approach.

Since the Mission is strongly driven by convergence with program and schemes that have similar objectives or can contribute to the Mission objectives, it is imperative that the planning process for the Mission be such that leverages such opportunities.

The planning for Mission has a huge focus on the Results that the Mission aims to achieve over a period of time. Planning for Results, just not for activities and inputs will guide the planning process. It would therefore keep the Result focus at the very core of the planning process.

The bottom up planning process will allow micro plans at individual village level to define their priorities and actions under various sub missions and cross-cutting interventions to achieve the stated outcomes under the Mission. The micro plans with in the operational landscape unit (L2) will also be informed by the perspective planning done at the landscape unit level and vice versa.

3.2 Planning Process at landscape levels

The L1 Landscapes: Once the L1 Landscape/landscapes in the State have been selected, it will require describing the landscape in terms of total Geographical Area, the forest area in different density classes, the areas of interest, total number of L2 level landscapes within the L1 etc. State Level landscape plan will also solicit collation of various L2 level Landscape Plans (L2) within a given L1. The State may begin implementation of the Mission with one L1 or multiple L1.

The L2 Landscape: This is the critical level for planning. Each L2 level landscape will bring out situational analysis for the landscape and keeping in view various Sub Missions to which the L2 will relate to. The baselines will need to be set in. The planning for L2 level will also

need to map the existing institutions and programs/schemes that are crucial for convergence, and are in conformity with Mission objectives. A detail of information for carrying out the situational analysis, base lines and setting the objectives is put up at Annexure-II.

The L3 Landscape: For each constituent unit or village of the L2 level landscape, a Micro Plan needs to be developed in participatory manner. The guideline developed by various States for JFM may be useful in developing village specific micro-plans.

3.3 Landscape Level Committee

A committee may be set up at the level of landscape (L2) to facilitate planning and monitoring of the landscape level plan. The composition and the functions of the committee are put up at Annexure-III.

3.4 Convergence with programs and schemes

The Mission would link with other ongoing land-based greening/restoration programs and schemes of different agencies as well as with related programs of MoEF&CC. The key programs for convergence as per the EFC include MGNREGS, CAMPA, NAP and schemes under the 13th Finance Commission. Other equally important schemes would include NRLM, IWMP, Bamboo and Horticulture Mission, Programs of Ministry of New and Renewable Energy, Rainfed Authority of India, MoEF&CC programs under EAP, as well as State Govt. program that have potential to contribute to the Mission objectives. The opportunity for seeking convergence with ongoing Mission under NAPCC also needs to be underscored.

The convergence with ongoing program/ schemes will be secured by getting representation of the concerned department/ministry in the organizational structure of the Mission at different levels. Moreover, the State may issue guidelines for convergence linked to various schemes with GIM. Similarly, at national level, convergence guidelines of GIM with other programmes will be shared with the States.

Convergence should be done also at the resource level i.e. for the same planning/ functional unit, all available funding should be pooled in one kitty and planning/implementation should be done. Convergence format prescribed for MGNREGS will be adopted for GIM.

Agro-forestry guidelines issued by Ministry of Agriculture are in sync with these guidelines of GIM. In future, if funds are allocated under Agro-forestry Mission, it will be converged with GIM funds.

4. Institutions for planning & implementation

The institutional framework proposed for the mission must help it to meet the aims and objectives. In line with the Mission document, the following core principles inform the institutional framework:

a) Strengthening of decentralized forest governance
b) Convergence of Mission activities with other existing schemes, programs and Missions
c) Use of existing institutional spaces, rather than creation of new institutions

The Mission envisages a new approach in forest management i.e. through **Strengthening Institutions for Decentralized Forest Governance.** As the implementation of the Mission would require several cross-sectoral linkages and innovations there is a need for adequate and appropriate institutions with sufficient manpower. The main features of institutional framework are as follows.

4.1 Village level

It will be the Gram Sabha and the Committees mandated by the Gram Sabha, including revamped JFMCs, which will plan and implement the Mission activities at the village level. The revamping of JFMCs includes setting up of JFMCs by the Gram Sabha following due process as may be specified in State Panchayati Raj Act or in the JFM guidelines. The plans will be approved by the respective Gram Sabha. It will have explicit linkages with Panchayat level planning to ensure maximum convergence. Financial powers may be jointly exercised by the JFMC President and the Member Secretary. States may develop their own mechanism for execution of the works by forming a committee and naming a Member Secretary for each JFMC at local level.

In urban areas, ward level committees/RWAs linked to Municipality/Municipal Corporation will have role in implementation of the Mission activities.

4.2 Landscape/Cluster Level

In conformity with the Mission objectives, it is imperative to have a cluster level institution to facilitate planning, problem solving and seeking convergence opportunities at the level of cluster (L2 landscape). This will facilitate common approach to different issues arising in the

villages of that particular cluster. It may be serviced by sub-Range/Range. The revamped JFMCs office bearers will be represented in the Cluster /landscape level committee, along with ex officio members. The Chair of the Committee may be elected by the elected office bearers. Cluster level institution like federation of JFMCs in a given landscape/cluster would therefore be key to oversee and agree upon development of landscape level plan on one hand while planning for those activities that affect them as cluster /sub cluster. For e.g. setting up of Common Facility Centre for NTFP processing that could service the entire cluster.

4.3 District level

It will be revamped Forest Development Agency (FDA), under the Chair of elected representative for General Body of the FDA, that will facilitate the Mission activities at the district level. It will have explicit linkages with District Planning Committee. Each State Government shall appoint a Member Secretary for each District FDA and District level Steering Committee which will ensure convergence of schemes and programs.

4.4 State Level

A revamped State Forest Development Agency, as autonomous society, will facilitate the Mission implementation within the state. To provide for maximum convergence opportunities and strategic direction to the Mission, a steering Committee under the Chairmanship of Chief Secretary shall be setup by each State Government.

4.5 National Level

At National level, the Mission will have an all inclusive Governing Council, Chaired by the Minister, Environment and Forests to provide for overall guidance and synergy of action and the Mission Director as Member Secretary. There shall be a National Executive Council chaired by the Secretary (E&F) which will have overall responsibility for the Mission. There shall be a Mission Directorate at the National level with the Mission Director as its CEO with overall accountability for the Mission deliverables and will be supported by a team of experts and secretarial staff.

4.6 So overall, the following institutional structure will exist at National, State and District level:

I.	National Governing Council	**National Level**
II.	National Executive Council	
III.	Mission Directorate	
IV.	State Steering Committee	**State Level**
V.	Revamped SFDA	
VI.	District Steering Committee	**District Level**
VII.	Revamped FDA	
VIII.	Cluster level Committee	**Sub–District Level**
IX.	Revamped JFMC	**Gram Sabha/ Panchayat Level**

Indicative composition of institutions at various levels with roles and responsibility is enclosed at Annexure-IV. Each state shall constitute the institutional structure accordingly as per the local conditions and issue orders under intimation to the Government of India. MoEF& CC will issue separate OMs for the national level institutions and inform the states.

5. Approval of Plans & Projects and Funding Mechanism

5.1 Approval of Plans

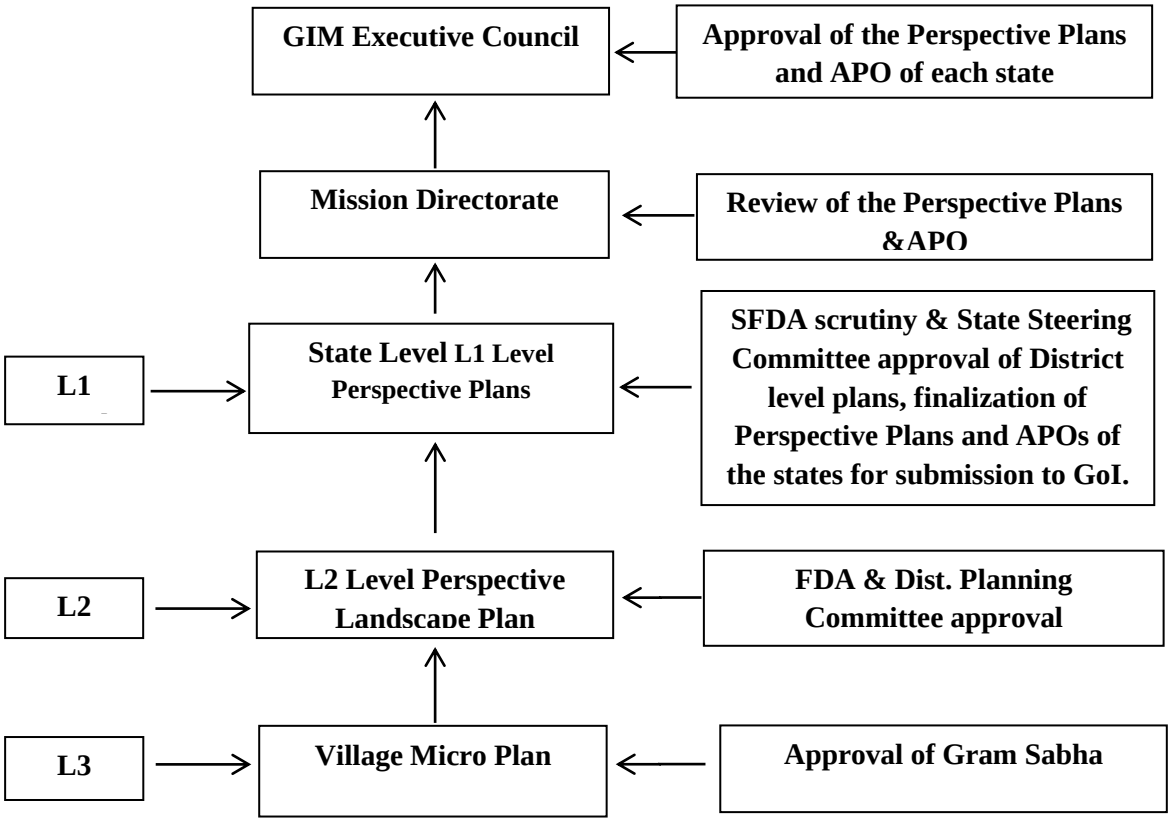
While identification of landscape is Top-down, planning shall be Bottom-up. It will not only allow effective participation of local stakeholders in decision-making and selection of priorities but will achieve better overall results. Operational units of landscape (L2) may be made fully coterminous with milli/micro-watersheds having unique identification numbers to ensure complete account of public funds spent earlier under other programmes.

L3 level micro-plans will be duly approved by the respective Gram Sabhas. L2 level perspective plans for the cluster will be approved by cluster level committee at the first level and then sent to FDA & to District Planning Committee for approval.

The District FDA will submit their perspective L2 plan to the State FDA. The SFDA will scrutinise all the L2 level perspective plans and the APO in conformity with the guidelines, and seek approval of State Steering Committee. Only state level perspective plan (of L1 level) and overall APO shall require National level approval. These perspective plans along with APO will be sent by SFDA to Mission directorate at national level, where it will be reviewed in conformity with the Mission guidelines. The APO will be taken for approval of the National Executive Council. After it gets approved L2 level approvals and release of instalments shall be possible.

The releases will be made to the State Government for onward release to SFDAs and to district FDA and JFMCs in conformity with approved plan. For support activities to be carried out at National, State and district FDA level, the funds will be made available as per the approved annual plan of operations.

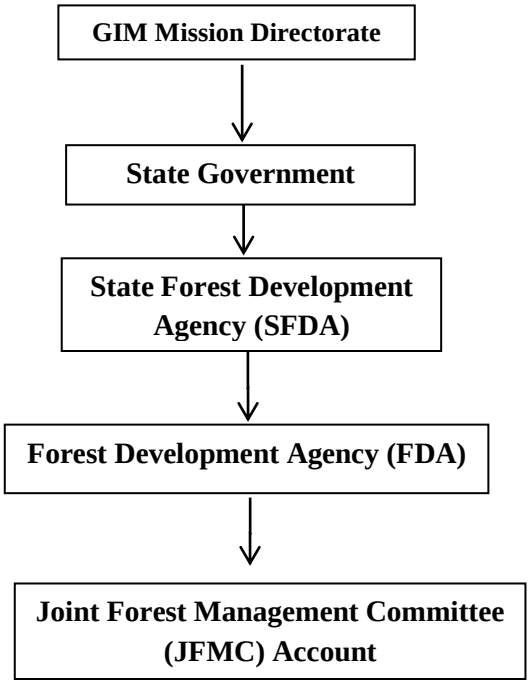
The institutional structure for approval of GIM plan is given below:



5.2 Nature of Central Assistance: The fund flow from Mission Directorate would be routed as Central Assistance to State Plans (CASP) through State Government. This is a Centrally Sponsored Scheme with Central Share of 75% for rest of India and 90% for NE and Special category States. However, 10% of the sanctioned amount would be made available as flexi funds to States for achieving the objectives to meet local needs and requirements within the overall objective of each submission and to pilot innovations and improve efficiency within the overall objective of the scheme and its expected outcomes and to undertake mitigation/restoration activities in case of natural calamities in the sector covered by the CSS.

5.3 The Mechanism: As per the guidelines for Flexi-fund within the CSS, 10% of the budget allocation for the respective State/UT will be set aside for Flexi-Funds and the remaining 90% for implementation of the Annual Plan of Operation (APO) in two instalments of 60% and 30%. The funds would be transferred by the PAO of the MoEF& CC to the Treasury of the State/UT Govt. for utilization of 90% for the APO and the remaining 10% as per instructions of the Ministry of Finance.

The State/UT Govt. would make provisions in their budget and transfer the funds well in time to the accounts of the SFDAs for implementation of the Mission through FDAs. The SFDA will open a separate bank account in any nationalized bank to operate and transact the fund received under GIM. The SFDA will devolve the funds to the concerned FDA in accordance with the approved Annual Plan of Operation (APO). The FDA will transfer the funds to the revamped Joint Forest management Committee (JFMCs) mandated by the Gram Sabha, which will implement the mission activities at the village level in accordance with the guidelines.



5.4 Unit Costs for the Mission Interventions:

Various components of the scheme and their unit cost proposed in the Mission document have been arrived after extensive consultations with the State Governments & UT Administration and as per similar conclusion of the Cost Norm Committee. The scheme provides for adequate flexibility to suit varied agro-climatic and site-specific conditions.

The cost estimates are firmed up on the basis of past experience, the tasks vis-à-vis actual need and requirement of afforestation and eco-restoration and other components of the Mission. The costs have been arrived at by taking into account wage rate of Rs 100. Sub-

Mission wise cost norms, as approved by the Cost Norm Committee, have been given at Annexure-V.

While the assistance under this Mission will be based on these cost norms, States & UTs are free to upscale the rates based on their prevailing and notified wage rates. Any difference in such rates will be borne by the concerned States & UTs and the same will not be reimbursed by the Mission Directorate.

6. Monitoring for Results

Monitoring and Evaluation (M&E) has been acknowledged as a key programme management function with significant bearing on programme efficiency and effectiveness. Acknowledging the role of M&E in programme delivery, monitoring at four different levels has been spelt out in the Mission document.

6.1 M&E Objectives

M&E in the GIM is expected to enable the mission in efficiently deliver the mission outputs and effectively achieve the mission outcomes. In consonance of the same, the objectives/results of M&E in the mission are shown at Annexure-VI.

6.2 Performance measurement

At the outset**,** the M&E system should enable continuous tracking of Mission performance and therefore should enable continuous measurement of expected results i.e. Outputs and Outcomes. The M&E system therefore would be a Concurrent Monitoring and Evaluation System that would encompass output and outcome levels rather than the conventional monitoring domains of input and activity tracking.

6.3 Planning

The M&E system would be user focused such that iterations and adaptive management is facilitated. The M&E system along with performance tracking would provide critical inputs to the entire planning process so that the feedback of the system can be factored into the planning process and variances accounted for.

6.4 Accountability

The system would ensure accountability on part of the implementers at the same time ensure transparency in the process of implementation. The M&E system would thus provide insights into efficiency and effectiveness of results delivered by the Mission.

6.5 Learning

The M&E system would provide for iterative learning, promotion of best practices and their dissemination. This would facilitate attainment of project objectives in the best possible way as well share the learning's with stakeholders.

6.6 M&E principles

The following would be the guiding principles shaping various M&E initiatives in the Mission.

6.6.1 Simple and comprehensive

The design of overall M&E system would be simple yet comprehensive to encompass all the dimensions of the mission. The simplicity of the system makes it easier to operationalize. The comprehensive nature would ensures keeping track of all the necessary parameters at the desired levels i.e. inputs, activities, outputs and results and the mission focus of biophysical resource status and socio-economic status of the dependent communities.

6.6.2 Participatory

M&E is not the stand alone function of the mission implementers but functional participation of all stakeholders is solicited for M&E. Taking cognizance of the multi-stakeholder environ in which the mission functions, avenues have to be designed that seek participation of other stakeholders at village, district and state level. Thus participation here is not only of the communities, but of other stakeholders impacting and getting impacted by the project.

6.6.3 Analysis and feedback

Analysis and feedback for the implementation process would be a key feature of a mission M&E system. Along with reporting requirements, the M&E system would facilitate analysis of information at various levels ensuring timely and continuous feedback for implementation. This analysis and feedback would help in timely information for planning and feedback to multiple agencies/ stakeholders.

6.6.4 Use of enabling technologies

The mission would integrate application of modern technology like Remote Sensing and GIS etc. for M&E purposes. The Mission would support use of Geomatics (remote sensing with GPS mapping of boundaries) for monitoring at the output/ outcome level. This service will be available for both Mission-financed activities as well as those undertaken and financed by other agencies/ stakeholders.

6.6.5 Capacities for M&E

Development of requisite capacities for effective implementation of M&E activities is quintessential for having a functional Decision-Support System. This necessitates adequate investments in creating necessary capacities for M&E. Capacity development for M&E would therefore be integral component of the M&E system encompassing human, physical and financial capabilities.

6.7 Performance monitoring framework (Result Framework)

In consonance with the Government of India (GoI) directives of adopting Results-Based Management (RBM) for design and implementation of state imperatives, the Performance Monitoring Framework (PMF) or Result Framework (RF) would be at the loci of the M&E system. All the M&E imperatives in the mission needs to be aligned to PMF/RF and should respond to the PMF/RF. An indicative Mission PMF is presented in the matrix at Annexure-VI. The indicators for monitoring shown at Annexure-VI are indicative; the State/implementing partners may evolve other indictors to monitor the progress, towards achieving of outcomes/results. The PMF has been developed synthesizing the outputs and outcomes stated in the mission document however, with simplification considerations, the same have been synthesized as 'expected results' in the PMF. The same would be the backbone of M&E in the mission.

6.8 Monitoring Levels

Monitoring is proposed at four levels-

Level 1: On-ground self-monitoring of the region by the local community, implementing organization and the Forest Department. Building community capacity to monitor Carbon and other services is envisaged using lessons from pilot projects.

Level 2: Field review by an external agency of randomly selected sites and will be primarily for Mission financed activities. Monitoring by third party and long term monitoring of certain eco system services at selected sites has been provided.

Level 3: This will use remote-sensing-based forest cover monitoring by the Forest Survey of India, supplemented by boundaries of areas covered under the Mission. The Mission will work in close collaboration with Forest Survey of India, National Remote Sensing

Agency and Indian Institute of Remote Sensing for developing a countrywide mosaic of high resolution satellite images (LISS-IV, CARTOSAT) and overlaying polygons of areas taken up for interventions under the Mission to help develop a centralized spatial data base in the GIS domain. Density slicing could be used to gauge migration within density class. This service will be available for both Mission-financed activities as well as those undertaken and financed by other stakeholders. The real-time, web-based monitoring system being developed for CAMPA by National Informatics Centre (NIC) will be taken as the starting point for the system.

Level 4: In addition, a few pilot areas will be intensively monitored to assess the impact and efficacy of different old and new practices, in tandem by the implementing agency, the Forest Department, and a support organization. In addition to growing stock and forest cover, other parameters will include monitoring environmental services and associated factors: ground cover, soil condition, erosion and infiltration, run-off, groundwater levels to develop water budgets, as well as the provision of locally relevant fuel wood, fodder, and other NTFPs, and basic biodiversity analysis. This would facilitate review of different regulatory conditions in the future. This analysis would require extensive support for communities and could form the basis for REDD-based monitoring methodologies.

6.9 Social Audit

In addition to these four levels monitoring, the Gram Sabha will carry out the **social audit** of the Mission activities at the village level. The Mission will learn from best practices on social audit, particularly the one designed for MNREGA. Section 17 of the NREGA Act empowers the Gram Sabha to carry out a social audit of all the works carried out by the Gram Panchayat. It requires that the Gram Panchayat make available all relevant documents, including the muster rolls, bill, vouchers, measurement book, copies of sanction orders and other connected books of account and papers to the Gram Sabha for the purpose. Taking a cue from the MNREGA, the Mission will similarly require that the Gram Sabha carries out a social audit of all expenses incurred by the Committees constituted by the Gram Sabha/revamped JFMCs and these reports would be shared in the public domain.

6.10 Audit by Government bodies

The Mission accounts will be subjected to audit by Comptroller and Accountant General (CAG) at Centre and by Accountant General (AG) in the States. Achievement of annual targets will be governed by the local conditions/site- specific planning in each State covered under the Mission, and may at times be at variance with the overall Mission targets. The CAG and the AG will need to be taken on board from the very outset to understand such variations.

7. Legal & policy provisions

7.1 Enabling Policy and Legal Regime for the Mission for improving investment climate for farmers

The Mission has a great deal of emphasis on forest on private /farmers lands. Over the Mission period about 3 million ha of new forest and tree cover is envisaged on the farmers land. Such target is possible; however, the Mission need to ensure their harvesting and transit issues are addressed in a manner that it is not hindered by cumbersome regulatory procedures. When regulations are complex, farmers in need suffer substantial losses by distress selling of their trees to agents. In effect this problem may be considered a regulatory barrier to conducting the business of growing trees, thus reducing the likely returns on investment and acting as a constraint to farmers investing in growing trees. For example, trees on private lands, especially those species that are most suitable to grow in the areas, as it grows in the natural forests in most states are governed by several regulations. Permissions are required for harvest, commercial use, own use, transit of forest produce as well as conversion of land use. In combination, these regulations pose diverse types of controls, multiple points of regulation, and considerable regulatory burden on farmers as well as on the implementing agencies.

The Mission will provide support in assessing the investment climate to help identify good practices, constraints, and regulatory lacunas/ vacuums, and to address the same through appropriate policy and legal frame work. Toward this end, the forest policy division of MoEF&CC has drafted the guidelines to ease out the regulatory regime for harvesting and transit of agro forestry species and the same will be issued separately.

7.2 Agro Forestry Policy 2014: Also a comprehensive Agro Forestry Policy is now in place which looks into all the aspects related to promotion of agro forestry in the country. The details can be accessed at Ministry of Agriculture website.

8. Making Mission a People's movement

8.1 Mission Outreach

The Mission seeks to unlock people's energy and solicit their engagement with the greening program by bringing area, beyond the existing recorded forests i.e. around 23.5% of the total geographical area, under the green cover to achieve the goal of bringing one-third of the area under forest & tree cover as per the National Forest Policy, 1988. It will strive to secure participation of multiple agencies/ organizations/ individuals (community, farmers, Panchayat bodies, Government/Non-Government, Private institutions/agencies, academia, business houses, children especially in rural communities, media, etc.) in greening activities. The Mission's communication strategy must engage an array of stakeholders. It must provide support to various agencies/organizations to undertake Mission interventions through provision of knowledge and knowhow, monitoring support, planting material and financial models for participation, as well as engage in decentralized monitoring. The area, besides the recorded forest area, covered under greening may be termed as Woodland. MoEF&CC may issue further guidelines for managing such woodlands.

8.2 Seeking people's engagement through Community Conserved Areas & Sacred grooves

Community Conserved Areas and Sacred Groves: Community Conserved Areas (CCAs) are defined as "Natural ecosystems (forest/ marine/ wetlands/ grasslands/ others), including those under minimum to substantial human influence, containing significant wildlife and biodiversity value, being conserved by communities for culture, religious, livelihood, or political purposes, using customary laws or other effective means". Examples of CCAs from across the country include many sacred groves. These are scattered all over the country, from scrub forests in the Thar Desert of Rajasthan maintained by the Bishnois, to rain forests in the Kerala Western Ghats, and are referred to by different names in different parts of India. Around 14,000 sacred groves have been documented from all over India; however their total number could be much higher and may run into over a lakh. Sacred groves act as reservoirs of rare fauna, and more often of rare flora, amid rural and even urban settings.

The Mission strongly supports using Sacred Grooves as loci to solicit people's engagement in conservation. The States may draw a list of such sacred grooves /CCA and build use them as centres to solicit people's engagement. The Mission will also support CCAs, including sacred groves, through institutional, policy and legal measures. The CCAs, as part of various landscapes/sub-landscapes prioritized under the Mission, would be given support for protection and conservation, using institutional diversity represented by the CCAs.

8.3 Engaging Schools and Colleges

School-children and college students are a valuable and enthusiastic group to help further the Mission objectives, while in turn receiving real-life learning by their involvement. India has about 1 million recognized schools18 and some 10,000 colleges. Programs such as the National Green Corps (NGC) coordinated by MoEF, NCC and NSS, and many other initiatives taken by State Govts, NGOs have shown a great deal of potential to engage school and college students and teachers in monitoring natural and restored forests and other landscapes as well as in actual "greening" activity. Working in tandem with these programs/initiatives and organisations, the Mission provides a unique opportunity to engage students and teachers in the greening initiatives.

8.4 Engaging NGOs &CSOs

The Mission envisages the role of NGOs as partners in furthering the Mission mandate especially in community mobilization, strengthening of the Gram Sabha and its myriad bodies, in facilitating community ownership and management of natural resources, developing the cadre of skilled community youths etc. NGOs as Process Support Groups would help in strengthening of institutions at various levels, from village level institutions to the State bodies. The Mission will ensure representation of NGOs in decision making bodies at different levels. The Mission will set the process guidelines for engagement of NGOs with proven track record. The State Mission organization, by using the guidelines, will be able to identify such NGOs and provide them with necessary support to help achieve the Mission objectives.

8.5 Private Sector Engagement

The Mission has ambitious target for supporting program of nurseries for raising of "quality seedlings" to meet the demands of farmers, including transportation to villages to provide easy reach and supply in an energy efficient manner. The private sector has a big role in Quality Seedling Production (QSP) and transportation. They may also engage farmers for raising decentralised nursery of quality planting material. The quality seedling so produced would be provided to farmers, the Mission has provisions to incentivising the farmers for planting and successfully raising of quality seedlings. The private sector companies can also enter into buy back agreements with farmers or declare remunerative price, and it should be the choice of farmer to sell the produce wherever he/she gets the best price.

8.6 Landscape Yatra as process tool to engage multiple stakeholders

To make GIM as People's movement, and to engage multiple stakeholders including government agencies, NGOs/CBOs, community representatives, Academia, media, people's representatives etc. Landscape Yatras may be organized to develop deeper understanding of the issues of the landscape/cluster by the planning teams .These are journeys/transect walks through identified areas of landscape, undertaken with multi-disciplinary team(s) including local community representatives, with immediate objective of improved planning and implementation of the program. Landscape Yatra manual will be shortly available on the MoEF&CC website.

Annexure -I

Selecting landscapes – outline of the process

This section provides a brief outline of the suggested process for identifying landscapes at multiple scales/levels

A. **Levels for landscape identification**: The mission aims to identify broad landscapes of importance (L1) as large contiguous areas of forest and non forests lands in a given landform / catchment and narrow down to operational units, usually Milli Watershed of appox 5,000 to 10,000 ha (L2) and the working units, usually micro watersheds and villages/hamlets within Level 2 landscape for actual implementation of the Mission. (L3)

B. **Criteria for Identification** Landscapes will be identified using a combination of criteria at different levels.

   Suggested **criteria** for different landscape levels may include :

   - Land forms /catchments /bio-geographic zones etc. (Data source : SOI /Watershed Atlas / WII)
   - Forest and tree cover giving density class wise details including moderately dense forests as well as open/scrub forests) Data Source : FSI
   - Corridors (wildlife Institute of India)
   - Wastelands (source : Space Application Center)
   - Vulnerability to Climate Change impacts, of forests and communities, (Source : IIS data , provided by FSI)
   - % population of STs / SCs, (Census data)
   - Poverty levels (BPL %) (Census data)

   While some criterion may be suitable to one level for e.g. landform or catchment could be useful for identifying landscapes at L1 level, there may be certain criterion that may the relevant for multiple levels, like forest and tree cover mapping may be useful at all 3 levels to identify and prioritize the landscapes. Special criteria may be added for specific sub-missions / cross-cutting interventions – e.g. sea buckthorn

areas in the western Himalayan states, shifting cultivation area in north east, areas for agro-forestry, urban landscape and catchments supplying drinking water, etc.

Once the criteria have been listed , various maps and spatial and attribute data sets need to be collected from different sources like FSI, Space Application Centres, IIRS, State Departments, Census of India, Dept. of Rural Developments, etc.

C. Identification of Landscape at different levels:

L1-Landscape: At L1 level broad landscapes of interest/importance can be identified using Land forms or catchments as base layer. For e.g. In MP, Satupra ranges, Vindhayan ranges, Malwa Plateau, Narmada Valley, etc are broad land forms. In Uttarakhand, 8 river catchments cover the state. In Haryana, the state has identified the Shiwaliks, the Aravallis and Plains, as key landform.

Next, forest cover and scrub layer can be overlaid on the base map of landforms/bio geographic units/catchments to identify areas of interest under different density classes. For example, areas with substantial moderately dense forest would be appropriate for the sub-mission on enhancing quality of forest cover and to improve ecosystem services. Areas with open and scrub cover would be appropriate for the eco-restoration of degraded open forest.

Identification at L1 level can be easily made with State Maps with landforms / catchments shown on it, to which latest available forest and tree cover layer from FSI can be overlaid. A simple visualisation process thereof can mark large landscapes of interest to the State in different density classes, in conformity with sub mission s. The state may also decide if they would like to work in all the L1 level landscapes or given the resource kitty, prioritisation of the L1 would be required.

Agro forestry (tree cover outside forest layer), urban /periurban layers may be considered to define the landscape at L1 level that cater to these sub missions.

L2-landscape: Once the landscape at L1 have been identified , delineation of L2 level can be done by putting watershed boundaries (Milli watershed/second hierarchy of stream) on the map , and thereby delineating L2 level landscape or the so called

operational units. Thus each L1 landscape will have multiple L2 level landscapes with area varying from about 5000 -10,000 ha.

Prioritisation of the L2 landscape is the most important task. The key criteria for prioritization may include forest and tree cover, vulnerability of forests to climate change, bio-diversity richness, wildlife corridors, along with the socio economic criteria like % of tribal population and incidence of poverty. To get clear prioritization of L2 landscapes, once data sets have been obtained for different criteria, they will have to be aggregated and combined in a way to provide a composite picture. Each criterion can be assigned relative weight, based on the specific requirement and priority of the state. For each criterion, the range of value should be normalised to cover a range of 0-1.

Then the normalized and weighted values can be added together to get a total score. In addition, some criteria for representativeness may also be used to ensure broad coverage, so that specific landscapes of interest or importance which may have small or localized coverage do not get left out – e.g. across forest types, agro-ecological/agro-climatic zones, etc. Similarly particular sub-missions, sub-categories and cross-cutting interventions may also be identified through specific criteria - e.g. for mangroves, urban pockets, drinking water supply catchments.

L3 level-Working Units: Once the L2 operational units are identified above, we can then move to identify the L3- actual Working Units. Based on the Micro-watershed/village boundaries, all the villages along with forest/non-forest area with a given L2 landscape will need to be taken up for treatment.

D. GIS and manual GIS options for aggregation

GIS based analysis: States are encouraged to collect their data sets and undertake their own GIS analysis on the lines indicated above to choose landscapes, sub-landscapes and operational units. Assistance of FSI Dehradun, NRSC, State Remote Sensing Application Centre and academic institutions, NGOs etc with GIS capabilities may be taken as desired.

Manual GIS analysis: An alternate option is to get hard copy map printouts of a few key criteria, and along with existing maps and data, use transparency sheets (or

acetate sheets) to overlay key parameters in a form of manual GIS and choose the landscapes for early implementation.

Role of expert opinion: Either analysis should be supplemented by expert opinion from within the Forest Department and also outside the Forest Department.

Each state will do the exercise using its GIS cell / Regional State Application Centre etc. in consultation with FSI / NRSC/ IIRS as required.

Table 1: Criteria for identification of landscapes at different levels

Criteria	**Layers**	**Rationale**	**Appropriate level**	**Source& Date Type**
Bio-diversity richness & habitat Diversity levels, patch size	Forest bio-diversity, patch size, fragmentation	National level data base that incorporates basic floral biodiversity as well as habitat characteristics such as patch size, fragmentation, presence of invasive species	L2	IIRS (Vector)
Poverty % of BPL Pop. /Total Pop.	Attribute data + district/block boundaries	Supplement % SC/ST with % of BPL as per existing state level data.	L2	States (Attribute)
Forest land	Forest land boundary layer	Representative indicator – the ratio of Forest land to overall area in landscape/range helps identify areas of low, med, high forest levels	L2 and L3	FSI/ State FD (vector)
Forest Type	Forest Type boundary layer	Representative indicator. Will help ensure different forest types and sub-types are well represented in the GIM	L1/L2	FSI Rastor and vector

Use of these criteria can help identify the L2 Operational Units at block/range level within the L1 landscapes that are good candidates for implementing the various sub-missions under the GIM. Situation or problem analysis may be started at L2 level and crystallize as concrete interventions at L3 level (see next para)

The datasets in addition to the ones identified above are likely to include the following:

Table 2: Indicators for consideration

S.No.	Layer	Data Type	Criteria	Source
1	High resolution imagery	Raster	To develop hi-resolution landuse/land cover map as a baseline	
2	Topography - contours	V/ Image	Will help correlate topography with forest cover and identify forests that are under-represented in topographic terms. If available in vector format, could also be used to create 3-D DEMs	SOI
3	Village, forest boundaries	V	All forest and village/hamlet boundaries should be digitized on a priority basis	Revenue /Forest. Dept
4				
5				

Table 3 - **Additional optional indicators for consideration**

S.N.	Layer	Data Type	Criteria	Source
1.	Wetlands / tanks	Vector	Location or Boundary of water bodies	State
2.	Springs	Point	Location of springs (if available)	State
3.	Drinking water supply intake points	Point	Shows points of intake for drinking water schemes - from springs, streams, rivers, wells, handpumps etc. Areas upstream of these will be drinking water catchments (if available)	Water supply depts.
4.	Forest land boundaries	Vector	Show extent of landscape within and outside 'FD' forest land.	FSI/ State FD
5.	JFM, Van Panchayats, KFCS, CFR (FRA), CCAs boundaries	Vector	Areas under local protection and management – likely to have higher chances of success in GIM. Can correlate forest condition within and adjacent to patches managed/protected by communities	State FDs
6.	Forest cover change map – over the last 5/10 years	Raster	This will show recent trajectory of change for forest cover and help identify areas under threat, establish the previous rate of deforestation and help guesstimate future threats of deforestation	FSI

7.	Urban / peri-urban areas	Vector	Boundary of urban areas, to help identify urban/peri-urban forest patches – current and potential	State
8.	Community conserved areas	Vector	A cross-cutting intervention in the GIM	State
9.	Areas already treated	Vector	Help identify extent of investments made in the past (1/5 year)	State
10.	Attribute data + district/ block boundaries	Distance of LPG	Identify areas with high and low LPG penetration	State

Annexure-II

Development of Perspective Landscape (L2) plan:

The various data/information required for perspective planning is given below. The committee may also decide on other factors on which the information would be needed considering the special requirements of the landscape/sub-landscape.

1. **Bio-physical Information** - **(i)** Land use **(ii)** Area of forest/non-forest **(iii)** Vegetation & fauna **(iv)** Biodiversity **(v)** Watershed classification and catchment area **(vi)**Types of forests & regeneration status **(vii)** NTFP resources **(viii)** Surface water and ground water resources **(ix)** Biomass and Carbon stock **(x)** Degraded forest and waste lands **(xi)** Areas needing special attention **(xii)** Fire/erosion prone areas/incidences
2. **Bio-cultural Information**: Areas of incomparable values, indigenous ecological knowledge
3. **Socio-economic information** - **(i)** Administrative **(ii)** Population **(iii)** Landholding pattern **(iv)** Cropping pattern **(v)** Livestock **(vi)** Drinking water **(vii)** Domestic Energy **(viii)** Occupation **(ix)** Infrastructure **(x)** Sources of income **(xi)** Forest-based livelihood enterprises **(xii)** Recreation/eco-tourism
4. **Dependency on forests – (i)** Food **(ii)** Firewood **(iii)** Fodder and grazing **(iv)** NTFP for consumption and trade **(v)** Timber/small timber **(vi)** Drinking water/irrigation **(vii**) Other forest-based Livelihoods
5. **Institutions - (i)** JFMC **(ii)** Other forest-related institutions **(iii)** Watershed Committees **(iv)** FRA committees **(v)** NGOs/CBOs **(vi)** Forest Deptt**. (vii)** Other Govt. Depts. **(viii)** Research/scientific institutions

Note: (*This may be done in a more interesting manner. First describe the attributes of the landscape in totality including bio physical socio cultural and economic; (it like a pen picture of L2) highlighting key values and attributes that the landscape houses (some of such values could include eco system service like water, carbon, biomass, NTFP, biodiversity etc.), the institutional diversity, ethnic/demographic dimension Key challenges /threats that the landscape has vis-à-vis the values/attributes (there could be time series data for different elements like forest degradation etc. to corroborate this). The schemes and programs of multiple agencies have to address the key challenges and the strength and gaps thereof).*

Annexure-III

Constitution of Landscape Level Planning (LSP) Committee at L2 Landscape Level

a) A Landscape Level Committee will be formed to oversee formulation of the perspective plan and monitor its implementation.
b) The Committee may be headed by CF/DFO of the Circle.
c) Will include representatives of the civil society, NGOs, scientific institutions, key lines agency representatives & presidents of JFMCs in the given landscape.
d) This committee will be setup by the SFDA and may be a sub-committee of the revamped FDA.

Functions of the LSP Committee

1. Oversee, guide and monitor the preparation of the Landscape Plan and micro-plans in the landscape.
2. Consider the adequacy of the data/information available for formulation of the perspective plan and decide on the strategy to address information gaps.
3. Commission Landscape yatras, rapid surveys/studies and appoint appropriate facilitators /NGOs/ experts to be engaged for the purpose.
4. Provide mechanism to put basic spatial and attribute data collected in a GIS platform and generate sets of thematic maps for the landscape.
5. Broadly analyze the landscape and devise strategies to address the drivers of degradation, improve/increase forest cover, enhance livelihood options, & ecological services and other desired outcomes.
6. Identify the entities to be involved in formulating micro-plan in every village/administrative unit and provide the guiding principles for the preparation of the micro-plan.
7. Formulation of the perspective plan of the sub landscape and approval from the district planning committee especially in case of convergence issues.

Annexure-IV

Institutional Landscape for GIM: The composition and Roles/Responsibilities

The Mission will have following institutions for planning, implementation and monitoring of various sub-missions and intervention at national, state and local levels.

A. Institutions at National Level

I. National Governing Council: A National Governing Council under the chairmanship of the Minister, Environment, Forests and Climate Change and with the following members shall be constituted. Functions of this Council shall, *inter-alia*, include:

- To provide overall guidance and synergy with other programme;
- To approve the Implementation Guidelines of GIM and make changes as and when necessary; and
- To approve the Annual Report of the Mission.

This committee shall consist of the following members:

(i)	Minister of Environment, Forests & Climate Change	Chairperson
(ii)	Secretary, Ministry of Environment, Forests & Climate Change	Member
(iii)	Finance Secretary, Ministry of Finance	Member
(iv)	Secretary, Ministry of Science and Technology	Member
(v)	Secretary, Ministry of Rural Development	Member
(vi)	Secretary, Ministry of Panchayati Raj	Member
(vii)	Secretary, Planning Commission	Member
(viii)	Secretary, Ministry of Agriculture	Member
(ix)	DGF&SS, MoEF&CC, Government of India	Member
(x)	ADG (Forest Conservation), MoEF&CC, Government of India	Member
(xi)	ADG (Wild Life) MoEF&CC, Government of India	Member
(xii)	Additional Secretary, MoEF&CC, Climate Change	Member
(xiii)	Financial Advisor, MoEF&CC, Government of India	Member
(xiv)	Three PCCF, one from six regions, to be nominated every year by MoEF&CC on rotation basis	Member
(xv)	IG (Forest Conservation), MoEF&CC, Government of India	Member
(xvi)	Three eminent NGO experts, one each in the field of forestry, wildlife and ecology, for a period of two years subject to not more than two consecutive terms	Member
(xvii)	Mission Director, Green India Mission	Member Secretary

It shall meet at least once a year.

II. National Executive Council: The Executive Council chaired by the Secretary (EF&CC) will be vested with following functions:

- To lay down and / or approve rules and procedures for the functioning of the body, subject to the overarching objectives and core principles of GIM;
- To provide Operational Guidelines for the implementation of the Scheme;
- To approve the Perspective Plan for each state;
- To approve the Annual Plan of Operation (APO);
- To monitor the progress of the utilization of funds released by the State GIM; and
- To ensure inter-departmental coordination and convergence.

This committee shall consist of the following members:

(i)	Secretary, MoEF&CC	Chairperson
(ii)	DGF&SS, MoEF&CC, Government of India	Member
(iii)	Director General, ICFRE	Member
(iv)	Director, IIFM	Member
(v)	Financial Advisor, MoEF&CC, Government of India	Member
(vi)	Director General, Forests Survey of India	Member
(vii)	A representative not below the rank of Joint Secretary level, from each of the Ministries of Finance, (Department of Expenditure); Science and Technology; Rural Development including NRLM, Agriculture, Tribal Affairs, Land Resources and Panchayati Raj, Government of India	Members
(viii)	Chairman, National Bank for Agriculture and Rural Development	Member
(ix)	Three non-Government Experts, one each from the field of forestry, Livelihood and wildlife	Members
(x)	Advisor, Planning Commission	Member
(xi)	Member, National Rainfed Area Authority	Member
(xii)	IG (NAEB)/ IG (EAP)/ IG (FC)	Member
(xiii)	Mission Director, GIM	Member Secretary

It will meet at least twice a year.

III. **Mission Directorate:**

The Mission Director will have the overall responsibility for the Mission deliverables and will be supported by a team of experts and secretarial staff. The Mission Directorate will also provide overall guidelines for implementation of the Mission, scrutiny and sanction of projects and will carry out the monitoring and evaluation. It will also coordinate pilot research projects related to activities envisaged in the Green India Mission and will document and disseminate such results for further improvement.

B. Institutions at State Level

At State level, the following new and revamped committees will oversee planning and implementation of the Mission.

I. Revamped SFDA

A revamped State Forest Development Agency will act as the highest body at the state level to guide the State Mission Directorate and will be chaired by the Chief Minister or a Minister to be nominated by the Chief Minister. It will solicit cross-sectoral representation and will guide all the Mission activities at the State level. It will consist of General body and Executive body to enforce decentralized governance in implementation of the Mission.

(a) General body: The functions of General Body shall *inter-alia, include:*

- To provide for overall guidance for the Mission in achieving Mission goals and objectives.
- To oversee implementation of the broad policy framework in achieving Mission goals and objectives.

This committee shall consist of the following members:

(i) Chief Minister or a Minister nominated by him	Chairperson
(ii) Principal Secretary (Forests)	Member
(iii) PCCF	Member
(iv) Chief Wildlife Warden	Member
(v) Nodal Officer (Forest Conservation)	Member
(vi) Chairman, Executive Committee, all FDAs	Member
(vii) Member Secretary, Executive Committee, all FDAs	Member
(viii) Nodal Officer (State CAMPA)	Member
(ix) Representative of three eminent NGOs of the State	Member

(x) Nodal Officer, GIM — Member Secretary

It will meet at least once a year.

(b) State Level Executive Committee: The functions of the Executive Committee will be as follows:

- Preparation of State APO and its submission to State Screening Committee for finalization;
- Technical approval of District level APOs;
- Preparation of the annual reports of the State GIM;
- Ensuring programmatic convergence at the L1 landscape level
- Providing technical guidance for implementation of GIM

This committee shall consist of the following members:

(i) Principal Secretary (Forests)	Chairperson
(ii) PCCF	Member
(iii) Chief Wildlife Warden	Member
(iv) Nodal Officer (Forest Conservation)	Member
(v) Chairman, Executive Committee of 3 FDAs	Member
(vi) Member Secretary, Executive Committee of 3 FDAs	Member
(vii) Nodal Officer (State CAMPA)	Member
(viii) Director, State Forest Research Institute	Member
(ix) Two representative of Scientific Institutions and Universities	Member
(x) Representative of two eminent NGOs of the State	Member
(xi) A representative from each of the Ministries of Finance, (Department of Expenditure); Science & Technology; Rural Development including NRLM, Agriculture, Tribal Affairs and Panchayati Raj of State Government	Members
(xii) Nodal Officer, GIM	Member Secretary

It will meet at a frequency to be decided by the State Government but at least twice in a year.

II. State Steering Committee: The State Steering Committee chaired by the Chief Secretary will be vested with the overall management of the State Green India Mission. The functions of State Steering Committee shall *inter-alia,* include:

- To provide for overall guidance and synergy with other programmes so that inter-dependent coordination and convergence can be ensured;
- To finalize the Perspective Plan for each L1 landscape in the state and forward it to Govt. of India;

- To finalize the APO of the State Mission and forward it to Govt. of India for approval;
- To monitor the progress of the utilization of funds released by the State GIM;
- To work as Empowered Committee for financial sanctions and approvals at the state level in accordance with guidelines issued by MoEF&CC from time to time.

This committee shall consist of the following members:

(i)	Chief Secretary	Chairperson
(ii)	Principal Secretary (Forests)	Member
(iii)	Principal Secretary (Finance)	Member
(iv)	Principal Secretary (Planning)	Member
(v)	Principal Secretary (Rural Development)	Member
(vi)	Principal Secretary (Agriculture)	Member
(vii)	Principal Secretary (Water Resources)	Member
(viii)	Principal Secretary (Tribal affairs)	Member
(ix)	Principal Secretary (Panchayati Raj Institutions)	Member
(x)	PCCF	Member
(xi)	Chief Wildlife Warden	Member
(xii)	Nodal Officer (SAPCC)	Member
(xiii)	Nodal Officer (Forest Conservation)	Member
(xiv)	A representative of the Ministry of Environment and Forests	Member
(xv)	Two eminent NGO's working in the field of Forest Conservation and livelihood to be nominated by the State Government for a period of 2 years at a time who shall be eligible for re-nomination	Members
(xvi)	Nodal Officer, Green India Mission	Member Secretary

It will meet at least once in six months.

III. Revamped FDA

The Mission implementation will be facilitated by revamped Forest Development Agencies (FDAs) at the District level and will link with District Planning Committee. Like SFDA, it will also consist of General body and Executive body to make decentralized governance in preparation, implementation and convergence of Mission activities with other schemes.

(a) General Body of FDA: The General Body of FDA will be chaired by elected representative/Chairperson of Zilla Panchayat for democratization of the institutions. The Committee's basic functions will be to deal with policy issues pertaining to

cohesion and convergence of different programme at Panchayat level for better efficiency of the Programme. Nominees from cluster level will be part of the General Body.

This committee shall consist of the following members:

(i)	Chairperson (Zilla Panchayat)/ Elected Representative	Chairperson
(ii)	Conservator of Forests in whose jurisdiction the FDA falls	Member
(iii)	DFO (Social Forestry)	Member
(iv)	Range Forest Officers, ACFs/ SDFOs	Members
(v)	Presidents of JFMC General Bodies, not more than 50 at any time, to be nominated by Chairperson on rotational basis for a period of one year , of which 20 would be women representatives In the event adequate number of women chairpersons are not available, the women representatives will be drawn from the members of the General Bodies of JFMCs (at least one member from each cluster)	Members
(vi)	Three non-official representatives to be nominated by the apex institutional framework of Panchayats.	Members
(vii)	DFO (Territorial)	Member Secretary

It will meet at least twice a year.

(a) **Executive Committee of FDA:** The Executive Committee of FDA of a District will be chaired by the Conservator of Forests in whose jurisdiction the district falls. The Committee's basic functions will be to deal with preparation of annual plans for the districts and convergence therein for coordination on other general issues as per guidelines circulated in this regard. This committee will be fully responsible at the district level of proper implementation of GIM in the district. Any problems/issues related with implementation/convergence will be brought to the notice of District Steering Committee and State Level Executive Committee for resolution.

This committee shall consist of the following members:

i.	Conservator of Forests in whose jurisdiction the FDA falls	Chairperson
ii.	DFO (Social Forestry)	Member
iii.	District Development Officer	Member

iv. District level Officers of Agriculture, Rural Development, Animal husbandry, Soil Conservation, Tribal Welfare, Industries, Public Health & Engineering, Welfare, Horticulture, Minor Irrigation, Small Scale Industries/ KVIC, Education Departments and the Lead Bank Officer ADM/AC to be nominated by DC/DM. Members

v. Three non-official representatives to be nominated by the apex institutional framework of Panchayats. Members

vi. Fifteen nominees from the JFMCs, to include minimum of 7 women

vii. DFO (Territorial)-cum-Chief Executive Officer Member Secretary

It will meet at least every quarter in a year.

IV. **District Steering Committee**

To provide for proper coordination and cohesion between implementation structures of like IWMP, NRLM MGNREGs and GIM, a District steering Committee under the Chairmanship of District Collector will be setup. It will have District Collector as Chairman and DFO (Territorial) as Member Secretary.

This committee shall consist of the following members:

i. District Collector Chairperson

ii. Conservator of Forests in whose jurisdiction the FDA falls Member

iii. District level officers of Science and Technology; Rural Development including NRLM, Agriculture, Tribal Affairs and Panchayati Raj, Non-conventional energy dealing with, expenditure in the District and to be nominated by the DC/DM Members

iv. Member Secretary, FDA Member Secretary

V. **Other Committees**

Gram Panchayat/ Gram Sabha, and the various Committees set up by it, will be the key institution for planning and implementation of the GIM at the village level as per procedure followed made under MGNREGS guidelines. A federation of these Committees along with a federation of self-help groups (SHGs)/ User Groups (UGs) at the cluster level will be represented in the revamped FDA at the district level. In urban areas, the ward level committees /RWAs linked to Municipality/Municipal Corporations will facilitate planning and implementation under the Mission.

Annexure-V

Approved Cost Norms

S. No.	Submission/Intervention	Category	Type	Cost (Rs./ha)
A. Cost norms for Sub Missions and Intervention				
1.	Sub Mission 1: Enhancing quality of forest cover and improving ecosystem services (4.9 m ha)	a) Moderately dense forest cover, but showing degradation		15000
		b) Eco-restoration of degraded open forests	Type A	16000
			Type B	30000
			Type C	50000
		c) Restoration of grasslands		35000
2.	Sub Mission 2: Ecosystem restoration and increase in forest cover (1.8 mha)	a) Rehabilitation of Shifting Cultivation Areas		30000
		b) Restoring Scrublands		50000
		c) Restoring/ planting Sea-buckthorn		100000
		d) Restoration of Mangroves		70000
		e) Ravine reclamation		70000
		f) Restoration of adandoned mining area		100000
3.	Sub Mission 3: Enhancing tree cover in Urban & Peri-urban areas (including institutional lands): 0.2mha			100000
4.	Sub Mission 4: Agro-Forestry and Social Forestry (increasing biomass & creating carbon sink): 3 mha	a) Farmer's land including current fallows		20000
		b) Shelterbelt plantations		80000
		c) Highways/Rural roads/Canals/ Tank Bunds		70000
5.	Sub Mission 5: Restoration of Wetlands: 0.1 mha			60000
6.	Promoting alternative fuel energy	Biogas, solar devices, LPG, Biomass-based systems, improved stoves		3300 per house-hold
B. For Support Activities				
	Activities Cost			
7.	Research (2% of A)			
8.	Publicity/Media/outreach activities (1% of A)			
9.	Monitoring and Evaluation (1% of A)			
10.	Livelihood improvement activities, (17% of A)			
11.	Strengthening local-level institutions (5 %)			
12.	Strengthening FDs (5%)			
13.	Mission Organisation, operation and maintenance, contingencies and overheads (4%)			

Annexure-VI

Performance Monitoring Framework (Results Framework)

Expected Results	Indicator	Periodicity	Data Source/Method	Responsibility	Baseline	Milestones				Target
					Y0	Y3	Y 5	Y 7	Y 9	Y10
1. Forest/tree cover on forest/non-forest lands is enhanced in the Mission Target Area (MTA)[1]	▪ % area with forest cover	Biennial	Forest Survey-Remote Sensing and ground truthing	FSI, NRSA	X%	X+a	X+b	X+c	X+d	28%
	▪ % area in various forest density classes	Biennial	Forest Survey-Remote Sensing and ground truthing	FSI, NRSA	X% in dense	X+a	X+b	X+c	X+d	X+e
2. Quality of forest cover & ecosystem services of forest /non-forests is improved in a. Moderately dense (1.5 mha), b. Open forests (3.0 mha)	a.1. % of forest area naturally regenerating a.2 Shannon Weiner Index a.3 Carbon sequestered a.4 Above ground biomass	Annual	Data from permanent plots	Local FD/local communities						

[1] The total area with its inclusions (scrubs, grasslands etc) needs to be defined here

Expected Results	Indicator	Periodicity	Data Source/Method	Responsibility	Baseline	Milestones				Target
					Y0	Y3	Y 5	Y 7	Y 9	Y10
c. Degraded grassland (0.40 mha) d. Wetlands (0.10)	b.1. % of forest area naturally regenerating b.2 Shannon Weiner Index b.3 Carbon sequestered b.4 Above ground biomass	Annual	Data from permanent plots	Local FD/local communities						
	c. Biomass	Annual	Data from permanent plots	Local FD/local communities						
	d. % Wetland area achieved	Annual	Data from permanent plots	Local FD/local communities						
3. Ecosystems are restored and forest cover is increased in a. Scrub (0.8 mha) b. Shifting cultivation areas (0.6mha) c. Cold deserts (0.10 mha), d. Mangroves (0.10mha)	a. % of area that is adequately stocked/productivity	Annual	Data from permanent plots	Local FD/local communities						
	b. Regeneration of native forestry species									
	c. Regeneration of indicator species									
	d. Regeneration of native									

Expected Results	Indicator	Periodicity	Data Source/Method	Responsibility	Baseline	Milestones				Target
					Y0	Y3	Y5	Y7	Y9	Y10
e. Ravines (0.10 mha) f. Abandoned mining areas (0.10 mha)	species									
	e. % of area reclaimed									
	f. % of area reclaimed									
4. Public forest/ non-forests areas (taken up under the Mission) are managed by the community institutions.[2]	▪ % of area under management of community institutions	Annual	Village survey/survey of the forest area (PRA/RRA)	Local FD/local communities/Facilitating NGO	0					50%
5. Improved fuelwood-use efficiency and alternative energy devices by adopted by households in the Mission Target Area.	▪ % of HH reporting use of alternative energy devices		Sample HH Survey	Local FD/local communities/Facilitating NGO						X+20 %
	▪ % of HH using fuel efficient devices	Annual	Sample HH Survey		X%					
6. Forest/non forest based livelihoods income for	▪ No. of targeted households (HH) reporting atleast 25%	Biennial	Sample HH Survey in the	External agency	0					3 millio

[2] Community institutions refer to institutions mandated by Gram Sabha at the village level (see section/para 5.4.1 for details)

Expected Results	Indicator	Periodicity	Data Source/Method	Responsibility	Baseline	Milestones				Target
					Y0	Y3	Y5	Y7	Y9	Y10
3 million forest dependent households is enhanced in the MTA	increase in real income		target area and estimation	contracted for household survey						n
7. Forest/non forest based livelihoods of about 3 million households living in and around forests are diversified	▪ % of HH reporting diversification of income sources	Annual	Sample HH Survey	Local FD/local communities/Facilitating NGO	0%					3 million
	▪ % of HH reporting increase in number of days of employment in primary occupation	Annual	Sample HH Survey	Local FD/local communities/Facilitating NGO	0%					3 million

National Mission for a Green India (GIM)
Ministry of Environment, Forests & Climate Change
Government of India
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New Delhi- 110 003
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Annexure A-3

NATIONAL MISSION FOR A GREEN INDIA

Mission Document

2021

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA

Table of Contents

Executive Summary

The National Mission for Green India was launched by the Ministry of Environment, Forest and Climate Change in 2011, as one of the eight Missions under the National Action Plan on Climate Change (NAPCC). It aims at protecting, restoring and enhancing India's forest and tree cover and responding to climate change through a combination of adaptation and mitigation measures aiding to enhance carbon sinks in sustainably managed forests and other ecosystems; enhancing adaptation of vulnerable species and augmenting livelihood opportunities for forest-dependent communities.

The Mission started with the objective to increase forest/tree cover on 5 million hectares (mha) of forest/non-forest land and improved quality of forest cover on another 5 mha land area, enhanced ecosystem services including biodiversity, hydrological services and carbon sequestration through the treatment of 10 mha of forest/non-forest land, enhanced annual carbon sequestration by 50 to 60 million tonnes in the year 2020, and an increased forest-based livelihood income of about 3 million households.

The Mission's interventions were started in the year 2015-16 with the collaborative effort of the Central and State governments. Various afforestation activities including tree plantation were taken up over 11.22 mha area from 2015-16 to 2020-21 under the schemes of the Central Government and State government including Green India Mission.

In pursuance of India's commitments under its Nationally Determined Contribution (NDC), the National Mission for a Green India aims to create an additional carbon sink of 2.5 to 3.0 billion tonnes of CO_2 equivalent through additional forest and tree cover by undertaking restoration of open forests and afforestation/tree plantation on wastelands; plantations along national and state highways and railway tracks; urban landscapes, promotion of agroforestry, treatment of marginal farmlands and river catchments, etc. in conjunction with various other schemes of Central Government and State governments including Compensatory Afforestation Fund. Activity such as restoration of open forests would be taken up on priority under the Mission given its large potential to create additional carbon sink[1] and also being the most cost-effective strategy to achieve the NDCs target.

[1]https://fsi.nic.in/isfr2019/isfr-fsi-vol1.pdf, Page 149, Box 4.

The Mission would adopt 'Micro-Ecosystem' approach to focus on identification of intervention pockets in the highly vulnerable landscapes like Aravallis, Western Ghats, Arid regions of North West India, Mangroves, Indian Himalayan Region (IHR) etc. and their restoration and saturation through regionally conducive best practices for holistic landscape management including planting of native multipurpose tree species with high carbon sequestration potential, and intensive soil and moisture conservation activities to achieve land degradation neutrality.

Forest Survey of India on Achieving India's NDC

The Forest Survey of India (FSI), in their India State of the Forest Report (ISFR) 2019 has indicated that the shortfall in achieving the NDC target can be achieved by undertaking activities such as restoration of open forests, and afforestation on different kinds of available lands like wastelands, agroforestry, plantation along highways, railway sidings, urban landscapes etc. The estimation further establishes that the restoration of open forests is the most cost-effective strategy to achieve the NDC target and at the same time it holds a large potential of creating additional carbon sink.

The interventions under the Green India Mission are categorized under three sub missions:

1. Enhanced quality of forest cover and improved ecosystem services
2. Increase in forest and tree cover and ecosystem restoration.
3. Enhancement of household incomes and diversification of livelihoods for forest-dependent communities

The Mission would promote the principle of 'Atma- Nirbhar Bharat- the Self-Reliant India', through developing a skilled Green India Force of trained and dedicated youth through extensive skill development and livelihood enhancement of the forest-dependent communities, besides undertaking Research & Development towards developing 'quality planting stock' of regionally conducive agroforestry species, which shall be one of its core strategies.

The Mission would also endeavor to establish:

a.) Livelihood Improvement Training Centres (LITCs), to enhance the traditional and acquired skills of the communities for processing, packaging and marketing of forest produce. Farm and non-farm related income generation trainings based on their local relevance will also be provided to forest-dependent communities.

b.) Sustainable Livelihood Enhancement Models for forest-dependent communities to enable them to diversify their income generation activities which will effectively reduce the pressure on the forest areas.

c.) Non-Timber Forest Produce (NTFPs) Processing Centres, to function as a single window source to address skill development, procurement of locally collected raw material, its processing, and its packaging and marketing for value chain enhancement. This would further help in the increase in the importance value of the forest produce and will also ensure that the farmers, producers and local population will have enhanced incomes.

d.) Integrated Nursery and Research Centres, to provide quality planting stock of forestry, NTFPs, horticulture, and agroforestry species, etc. to increase land productivity, agricultural produce and enhance farmers' income, and
e.) Reducing the gap between research and field practices by strengthening the State Forest research wings with the support and coordination with research institutions through 'Lab to field' approach[2].

The Mission would establish a comprehensive Monitoring and Evaluation Mechanism for an efficient and effective monitoring of its interventions. The M&E would be carried out at five levels, at the National Mission Directorate by the dedicated Monitoring Cell for performance tracking through web-based National Afforestation Dashboard & MIS, and GIS based monitoring through analysis of satellite imageries. The National Afforestation Dashboard would also serve as a tool for effectively capturing and reporting on the tree plantation and regeneration activities undertaken across the country under the Central Govt. schemes and State plans including the activities by the private players, NGOs, Civil societies, and individuals. The other levels of monitoring would include on-ground self-monitoring by the implementing agencies, social audit by the members of Gram Sabha and the remote-sensing based monitoring by the Forest Survey of India and other specialized agencies. Periodic monitoring of the identified intervention areas by third-party will be one of the components under the mechanism.

Establishing convergence with the various schemes would be fundamental for the implementation of the Mission's activities and achieving its objectives. The Mission would follow a 'Bottom-up' model to strengthen the decentralized governance and management of its interventions. Joint Forest Management Committees (JFMCs) would be the key implementing units, with further management and coordination vested with the Forest Development Agencies, State Forest Development Agencies and the Mission Directorate in an ascending order.

The total Mission cost is estimated as Rs 12,190 crores for implementation of afforestation activities over 1.0 million hectare during the period of 10 years (2021-30). The Mission costs will be met partly from the budget under ongoing Green India Mission CSS scheme and balance from funds available under National fund of CAMPA. The Mission along with ongoing afforestation schemes/activities of Government of India, the line Ministries and the State Governments, will achieve the target of 24.0 million hectare to achieve the NDC goal and various national and international commitments.

[2] http://www.millenniumpost.in/kolkata/state-starts-lab-to-field-initiative-to-boost-agri-sector-421689

1. Background

India is among the few countries in the world to achieve a positive trend of increase in forest cover. This has been possible because of high priority accorded under the strong framework of Policies, Acts & Rules and programmes to ensure the conservation of forests and biodiversity, enhance green cover and the participation of people in the conservation activities while protecting the rights of forest dependent communities.

NDCs have become the bedrock of India's climate actions post-2020 and are also indicative of the country's "best-efforts" while balancing the developmental imperatives, with sustainable development and poverty eradication[3]. Several proactive climate actions are being implemented to fulfil their obligations as per the principles of common but differentiated responsibilities and respective capabilities and equity. Among the various interventions' priority is being accorded to raise ambition and accelerate action to implement the Paris Agreement. Mobilizing finance, Energy transition i.e. accelerating the shift away from fossil fuels and towards renewable energy, as well as making significant gains in energy efficiency; emphasis on Nature-Based Solutions (NbS), whereby to increase the sink capacity and enhancing resilience within and across forestry, agriculture, oceans and food systems, through biodiversity conservation, leveraging supply chains and technology; strengthening and motivating cities and local action and resilience, adaptation and mitigation to manage the impacts and risks of climate change amongst the vulnerable communities.

2. Introduction and Sector Profile

The National Mission for a Green India is one of the eight Missions under the National Action Plan on Climate Change (NAPCC) with an aim to respond to climate change through a combination of adaptation and mitigation measures. The Mission recognizes the influences that the forests and other natural ecosystems have on climate adaptation/mitigation, and food, water, environmental and livelihood security of tribal and forest dwellers specifically, and the nation at large.

The Mission acknowledges the challenges in bridging the demand and supply gap of various provisioning services from forests, particularly fuelwood, fodder and grass, timber, cane/bamboo, NTFPs etc., which is creating unsustainable pressure and contributing in degradation of forests and ecosystems. The productivity of forests is also relatively low, thereby widening the gap between demand and supply of various forest products even further.

Climate change has caused the altitudinal and latitudinal shift of the species from forest ecosystems, higher incidences of forest fire, pests and disease attack, increased proliferation of invasive species, change in species assemblage/forest type, forest die-

[3] https://dea.gov.in/sites/default/files/FINAL%2017%20SEPT%20VERSION%20Climate%20Summit%20for%20Enahnce%20Action%20A4%20size.pdf

back and loss of biodiversity, which has magnified the vulnerability of the country's forests. Consequently, the livelihoods of forest-dependent communities are also getting severely affected, especially of women who depend on fuel, fodder and food from forests, thus increasing their vulnerabilities as well.

The Mission taking into account the intensity of these vulnerabilities, will select landscapes for its interventions for ameliorating climate change, enhance food & water security and diversification of livelihoods and increased household incomes of the local communities. The Mission adopts the Micro-Ecosystem approach for undertaking landscape specific eco-restoration interventions to deliver qualitative improvement of the degraded forest areas and to quantitatively reinforce improvement of forest and tree cover on the forest and the non-forest areas. Based on the Principle of Additionality[4], the Mission will focus its interventions to enhance the reclamation and restoration process in the degraded land towards the generation of offsets[5] guided by the nature and the extent of the vulnerabilities of the identified areas. Approach towards saturation of vulnerable landscapes through tree plantation would be adopted to carry out afforestation/tree plantation activities.

The Mission under its decentralized approach focuses on efficiency in planning and implementation of its interventions. The JFMCs will have a prominent role in the identification of the landscapes, the treatment areas and the afforestation models. A comprehensive five years perspective plan will be prepared for each JFMCs detailing the benefit sharing mechanism with the Forest Departments. The State Governments will consolidate and prepare a comprehensive afforestation plan under the Mission taking reference of the targets and the funds availability of the other afforestation schemes being implemented in the respective state. The interventions under GIM will be implemented in convergence with other similar schemes and reporting will be done through the National Afforestation Dashboard.

The Mission through its interventions would emphasize upon the adoption of-

1. Reclamation/Restoration Forestry
2. Best practices of Nature Based Solutions (NbS),
3. Decentralized models of implementation for a proactive multi-stakeholder involvement and to effect synergies with the relevant ongoing afforestation schemes, and
4. Promoting Self-reliance among the forest dependent communities through skill enhancement and enabling diversification of livelihoods.

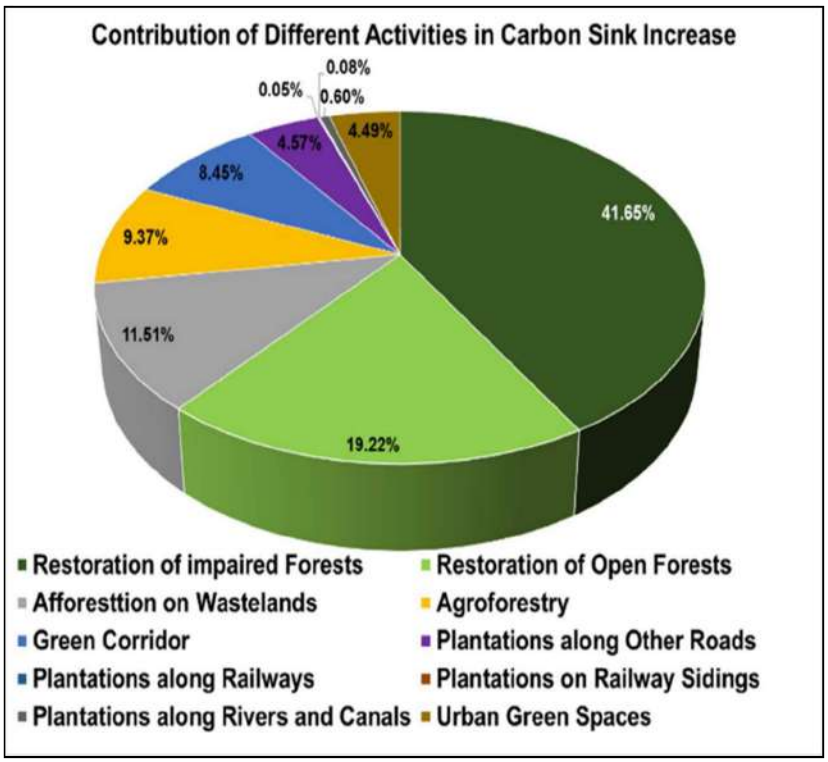
This approach would in principle align the Mission with the three major United Nations Sustainable Development Goals SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture), SDG 6 (Ensure availability and sustainable management of water and sanitation for all), and SDG 15 (Protect, restore

[4]https://www.conservationgateway.org/Documents/TNCApplyingTheMitigationHierarchy.pdf
[5]counteract (something) by having an equal and opposite force or effect.

and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss).

The Mission interventions are categorized under three sub-missions, aligning with the recommendations of the Forest Survey of India under the India State of Forest Report 2019. All the interventions shall be executed strictly in accordance with the Mission's mandate.

The Forest Survey of India (FSI), a premier national organization under the Ministry of Environment, Forest and Climate Change to conduct survey and assessment the forest resources of the country, has estimated that forests of the country have contributed to 29.62 billion tonnes of CO_2 equivalent carbon stock in 2015 and total forest carbon stock shall increase to 31.87 billion tonnes of CO_2 equivalent by 2030 through the increased forest and tree cover. Ten categories of activities have been considered by the FSI for the potential increase in carbon sink and forest cover in the country and include restoration of impaired forests, restoration of open forests, afforestation on wastelands, agroforestry, setting up of green corridors, undertaking plantations along roads and railways, undertaking plantation on railway sidings, along rivers and canals and the creation of urban green spaces.



The estimation establishes that the largest potential of creating additional carbon sinks lies in the restoration of forests which have impaired in the last 15 to 20 years, along with the activities like restoration of open forests, afforestation on wastelands and Agroforestry. These two activities of restoration of natural forests contribute up to 60% of the total carbon sink which can be achieved by 2030. It is also indicated by the FSI that to bring about an increase in carbon sink (CO_2 equivalent billion tonnes) by 2.51 and 3.39 by 2030, a corresponding increase of 18.71 and 24.69 million hectares of enhanced forest and tree cover area would be required respectively.

Potential Increase in Carbon Sink

Activities	Tentative Projections	
	CO_2 eq. (billion tonnes)	Area (ha)
Restoration of impaired forests	0.95	96,19,877
Restoration of Open forests	0.94	5669,967
Afforestation on Wastelands	0.56	37,40,844
Agroforestry	0.31	27,46,400
Green Corridor	0.23	7,00,000
Plantation along other roads	0.15	11,57,817
Plantations along Railways	0.0025	20,006
Plantations along railway sidings	0.0012	5,154
Plantations along river and canals	0.029	1,17,126
Urban Green Spaces	0.22	9,14,398
Total National Level CO_2 eq. (billion tonnes) upto 2030	**3.39**	**2,46,91,590**

Moreover, India has a unique distinction to be among the few countries in the world who achieved the increasing trend of forest cover and tree cover, despite large biotic pressure and dependency on forest. This could be possible because of the high priority accorded to conservation and restoration of forest and enhancing biodiversity and green cover under the policies, Acts & Rules and programmes, and an efficient collaborative implementation of the afforestation efforts of both National and State Governments under various plans and schemes of the Central and the State governments.

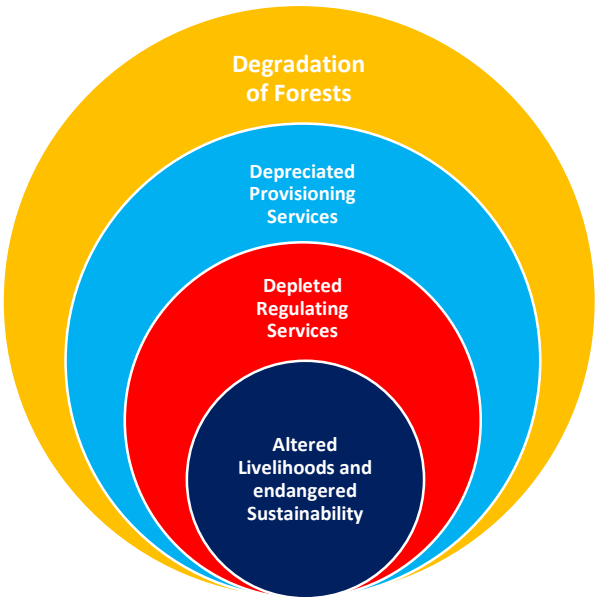
The Mission's interventions were started in the year 2015-16 and about 11.22 mha area could be included under plantations till 2020-21 as reported under the Twenty Point Program and depicted in the table given below. The FSI study also establishes that the targets of afforestation and carbon sequestration conceived under the Mission as part of the National Action Plan on Climate Change to be achieved by 2030, can be achieved easily by sustaining the existing policies and programmes.

Area covered under various Plantation activities reported under Twenty-Point Programme		
S. No.	**Year**	**Area (in m.ha)**
1	2015-16	1.38
2	2016-17	1.99
3	2017-18	1.68
4	2018-19	1.84
5	2019-20	2.12
6	2020-21	2.21
TOTAL		**11.22**

The Mission in its new phase will continue to strive to achieve the commitment of creation of additional carbon sink by adopting efficient social, community and agro-forestry practices, in addition to reduce the vulnerabilities of the landscapes and the forest dependent communities through its interventions on the micro-ecosystem basis and effecting convergence with the other related schemes.

3. Key Vulnerabilities/Challenges due to Climate Change

The Green India Mission recognizes the influences and potential that the forests and other natural ecosystems have on climate adaptation/mitigation, and food, water, environmental and livelihood security of tribal and forest dwellers specifically, and the nation at large.



The Mission acknowledges the challenges on account of the demand and supply gap of various provisioning services from forests, particularly fuelwood, fodder/grass/grazing, timber, cane/bamboo, NTFP etc., which is creating unsustainable pressure and contributing to degradation of forests and ecosystems. The productivity of Indian forests is relatively low, thereby widening the gap between demand and supply of various forest products.

Through the scientific modelling done using RCM (Regional Climate Model) and BIOME model (BIOME 4), change is projected for 8% 18%, 56%, and 30% of the vegetation grids[6]. Use of the dynamic global response model IBIS (Integrated Biosphere Simulator) predicts the percentage of forested grids expected to undergo vegetation change range from 3.5% in the North-Eastern states to 73% in Chhattisgarh[7]. Already challenged forest eco-systems will become much more vulnerable to the adverse climatic conditions.

Climate change has caused the altitudinal and latitudinal shift of the species from forest ecosystems, forest fire, pests and disease attack, proliferation of invasive species, change in species assemblage/forest type, forest die-back and loss of biodiversity, which has contributed in increasing the vulnerability of the forests. Consequently, the livelihoods of forest-dependent communities are also getting severely affected, especially women who depend on fuel, fodder and food from forests, thus enhancing vulnerability of forest-dependent communities.

The Mission will hence select landscapes taking into account the intensity of these vulnerabilities and will contribute to ameliorating climate change, food & water security and enhanced livelihood income of local communities.

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[6] http://moef.gov.in/wp-content/uploads/2018/04/Innca-press-release_0.pdf

7 RK Chaturvedi, Ranjit Gopal Krishnan, MathangiJayaraman, G Bala,, NV Joshi, R Sukumar and NH Ravindranath, Impacts of climate change on India's forests : a dynamic vegetation modeling approach, http://hpccc.gov.in/PDF/Forests/Impact%20of%20Climate%20Change%20on%20Indian%20Forests%20a%20Dynamic%20Vegetation%20Modelling%20Approach.pdf

4. The Goal, Objectives, and Key Priorities

Goal

The Mission aims at responding to Climate Change through a combination of adaptation and mitigation measures which will help in enhancing carbon sinks in sustainably managed forests and other ecosystems, adaptation of vulnerable ecosystems and adaptation of forest-dependent communities.

Mission Objectives

The Mission aims for-

1. Improved quality of forest cover and increased forest and tree cover on forest/non-forest lands
2. Improved ecosystem services including biodiversity, hydrological services and carbon sequestration
3. Increased forest-based livelihoods and household income of forest dependent communities living in and around the forests.
4. Creation of an additional carbon sink of 2.5 to 3.0 billion tonnes of CO_2 equivalent by 2030.

Mission's Core Priorities

1. Restoration/reclamation forestry under the landscape approach focusing on vulnerable habitats and degraded forest and non-forest areas through existing and regionally applicable eco-restoration models, including agroforestry and social forestry.
2. Saturation of vulnerable landscapes through tree plantations in identified gaps in consonance with the ongoing afforestation schemes of the Central and the State governments.
3. Enhancement of livelihoods and household income of the forest dependent communities living in and around forest areas through skill development and sustainable cultivation of the NTFPs.
4. Application of adaptation/mitigation measures, enhancing Ecosystem Services, Carbon Sequestration, Soil and Water Conservation, Biodiversity Conservation and Livelihood Security etc. Local communities will be motivated to play a key role in prioritizing the range of ecosystem goods and services through the process of informed decision making.

5. Mission Strategies to address Key priorities and Linkages with India's NDC Commitments for the period 2021-2030

The Mission's approach in its new phase will depend on the following strategies which are devised based on the learnings and guided by the imperatives of the country's policy commitments

Strategy 1: Saturation of Vulnerable Landscapes through Tree Plantation in the identified gaps

The Mission seeks to work in tandem and synergistically with all the ongoing afforestation schemes implemented under the Central and the State missions and plans. The Mission recognizes the efforts put in by the States in undertaking plantation activities under the various ongoing Central and State-specific schemes. The Mission seeks to complement the ongoing efforts of the States by providing itself as a tool to fill in any gaps and address the shortfalls in undertaking activities under the ongoing schemes. Efforts would be directed to saturate the intervention landscape, working in tandem with the ongoing afforestation schemes.

Criteria for selection of project areas/ sub-landscapes/sub-watersheds under the Mission will include projected vulnerability to climatic change, the potential of areas for enhancing carbon sinks and the significance of the area from the ecosystem services dimension, such as biodiversity and hydrological services.

The efforts for saturation under the revised Mission shall focus on-

a.) Inclusion of additional and new landscapes for undertaking interventions in concordance with the Mission's mandate.

b.) Inclusion of additional priority intervention pockets within the selected landscape identified under its different sub-missions.

c.) Inclusion of additional activities in the selected landscape not supported under the other schemes and considered as important for furthering the States' efforts (urban, peri-urban, agroforestry, eco-restoration and soil and moisture conservation activities). The identified activities must fall under the mandate of the Mission and align with the activities detailed under the Mission's different sub-missions.

This approach shall contribute to the success of the vision that all existing schemes together will contribute to fulfilling the NDC targets.

Strategy 2: Focused approach for Greening Outside Forest Areas

Forest conservation and its role in meeting subsistence needs of the forest-dependent communities are emphasized as national priorities. The Mission will promote various afforestation activities and interventions on the forest and the non-forest areas for the qualitative and quantitative improvement of the forest and tree cover on the micro-ecosystem basis. Best models of innovative afforestation practices will be adopted to increase forest and tree cover in non-forest areas, and to saturate available lands through extensive plantation in conjunction with various related schemes of central and state governments.

The protection and conservation of natural vegetation and biodiversity, removal of invasive species, soil moisture and water conservation, and sustainable livelihood and ecosystem management practices will also form an integral part of the interventions under the Mission. The Mission further seeks to introduce the concept of Geo-tagging and GIS based monitoring of trees planted under its interventions to monitor the progress of the planting activity and also to recognize the efforts of the JFMCs members in the implementation of the Mission's activities. Granting a share in the usufructs to the community for tending and protection of trees planted shall also be a part of Mission's strategy.

The private sector, including individuals, local communities and industry, are seen as partners in sustainable forest management. Suitable mechanisms for motivating the role of private agencies shall be devised under the identified Mission's interventions. The Mission recognizes the concept of 'Sustainable Private Sector Forestry' which necessitates the private sector participation in sustainable forest management and identifies measures to ensure future sustainable supplies of forest produce from outside forest areas, thereby reducing the burgeoning pressure on the forests. The National Forest Policy indicates that forest-based industry should meet its raw material needs by establishing direct relationships with farmers. As such, the concept of Farm Forestry provides ample potential for the private sector to promote industry-farmer partnerships for the supply of raw material to wood-based industry. The Mission will explore the role of private players in the Mission's interventions based on the development of appropriate policy framework and guidelines.

Strategy 3: Availability of Quality Planting Material (QPM)

The Mission would seek to ensure the sustained availability of Quality Planting Materials (QPM) for undertaking massive tree plantation in the forest and non-forest areas and including the promotion of agroforestry on farmers' lands. The Mission would support developing new nurseries and strengthening existing nurseries at appropriate sites for efficient production of good quality plants. These nurseries may be objective-driven for the production of high-quality planting material of the species depending on demand and their suitability to the landscape. Existing nurseries owned by government/ private agencies shall also be strengthened and capacitated, which will maintain the production of planting stocks of desired quantity and quality. These nurseries would function as a

tool to develop, undertake research and production of certified QPM, and its further distribution at subsidized prices.

This would help in enhancing the availability of and beneficiaries' accessibility to QPM, extension of technical knowledge and marketing of the produce, and also enhancing the skills and the awareness of farmers on benefits of using QPM in farming practices through different modes of communication viz. radio, TV, pamphlets and brochures in local languages, seminars, village meetings and campaigns.

The Mission shall also strive to develop a system of accreditation for the nurseries as the certified supplier of authentic and credible planting material, and to be implemented by the Forest Department. Gene Banks shall also be established within the certified nurseries through selection of Candidate Plus Trees (CPTs) and establishment of Seed Production Areas (SPAs), with the primary objective to ensure improved productivity of plantations through identified suitable species for different agroecological zones.

Strategy 4: Establishing Repository of Vulnerable Landscapes

Vulnerable landscapes which will be a mix of degraded forest lands and non-forest lands shall be identified using the satellite imagery for undertaking comprehensive afforestation and eco-restoration measures. The details of the land resources available in each state for the Mission's interventions shall be made available on the online portal of the Green India Mission on a real-time basis. The repository shall further enable undertaking of suitable R&D to develop additional combinations of trees and agricultural crops suitable to the climatic condition, soil profile, socio-cultural acceptability and with a favourable cost-benefit analysis with regards to the available land areas.

The sole objective of this repository shall be to devise and implement replicable and conducive landscape specific afforestation and eco-restoration models and impart suitable know-how to the community, besides enhancing the productivity of the vulnerable pockets in the identified landscape.

Strategy 5: Adoption of Micro-Ecosystem Approach

The Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. This approach is based on the application of appropriate scientific methodologies focused on different levels of inter-relationship between various biological factors and involving essential processes, functions and interactions among organisms and their environment. The approach recognizes that humans, with their cultural diversity, are an integral component of ecosystems. The Mission will adopt a micro-ecosystem[8] approach working in the smallest units of the landscape with their impacts being

[8]https://www.sciencedirect.com/topics/earth-and-planetary-sciences/microecosystem

magnified and collating at the macro or the landscape level. The regionally conducive and established, identified and demonstrable models will be adopted for the holistic eco-restoration of the identified intervention areas within the larger landscapes.

The Mission's interventions including various afforestation activities shall be implemented **through Joint Forest Management Committees (JFMC) at the Village level.** JFMC will be involved in selecting vulnerable landscapes for tree plantations by the forest department. The Mission through the JFMCs will add "value" to ongoing programs/schemes on "greening", being implemented by multiple agencies. Such value addition will come through sharing of traditional knowledge by the local communities and comprehensive research and development activities.

Strategy 6: Ensuring Sustainability of Interventions

Restoration Ecology, where on one hand strives to undertake restoration of ecologically degraded areas, on the other seeks to establish the sustainability of the interventions through the provision of suitable livelihood opportunities for the dependent communities and also providing livelihood alternatives to enhance their household income and to reduce their dependence on forest resources.

The Mission through its interventions would adopt an enabling and an advisory role in suggesting technological solutions to address challenges in bringing about a holistic enhancement in the socio-economic conditions of the forest-dependent communities and reduction of ever-increasing pressure on the natural forests. Livelihood Improvement Training Centres (LITCs) in the key forest landscapes shall be established for the diversification of forest-based livelihoods, especially for the rural poor and women. Knowledge and skill building (KSB) of the forest-dependent communities on integrated farm-based development shall be undertaken through focused training on ancillary livelihood activities for enhancing their understanding and facilitating the adoption of those interventions.

NTFPs play a crucial role in providing a safety net for poor people who rely on forests and forest produce for their livelihood. India's tribal population forms the most disadvantaged section of society, with more than half of India's 70 million tribal population subsisting on forests[9]. In addition, an estimated 147 million villagers in India live in or around forests, and another 275 million villagers depend heavily on forests as their source for livelihoods[10]. The Mission also aims to establish NTFP as high-end products and the preferred species under community and agroforestry practices. Sustainable community-based agroforestry models shall be promoted for the cultivation of the NTFPs outside the forest areas. NTFP processing centres shall be established to function as a single window source to enhance the skills of villagers for sustainable harvesting of NTFPs, processing of raw materials and marketing of finished products**.** These would thus be multi-purpose centers for providing avenues for the cultivation,

[9]http://www.fao.org/3/XII/0586-C1.htm
[10]https://stopgetrees.org/forest-communities-struggle-traditional-customary-use-forests-india/

harvest, production, processing and marketing of NTFP produce, collected locally and access to markets.

All of these initiatives shall be implemented in coordination and collaboration with the Livelihood and Skill development programmes of the government and in convergence with the Pradhan Mantri Van Dhan Yojana and National Innovations on Climate Resilient Agriculture (NICRA), a network project of ICAR.

The emphasis will be on plantations of suitable native species having a high carbon sequestration potential under the social and agroforestry models. The core strategy would thus be on raising plantations of quality seedlings and ensuring the high survival rate of plantations. This approach will provide qualitative enhancement in forest/tree cover and will establish a platform to adopt best practices under the Mission.

Strategy 7: Reducing the pressure on forests through addressing the drivers of forest degradation

Apart from restoring degraded forests through assisted natural regeneration, reforestation, removal of invasive species and soil and moisture conservation, mitigating the primary causes of forest degradation would also be taken up under the Mission.

Reduction of grazing pressure on forests and enabling the removal of other forest produce like firewood and MFPs without affecting the forest's productivity, would be the key emphasis areas.

The Mission will promote mechanisms for regulated grazing in synergy with the animal husbandry departments for development of stall feeding, improving the nutrition of cattle and thereby enhancing livestock productivity.

Pilots would be implemented for development of alternative sources of fuelwood from agri-based biomass, energy plantations, etc. Improvement of irrigation facilities, development of water sources through watershed activities, crop diversification and value addition, and access to markets would be attempted in convergence with schemes like PMKSY-watershed development and agriculture departments.

A unit at the State level established under the Mission would facilitate integration and exchange of information on various schemes of the relevant line departments which shall be dovetailed in the forest landscape in which the Mission is being implemented by preparing holistic plans in consultation with and in agreement with the various line departments.

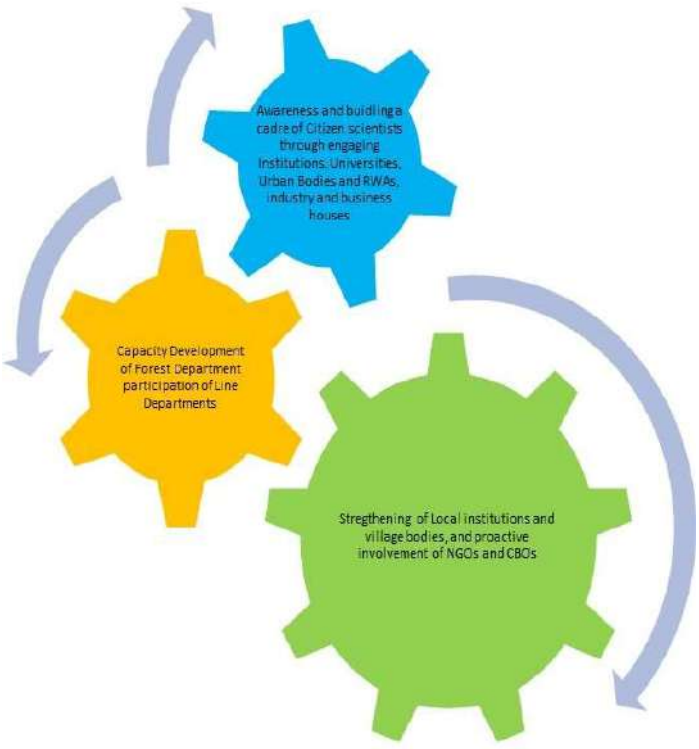
Strategy 8: Convergence and Integration of Traditional Knowledge and Practice

Research and Development, Training and Capacity Building of the communities will be one of the key components under the support interventions of the Mission. The

promotion of the Nation's call for self-reliance *'Atma-Nirbhar Bharat'*, would be the key driving force behind the proposed interventions under this head, and include technological research and development, developing the capacities of the stakeholders and enhancing their skills towards establishing sustainable models of livelihood security. Scientific innovations using the traditional knowledge of the communities and their applications in the field would also be promoted. Numerous initiatives portraying self-sustainable community and agroforestry models with immense potential are also being planned under this component.

Strategy 9: Adoption of Inclusive Development through Multi-stakeholder Approach

The Mission seeks to unlock people's energy and solicit their engagement with its mandate. Various stakeholders (community, farmers, Panchayat bodies, Government/Non-Government, Private institutions/agencies, academia, business houses, children especially in rural communities, media, etc.) will be encouraged to undertake greening activities. This support will be provided in the form of knowledge and information dissemination, capacity building and skill enhancement, infrastructure support like planting material etc. and further engaging them in the decentralized monitoring of the Mission's interventions. The Mission acknowledges the crucial role of women in forest conservation and its sustainable use. The Mission will support women in the planning and the execution of its interventions, and also engage them in the decision-making process at various levels.



Inclusive Development Model under Green India Mission

Strategy 10: Involvement of private sector

The scale and the magnitude of the national effort required for the restoration of degraded land and an improvement of tree cover would imminently require the proactive involvement of all the stakeholders. An active association and involvement of the private sector will therefore be pursued as a strategy for funding some of the interventions under the Mission, and can be achieved through

1. Involvement of companies utilizing wood and wood-based raw material to develop their supply chain by involving the community through JFM committees and panchayat bodies.
2. Contributions from Corporate Social Responsibility (CSR) funds for restoration of vulnerable and critical areas or adoption of certain villages by supporting committed individuals or groups could act as a feather in the cap for the concerned private entity.
3. Undertaking greening of vacant institutional lands through the institution owning the land.

Garnering the commitment of institutions, both public and private, commercial and non-commercial, can be explored through existing laws and guidelines. State agencies can help these institutions by providing planting material and technical knowhow whereas the institution can provide watch and ward and inputs in addition to land. Harvesting of such plantations may be allowed at the request of the owner or user of the land as per their need and request without any liability or compensation. Dialogues with large philanthropic organizations may be initiated to request them to support the greening movement in the country.

To enable the contribution of the private sector, efforts will be undertaken at the MoEF&CC to reach out to the various corporate houses through meetings, seminars, industry road shows and dialogues, eliciting and considering their point of view and creating an enabling environment for them to contribute to the movement.

Strategy 11: Fund Mobilization through effective convergence

The Mission shall strive to enabling effective and efficient cooperative collaboration and leveraging of available funds from the ongoing schemes and programmes of various ministries and departments, including National CAMPA and State CAMPA, National Adaptation Fund for Climate Change (NAFCC), National Mission for Sustainable Agriculture (NMSA), National Bamboo Mission (NBM), Mission for Integrated Development of Horticulture (MIDH), Sub-Mission on Agroforestry (SMAF), Integrated Scheme for Agricultural Marketing (ISAM), National Skill Development Programme (NSDC), MGNREGA, NABARD, NHAI, IWMP, Namami Gange, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), National Highways Authority of India (NHAI), Ministry of Railways, Department of Mines, Ministry of New and Renewable Sources of Energy (MNRE) etc.

The Mission would further seek to facilitate channelization of philanthropic contributions and Corporate Social Responsibility (CSR) funds towards the broader and the specific objectives of contributing to the national effort of enhancing the forest and tree cover of the country through extensive afforestation and eco-restoration efforts to be undertaken both in the rural and the urban landscapes.

Strategy 12: Tapping of Carbon Market

The voluntary carbon market can be tapped for the sale of carbon of forestry origin for both forestry and agroforestry plantations. This area has not been explored so far, especially by the government agencies involved in afforestation due to various reasons including the absence of a national carbon market, but the initiative could be supported under GIM. Establishing a Carbon Registry would also function as an innovation for generating additional financial incentives. However, the involvement in international carbon markets in the post 2020 period (including voluntary markets) would depend on the rules for market mechanisms finalized under Article 6 of the Paris Agreement, and its implications for achievement of India's NDCs.

Strategy 13: Strengthening Policy and Regulatory Regime

The Mission shall also strive to evaluate the present regulatory regime impeding adoption of tree planting in the form of agroforestry and farm forestry by the farming community and suggest research-based policy reforms and their rationalization. The scope of Mission's intervention may include-

- Rationalization and easing out of felling and transit prescriptions on wood and wood products coming from agroforestry, farm forestry and tree cropping areas.
- Notifying wood, wood products and NWFP grown on non-forest lands as agricultural produce to bring them under the progressive agri-market reforms and e-NAM.
- RET species with in-country and export markets to be encouraged for cultivation on non-forest lands with strict supervision and regulations with spin-off benefits of ensuring conservation of RETs in natural habitats.
- Formulation of policy proposals for revisiting the definition of Forest Produce and Pan-India Transit Pass for agroforestry produce.
- Use of IT and digital technology for monitoring and surveillance of agroforestry and forestry products in transit by, inter alia, digital linking of check posts and barriers on national highways.
- PPP models for high yielding plantations by forging collaboration between FDC and the private sector.
- Rejuvenating agroforestry, farm forestry and social forestry in the State's deficit in wood and wood products.
- Tree Insurance for forest species and MSP coverage for agroforestry and farm forestry wood, wood products and NWFP, and
- Facilitating creation of a Carbon Registry to provide a listing, trading and tracking platform for carbon credits to stakeholders including industry with an

overarching objective of meeting the NDC commitment of the country under the Paris Agreement of UNFCCC.

Strategy 14: Protection of Trees Planted through Pro-active Green India Force

Local organizations and traditional institutions due to their proximity, are increasingly taken into account as entities capable of efficiently managing natural resources. Participation itself came to be seen as a means to ensure long-term engagement by those involved in the process of solution finding and with the scope of creating accountability and ownership of eco-restoration and conservation objectives. Adaptive co-management is recently gaining momentum, permitting the local actors to share management responsibilities and learn from their actions.

The Mission focuses on community-based protection as an essential component to ensure the sustainability of its interventions. A cadre of willing, dedicated and trained youths shall form the pivot of Green India Force, which shall have the onus for the implementation of the interventions and the upkeep and maintenance of the assets generated under the Mission. These assets may be the trees planted, soil and moisture conservation structures, and community level infrastructure developed for livelihood enhancement under the Mission. The Force will be the first level trainees who will assume the role of trainers in their village.

The members of the Force shall be selected by the Joint Forest Management Committees for undergoing skill building and capacity enhancement initiatives under the Mission. A person possessing the leadership quality for protection of forests and wildlife may become a member of Green India Force.

Strategy 15: Programme Management Unit for the Mission

A Programme Management Unit would be established at the National and the state levels to focus on programme monitoring and evaluation and the coordination with other Ministries and Departments to implement activities in convergence with programmes related to agriculture, animal husbandry, agroforestry, bamboo mission, watersheds, MGNREGS, Skills, Livelihood etc. as well for reaching out to the private sector to facilitate their involvement in the Mission's activities. The Unit will also have a key role in the development of a perspective plan in coordination with different departments/ stakeholders in the states.

6. Mission's Planned Activities and Interventions

Under the National Mission for a Green India, the collaborative afforestation efforts at the National and the State level will directly or indirectly support the policy framework and the various national or international commitments including the NDC targets submitted by the Government of India to UNFCCC. The afforestation targets outlined under the different schemes will also be incorporated under the Mission's interventions

to be taken up in the priority vulnerable landscapes identified under the Mission. The achievement under different schemes will be consolidated and be reported through the National Afforestation Dashboard on a real time basis.

The landscapes prioritized under the Mission shall include the Aravallis, Western Ghats, Arid Regions of North-west India and Cold Desert regions, Mangroves, River Catchments, Ravines and Wetlands, Himalayan Regions including Sea buckthorn, the areas affected by shifting cultivation, degraded bamboo forests etc. Equal importance shall also be accorded to urban, peri-urban, private, institutional and defence and public sector landscapes, for the Mission interventions.

The project areas/ sub-landscapes/ sub-watersheds under the Mission shall be selected, governed by a set of criteria which include projected vulnerabilities of these landscapes to climate change. Indian Institute of Science (IISc) has defined seven vulnerability classes by spatially combining information on forest diversity (monoculture versus natural forest), forest density (an indicator of degradation) and IBIS vegetation type change estimates for the forest grids[11]. The vulnerability maps thus prepared will provide useful criteria for the selection of areas under the Mission. The other equally important parameters for area selection would include corridors, critical biodiversity habitats and ecosystems, important groundwater/ spring recharge catchments, and potential of areas for enhancing carbon sinks etc. The India State of Forest Report provides state-wise details of forest areas that are devoid of forest cover and could be brought under green cover. This could be an added criterion for area selection. Rural poverty and scheduled areas could be taken as an additional parameter while prioritizing the areas under the Mission.

Soil and Water Conservation (SWC) is an integral component treatment of landscapes for reducing soil erosion hazards and land degradation and enhancing the conservation of water resources. The Mission under its interventions would undertake intensive SWC activities and may include terracing and reclamation, erosion control, water conservation and distribution, afforestation, cash/horticulture crops development works water harvesting works, farm ponds, conservation works in urban areas, etc.

The Mission under its decentralized approach will focus on efficiency in the planning and implementation of its interventions. The JFMCs would be involved in the identification of landscape, treatment area and site conducive afforestation models. A comprehensive five years perspective plan will be prepared for each JFMC detailing the benefit sharing mechanism with the Forest Departments. The State Governments will consolidate and prepare a comprehensive Afforestation Plan under the Mission in convergence with the other afforestation schemes being implemented in the state. The

[11] The study by IISc on vulnerability mapping shows that nearly 39% of forested grids in India are vulnerable to climate change. The forests in the central part of India, and especially the north-western part of India, are highly vulnerable. A significant part of the Himalayan bio-diversity hotspot is projected to be highly vulnerable due to higher warming. Northern and central parts of the Western Ghats are also vulnerable to climate change. Thus, vulnerability analysis helps to identify forest types and regions which require adaptation strategies to enable forests to cope with climate change.

private sector, including individuals, local communities and industry, are seen as partners to identify and implement measures to ensure future sustainable supplies of forest produce from outside forest areas, thereby reducing the burgeoning pressure on the forests.

Afforestation activities under GIM will be implemented in convergence with and through leveraging funds from the related Centrally Sponsored Schemes and State plan Schemes including Compensatory Afforestation fund (CAMPA) during the period 2021-30. Guidelines of the respective schemes shall be followed in the identification and implementation of Mission activities.

The Mission will seek to establish replicable plantation models under various landscapes besides undertaking innovative technological interventions to encourage and motivate holistic eco-restoration practices to boost community-based innovations utilizing the treasure of traditional knowledge available within the communities. The Mission's interventions will be based on the comprehensive plans submitted by the State Forest Development Agencies (SFDAs) taking into account the potential vulnerabilities of the landscapes as identified by the Forest Development Agencies (FDAs). The Mission's interventions thus shall provide an Additionality to the efforts to meet country's commitments to enhance the reclamation and restoration process in the degraded land towards the generation of offsets guided by the nature and the extent of the vulnerabilities of the identified areas.

The Mission's interventions are categorized under three sub-missions for contributing towards achieving the Mission's objectives-

1. Sub-Mission 1 will address the Mission's first objective i.e. qualitative and quantitative improvement of forest and tree cover in the existing forest areas.
2. Sub-Mission 2 will contribute towards increasing the forest and the tree cover in the non-forest areas, and
3. Sub-Mission 3 will focus on income enhancement and livelihood diversification of the forest dependent communities.

All the interventions will cumulatively contribute towards enhancing ecosystem services, particularly the biodiversity, carbon sequestration and hydrological services on the identified landscapes in these areas.

The sub-mission wise detailed activities to be implemented are as follows:

Sub Mission 1: Enhanced Quality of Forest cover and Improved Ecosystem Services

Ecosystems/landscapes prioritized under this sub-mission will include a mosaic of degraded and open forest areas affected by rapid ecological degradation and uninhibited exploitation. The Mission shall focus on highly vulnerable landscapes including Aravalli landscape, Western Ghats, Arid regions of North West India, Mangroves in coastal areas,

Indian Himalayan Region and Degraded Bamboo forests on priority for enhancing ecosystem services and carbon sink. The Mission will take up tree plantations in identified gaps for saturation of these landscapes to have a magnified impact.

Component 1.1: Restoration of Degraded Forest ecosystems:

About 30.4 m ha of India's forest cover comes under the open forest category. The open forests are located mostly in the forest fringes adjoining the villages and are subjected to intensive biotic pressure and unsustainable removals of forest produce. These lands have an immense potential for meeting the requirements of fuelwood, fodder, small timber and NTFP for village communities. These areas also offer ample scope for increasing carbon sink by improving the growing stock and the quality of forest cover.

Under this sub-mission, best practices of restoration and reclamation forestry will be implemented on priority in these landscapes governed by the nature and extent of their vulnerabilities. The extent of degradation will guide the selection of interventions. The various key interventions that will be taken up under this component include assisted natural regeneration, soil and moisture conservation works through the ridge to valley approach, cut-back operations, removal of invasive weeds, fire prevention activities, and protection of the area through restriction of grazing followed by multiple shoots cutting, singling and thinning operations, rainwater harvesting and plantation of indigenous species. Native fast-growing species will be preferred for planting purposes in the identified landscape.

Key Interventions:

- Assisted Natural regeneration/Artificial regeneration and affording efficient protection
- Improving quality of seedlings by using seeds of known origin
- Fire Management (both prevention and detection and control), and eradication of invasive species, pests and pathogens,
- Regulated grazing
- Improving hydrological regime through soil/moisture conservation (on ridge to valley basis)
- Coordinating with line departments like Agriculture, Animal Husbandry, Watershed, Rural development, Skill addressing drivers of degradation and improving livelihoods

Component 1.1.1: Restoration of Aravalli Hills:

The Aravalli hills are one of the oldest mountain ranges and extend for about 700 kilometres from Champaner in Gujarat to Delhi traversing through Rajasthan and Haryana. The Aravalli hills, with its vast landscape and biological diversity, have wide-ranging impacts on the sustainability of the natural resources in the region. These hills

are under severe ecological threat due to extensive mining and unhindered construction activities.

The decrease in open forest cover in the Aravalli range in the last three decades has presented an increasing threat of desertification. This deforestation of the range has led to reduced moisture in the air, further causing sand storms. Consequently, the rainfall has drastically reduced in the region which has significantly depleted the groundwater availability in the region. The 2017 State of the Environment Report estimated that around 40% to 70% of the land has undergone desertification in the eight states of Rajasthan, Delhi, Goa, Maharashtra, Jharkhand, Nagaland, Tripura and Himachal Pradesh. This increasing desertification presents a substantial threat to agriculture in the region and also in the adjoining eco-geographic zones.

The efforts of the Mission would thus be to restore, conserve and enhance the ecological values of Aravallis by creating a green wall which will prevent extension of desertification by acting as a barrier against the sand-bearing winds from the Thar desert. This green wall will further function as a groundwater recharge zone for the long-term ecological security of the dependent cities. In addition, comprehensive eco-restoration activities including the soil and water conservation work and the plantation activities will also be taken up under the Mission. Key interventions would include plantation of indigenous tree species and shrubs, native fast-growing species, locally relevant NTFP species for agroforestry and social forestry, soil and moisture conservation works on ridge to valley approach, removal of invasive weeds and various assisted natural regeneration measures.

- **Key Interventions:**
- Identifcation of landscape for intevention
- Afforestation of Native Species
- Intensive Soil and Moisture Conservation Activities
- planting of windbreaks in the western ecotone (towards the Thar desert)
- Reclamation of abandoned mining areas
- Promotion of Agro-forestry and Social Forestry

Component 1.1.2: Restoration of Western Ghats:

The Western Ghats, is among 34 Global hotspots of biodiversity in terms of flora, fauna, landscape and ethnicity. The region harbours a rich biodiversity with about 1,741 species of plants, 403 species of birds and a variety of reptiles. The Ghats extend to a

length of around 1600 kms and an approximate area of 1.6 lakh sq.kms. along the Indian West Coast from Gujarat to Tamil Nadu. As per the estimates, the Ghats neutralize about 4 million tonnes to 14 million tonnes of CO_2 annually. Due to its diverse forest ecosystems, the **region** neutralizes 10 percent of the total greenhouse gas emissions of India[12].

The eco-system of Western Ghats has degraded due to extensive deforestation, felling of trees and illegal mining of minerals which causes extensive pollution, deterioration of water & air quality, depletion of ground water, scarcity of drinking water during summer, changes in agriculture practices and crops pattern etc. Siltation of tanks, drying up of rivers and springs, invasion of eupatorium, and increased human-wildlife conflicts are other major problems in the area.

The efforts of the Mission would thus be to restore, conserve and enhance the ecological values of Western Ghats through:

1. Conservation of biodiversity and enhancement of carbon sequestration potential
2. Intensive Afforestation and SMC activities to increase the groundwater recharge for the long-term ecological security of the zone.
3. Working in tandem with the Ministry of Mines for the eco-restoration of abandoned mining areas through planting of native and indigenous species so as not to disturb the eco-fragility of this zone.

- **Key Interventions-**
- Idenfication of lanscapes for interverntion
- Afforestation of Native Species
- Intensive Soil and Moisture Conservation Activities
- Reclamation of Abandoned Mining Areas
- Eradication of Invasive Species
- Agro-forestry and Social Forestry

Other key interventions in these areas would also include plantation of indigenous tree species, shrubs, native fast-growing species, locally suitable NTFP species for agroforestry and social forestry, soil and moisture conservation through ridge to valley approach, removal of invasive weeds and various assisted natural regeneration measures. Interventions under the Mission would also complement the activities of the respective forest departments.

[12] http://peacefulsociety.org/the-western-ghats-save-the-western-ghats-movement/

Component 1.1.3: Greening of Arid Regions of North-West India:

The world's arid lands cover 40% of the global land area and make up a significant yet fragile ecological system that supports a third of the world's population. The Indian hot arid zone covers an area of 31.7 m ha. (12% of the country's total geographical area) in states viz. Rajasthan, Gujarat, Punjab, Haryana, Maharashtra, Karnataka and Andhra Pradesh. The bulk of the hot Indian arid zone (62 per cent) is contained in West Rajasthan followed by about 20% in Gujarat.

The problem of soil erosion in the arid regions of North West India renders a sizable fertile area into barren wasteland every year. The main causes of erosion in this area are wind, indiscriminate exploitation of natural vegetation by the nomadic population, excessive grazing by a relatively larger population of animals as compared to the available resources, poor range management practices, increasing demand for agricultural land and destruction of vegetation for fuel and other requirements.

The Mission recognizes that degradation of India's agricultural lands, forest lands and range lands is a serious concern due to increasing population coupled with the declining agricultural productivity. In the case of forests, widespread loss of myriad ecosystem services and biodiversity have enormous social, biological and economic implications for India's more than 270 million population[13].

Key priority interventions under the Mission will include planting of shelterbelts and windbreaks of native salt-tolerant species, regulated grazing, soil and moisture conservation works, planting of hardy, salt-tolerant grass species, and rainwater harvesting. Interventions under the Mission would also complement the activities of the state-level schemes being implemented by the forest department.

- **Key Interventions-**
- Identifcation of vulnerable areas for intervention
- Activities for prevention of desertification
- Afforestation of Native Salt tolerant Species as Shelterbelts and Windbreaks
- Intensive Soil and Moisture Conservation Activities to enhance land productivity
- Development of pastures with selected grass species to improve livestock productivity
- Regionally conducive Agro-forestry and Social Forestry practices

[13] https://www.teriin.org/sites/default/files/2018-04/Vol%20I%20-%20Macroeconomic%20assessment%20of%20the%20costs%20of%20land%20degradation%20in%20India_0.pdf

Component 1.2: Restoration of Mangroves:

Mangrove vegetation spreads over 4,975 sq kms and can be categorized as very dense (29.66%); moderately dense (29.73%) and open mangroves (40.61%) (ISFR, 2019). Mangrove and coastal ecosystems deserve special conservation efforts as these ecosystems are critical for protecting human lives and property from natural calamities such as cyclones, tsunami, storm surges and coastal erosion, and are the breeding, feeding and nursery grounds for many estuarine and marine organisms.

The Mission will support the restoration of mangroves in the potential areas through improving the quality of mangrove cover. The restoration activities will be taken on priority over such areas where mangroves have disappeared but were historically present. These patches of biodiversity-rich habitats will be protected through protection and restoration activities in the coastal, riverine and deltaic belts.

Key interventions would include planting of littoral species and mangrove associates and cutting channels in uplifted areas to facilitate sea-water inundation and plantation of native mangrove species as priority activities under the Mission. Pisciculture based livelihood promotion activities shall also be undertaken under the intervention.

- **Key Interventions-**
- Identifcation of mangrove patches which require restoration
- Development of channels for plantation and nursery beds
- Afforestation with local species

Component 1.3 Regenerating and Revegetating Himalayan Mountains:

The Indian Himalayan Region (IHR) is the section of the Himalayas within India, spanning 11 Indian states and union territories namely UTs of Jammu and Kashmir and Ladakh, Himachal Pradesh, Sikkim, Uttarakhand, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Assam and West Bengal. The region is responsible for providing water to a large part of the Indian subcontinent and contains various flora and fauna. The IHR starts from the foothills of the south (Shivaliks), and extends up to the Tibetan plateau on the north (Trans-Himalaya). Three major geographical entities, the Himadri (greater Himalaya), Himanchal (lesser Himalaya) and the Shivaliks (outer Himalaya) extending almost uninterrupted throughout its length, are separated by major geological fault lines.

The Mission will emphasize on the restoration, regeneration and revegetation of the degraded slopes through planting of native species. The objective would be to arrest soil

erosion, regulate landslides and undertake slope stabilization through drainage line treatment activities including gully plugging and developing contour trenches for arresting soil run-off and rain-water harvesting. A prior land use planning exercise will also be taken up for treatment of the landscape which shall provide a basis for undertaking a range of potential interventions including natural regeneration, mixed plantations, and suitable agroforestry practices. These activities will not only help in conserving biodiversity, and enhancing carbon sequestration, but will also enhance rural livelihoods and spur the rural economy of the region. The Mission shall also seek to promote effective traditional agroforestry practices such as Hill Paddy Field Protection Plantations under this intervention.

Shifting cultivation is the predominant land use and agricultural system in north eastern states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. Shifting cultivation which has evolved as an ecological necessity of the terrain is deeply embedded in the cultural ethos of the local people. However, conversion of forest land for jhum cultivation is one of the causes of deforestation and land degradation in the tropical regions. Increasing population and food grain demand, shortening of fallow jhum period and non-availability of alternative land resources has made this cultural practice unproductive and unsustainable (Nath et al., 2015). The Mission recognizing the variance in the practice would seek to treat the jhum area through apt technological interventions that respect local customs. The Mission would seek to adopt an integrated application of agriculture, horticulture, herbs and medicinal species, indigenous food species, forestry, animal husbandry, soil science, water resource engineering, industrial engineering and design, financial management and banking, anthropology, and related disciplines. Solutions due to such integrated application of the above diverse disciplines are more likely to be economically pragmatic,

- **Key Interventions-**
- Identification of area based on land use and watershed approach
- Drainage line treatment and SWC measures like Gully plugging and construction of check dams/contour trenches to prevent top soil runoff
- Encourage cultivation of traditional varieties of crops and horticulture by promotion of organic farming
- Regionally conducive Agro-forestry and Social Forestry practices, with due regards to traditional best practices
- Afforestation of Seabuckthorn in suitable areas as nitrogen fixing deciduous plant.
- Intregrated treatment of jhum areas.

development-oriented, locally acceptable, technologically advanced and ecologically sustainable, thereby addressing a majority of the SDG targets.

Seabuckthorn (*Hippophae rhamnoides* L.), popularly known as Leh berry, indigenous to the high altitudes it grows widely in the Himalayan region has immense potential in combating global warming, environmental conservation of high-altitude areas of the Indian Himalayas, in health care and poverty alleviation. Being a nitrogen-fixing deciduous plant, it is designated a a high-priority plant for commercial purposes as well as for environmental protection, especially through afforestation. Afforestation of Seabuckthorn in suitable areas in the States of Himachal, J & K, Uttarakhand and Sikkim will be taken up under the Mission. A pilot project on development of the value chain of Seabuckthorn would be taken up for further research, extension, technology intervention under the Mission.

Component 1.4 Eco-Restoration of Bamboo forests with specific focus in the North-East and Central India:

The North-east area consists of eight states namely Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim which comprises an area of about 2,62,179 km^2 and is known for its rich biological and cultural diversity.

Bamboo forests are important forest types which can rapidly colonize and have high adaptability, nutrient enrichment and conservation ability. Due to its biological characteristics and growth habits, bamboo is not only an ideal economic investment for villagers but also has enormous potential for eco-restoration of degraded lands.

Bamboo protects steep slopes, soils, prevents soil erosion, sequesters carbon and brings many other ecosystem benefits. Its fast-growing nature and the dense foliage help to maintain the thick layer of litter and maintain the stability of microclimate specially the soil moisture content, the most important factors for the restoration of degraded lands.

The Mission would seek to adopt Bamboo and Rattans to:

1. decrease the rate of land degradation and enhance land reclamation and eco-restoration towards ensuring land degradation neutrality
2. diversify the income generation potential and provide economic incentive to the communities.
3. establish and emphasize the importance of bamboo and its impact in changing behaviour towards soil erosion control, biodiversity conservation and increasing capacities for the restoration of degraded lands.

The Mission will work in close coordination with the National Bamboo Mission to optimize outcomes at both the Centre and State level.

Sub Mission 2: Increase in Forest and Tree cover and Ecosystem Restoration

The India State of Forest Report 2019, puts specific emphasis on the importance of enhancing forest and tree cover and the growing stock in the potential forest and non-forest landscapes. Suitable eco-restoration and afforestation interventions would be specifically planned and implemented for River catchments; Ravines; Agricultural landscapes; Marginal farm-lands and fallows; Wastelands; State and National highways; and also, along the Railway track and Vacant lands in urban landscapes etc.

The Mission recognizes the due importance of this Sub-Mission and will focus specifically on the available vacant lands in the non-forest areas identified for undertaking conducive interventions.

Component 2.1: Treatment of River Catchments and Ravine Reclamation:

Landscape planning is the key approach for efficient river catchment restoration and ravine reclamation. Planning and interventions would be undertaken at the macro-watershed, sub-watershed and micro-watershed levels for the holistic restoration of the river catchment areas. The State Forest departments would be expected to align their catchment area treatment plans with the Mission to restore and enhance the ecology of the area, and socio-economic conditions of the dependent communities.

Ravine reclamation would also be one of the priority areas under the Mission's interventions. The total area under ravines in the country is 0.96 m ha (Wasteland Atlas, 2019). Effort would be taken up to check the further ingress of ravines into the non-ravine farmland by using the time-tested method of *dorbandi* (closing the ravine head).

- **Key Interventions-**
- Land Use Planning for eco-restoration and plantation activities identification of area of intervention.
- Planting of native Multi-purpose tree species like Acacia and Dalbergia.
- Intensive SWC Activities including Gully plugging through construction of earthen bunds
- Encourage restoration of the area by undertaking planting of native grass species to restore the productivity of the ravine areas.
- Planting of drought hardy species
- Regionally conducive Agro-forestry and Social Forestry practices

Shallow gullies can be tackled through the creation of earthen bunds and plantation of hardy grass species for soil stabilization, followed by planting of native species like Dalbergia, Acacia etc. Land use planning incorporating artificial regeneration, mixed plantations, and different regional suitable agroforestry practices, would further enable the reclamation of these areas and enhance the livelihoods of the dependent rural communities.

Component 2.2: Eco-restoration of Wetlands:

Wetlands are considered as highly productive systems in their natural forms. In India, wetland ecosystems support diverse and unique habitats and are distributed across various topographic and climatic regimes. They not only support large biological diversity but also provide a wide array of ecosystem goods and services (Wetlands Rules, 2010). They are also playing an important role in groundwater recharge, flood control, carbon sequestration and pollution abatement. However, the management of wetlands has received inadequate attention in the national water sector agenda. As a result, many of the wetlands in urban and rural areas are under anthropogenic pressures, including land use changes in the catchment; pollution from industry and households; encroachments; tourism; and over exploitation of their natural resources.

India has about 757060 wetlands with a total area of 15.3 m ha, accounting for nearly 4.7% of the total geographical area of the country. Out of this, the area under inland wetlands accounts for 69%, the coastal wetlands 27%, and other wetlands (smaller than 2.25 ha) 4% (SAC, 2011). Moreover, out of 2,414 Ramsar sites in the world, 42 Ramsar sites are in India with a surface area of 1,081,438 hectares (as of December 2020) covering 19 states[14].

The Mission would be working closely with the Ministry of Jal Shakti and State Wetland Authorities to ensure judicious use of these sites and their conservation. Priority will be given to those wetlands that have a high value as habitats for animal, bird and plant life to achieve biodiversity conservation along with livelihood improvement and carbon benefits. Efforts will be made to restore the drainage system and links across neighboring wetlands to recreate natural flow for recharge of the wetlands. Carefully selected aquatic species will be planted on the banks and islands. Local communities would be encouraged to continue with compatible use of wetlands and seek new opportunities for livelihood enhancement (e.g., ecotourism). Coastal wetlands will also be identified for protection. Conservation of wetlands would also go a long way in achieving the objective of 'Nal se Jal' in each household[15].

Key interventions:

1. Comprehensive treatment of wetlands' catchment areas
2. Support to compatible land-use practices, fencing of strategic areas to protect wildlife and control encroachments
3. Control of invasive weeds and Water quality monitoring

[14]https://www.jagranjosh.com/general-knowledge/ramsar-sites-in-india-1605708327-1
[15]https://pib.nic.in/PressReleasePage.aspx?PRID=1600857

4. Planting of carefully selected aquatic species
5. Priority will be given to those wetlands with high biodiversity value.

Component 2.3: Restoration of Abandoned Mining areas:

India has a total area of about 0.23 m ha land under the Mining Wasteland (Wasteland Atlas, 2019). The Indian Bureau of Mines (IBM) had identified 297 abandoned mine sites, out of which 106 abandoned mine sites belong to Public Sector Undertakings, major and other private sector companies. Out of the above 106 sites, 24 mine sites become operational again, thus requiring reclamation and rehabilitation in respect of 82 abandoned sites only[16]. In total 197 abandoned Coal Mines also exist in the country[17]. The major share of abandoned mining sites is found in Chhattisgarh, MP, Andhra Pradesh, Tamil Nadu, Jharkhand, Orissa in descending order.

Afforestation is an important component of the plan for reclaiming abandoned mines. The Mission will work with the Ministry of Mines and the Indian Bureau of Mines and will undertake afforestation over the abandoned mines involving local communities. Plantation of suitable native species and soil moisture conservation will also be taken up over the identified areas.

Component 2.4: Plantation over vacant land under the control of PSUs:

The government owned corporations are termed as Public Sector Undertakings (PSUs) in India. In a PSU majority (51% or more) of the paid share capital is held by the Central government or by any state government or partly by the central government and partly by one or more state governments.

As per the Survey 2018-19, there were 348 CPSEs as on 31st March, 2019 out of which 249 were operational and the rest 86 CPSEs were under construction[18]. Besides these there are also SPSEs under the jurisdiction of the respective State Governments. As per the Wastelands Report 2019, about 31720 hectares of wasteland exist under the jurisdiction of the CPSEs, besides the land under their functional interventions[19]. The Central and the State governments have been taking up initiatives to reclaim these wastelands and also to undertake plantation operations[20]. Vacant land with the PSUs provides an ample opportunity to increase forest/tree cover, meet the needs for forest produce and create carbon sink. The Mission would seek to complement these activities through restoration/reclamation forestry and comprehensive regionally conducive eco-restoration activities.

[16]https://ibm.gov.in/index.php?c=pages&m=index&id=90&mid=23897
[17]https://mnre.gov.in/file-manager/UserFiles/Abandoned-Coal-Mines-in-India.pdf
[18] https://pib.gov.in/PressReleseDetailm.aspx?PRID=1602623
[19] https://dolr.gov.in/sites/default/files/Wastelands%20Map%20of%20India%202015-16%2C%20State-wise%20and%20Category-wise%20distribution%20of%20Wastelands%20during%202015-16%20vis-a%20vis%202008-09.pdf
[20] http://revenueodisha.gov.in/sites/default/files/document/Govt_Land/21261_1_7_2017.pdf

The Mission will encourage PSUs to take up massive afforestation over their vacant land through the participation of the local communities with the support of the Forest department. Benefits accrued out of such activities will be shared with the local communities and the PSUs. The status of land available with the PSUs would be collated at the level of MoEF&CC and shared with the states for further inclusion in their Perspective plan and Annual Plan of Operations (APO). Vacant land available with defence establishments may also be considered for undertaking afforestation interventions.

Component 2.5: Enhancing tree cover in Urban and Peri-Urban areas including institutional lands

The urban and peri-urban areas form one of the most rapidly evolving ecosystems in India and thus have an immense role to play in the ecological restoration process. Due to the increase of population, the vulnerability of the urban areas towards climate change has increased many folds. Rapid urbanization has also deteriorated air quality, increased atmospheric temperature, noise levels, water & land pollution. In the context, urban forests will provide an opportunity to help a) mitigate climate change, b) ameliorate air pollution c) improve the overall water regime, d) nurture urban biodiversity and e) provide shade and reduce ambient temperatures and the heat-island effect. The Government of India has taken several measures to increase the urban forest and its biodiversity and has launched 'Nagar Van Yojana' for developing city forests across the country by involving local communities, educational institutions, local bodies, NGOs, private players etc.

Under the Mission, a multi-pronged approach will be adopted to address the eco-preservation and improvement of ecosystem services through improved amenities for urban dwellers, soil and water conservation, biodiversity conservation and improved habitats for resident and migratory wildlife. Public–private partnerships in the management of urban forests would be explored for green space plantings and maintenance, where private companies and agencies can carry out work along with public authorities. The involvement of the private sector, NGOs, RWAs etc will be explored in the upkeep of the created green spaces.

The Mission will support urban greening through various interventions, falling under the following broad categories:

1. **Development of Biodiversity Parks**: Biodiversity Parks are nature reserves that harbor the natural heritage of the area and have conservation, educational and cultural values and enhance the environmental quality in urban centers. The underlying principle of the Biodiversity Park is to recreate self-sustaining ecosystems with native flora and fauna characteristic of the area for enhancing the quality of the urban environment. The Mission shall develop such parks with the primary aims of conserving and propagating species of rare, threatened and endangered plants of India, promote public awareness and environmental education and provide a suitable research/education ground for the local public, students and researchers to understand the biodiversity and the local ecosystems.

2. **Creation of Green Spaces**, including the development of Biodiversity parks, around zoological gardens and hospitals, places of traditional and cultural interest, vertical gardens along the metro and flyover pillars and school nurseries and orchards, and undertaking peripheral plantations including green hedges.
3. **Tree Planting Activities** on institutional lands, consulates, landfills, sewage drainage lines and garbage dumping sites, planting along roads and on dividers etc. Green belts around the dumping yard and along natural drains would help create a natural sink for various pollutants and toxic chemicals including chemicals coming out from solid waste, and sewage, besides having a profound positive impact on the city environment and health of its inhabitants.
4. **Conservation and Reclamation Activities,** including planting of suitable tree species to serve as natural buffers along the urban water bodies, drinking water reservoirs and natural drainage lines by improving water quality by filtering potentially contaminated water before it enters a water body, besides their protection and stability.

Some of the suitable plant species that may be taken up for plantation in the urban landscape along roadsides are *Cassia siamea* (Cassia), *Acacia nilotica* (Babul), *Azadirachta indica* (Neem), *Saraca indica* (Ashoka), *Pongamia pinnata* (Karanj), *Delonix regia* (Gulmohar), *Mangifera indica* (Mango) etc.

The Mission will establish convergence with other Missions and other related schemes like Smart Cities, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), and Nagar Van Yojana, and greening and afforestation programmes of the respective urban local bodies etc. to promote plantation/afforestation activities. There also exists an ample scope for involving the private sector in providing funds for urban greening, especially for developing biodiversity parks, creation of vertical gardens and creation of roadside/ avenue plantations, which shall also be explored under the Mission.

Component 2.6: Plantation along the National/ State Highways and Railway tracks:

The Ministry in consonance with the NFP, 1988, has issued an advisory to State Forest Departments for partnering with Railways and National Highways Authority of India (NHAI) for taking up plantation of trees along the highway sides and vacant areas by the side of railway tracks. Model guidelines were also circulated to all States/UTs for undertaking plantation on Railway land and plantation on sides of National Highways. The Ministry of Road Transport & Highways has promulgated Green Highways (Plantation, Transplantation, Beautification & Maintenance) Policy-2015, under which plantations have been initiated in collaboration with Forest Departments and other agencies. 1% of the total project cost of all highway's projects will be kept aside for the highway plantation and its maintenance.

The Ministry of Railways has been undertaking substantial steps to promote tree planting along the railway tracks. The Ministry of Railways has finalized a model

agreement in consultation with MoEF&CC to be entered between Zonal Railways and respective State Forest Department in January 2016 for plantation of trees on Railway land along the railway track and station yards without any transfer of ownership and on cost sharing basis. The plantation work on Railway land along the railway track has already been started under this agreement in some of the States. During the year 2017-18 (up to January 2018) Rs. 85.25 lakh saplings have already been planted[21].

Under this component the Mission shall provide technical and resource support to the National and State Highway departments and the Ministry of Railways for undertaking-

- Plantation of suitable native and multipurpose tree species along the roads and railway tracks
- Massive awareness programs, in making greening efforts a people's movement
- Identification of places of high public interest for priority-based interventions, and
- Setting up an effective monitoring mechanism at the State level to ensure the timely and efficient implementation of plantation activities.

The Mission will seek convergence with the Ministry of Road Transport and Highways' Green Highway scheme and the Ministry of Railways Green Railway Scheme, for undertaking site-specific plantations along the roads and the railway tracks under the Green India Mission. Convergence with the State Road and Highways departments shall be established towards realization of the Mission's mandate.

Agencies such as the Roads Department, NHAI and railways may allocate a certain amount for tree plantations as part of their project development cost. This could be enabled through coordination and necessary changes in guidelines initiated at the national level

Component 2.7: Enhancing tree cover through undertaking Agroforestry and Social forestry

Agro-forestry is defined as a land use system that integrates trees and shrubs on farmlands in rural landscapes to enhance productivity, profitability, diversity and ecosystem sustainability. It is envisaged as one of the important contributing sectors under the NFP, 1988 to achieve the target of increasing forest/tree cover to 33 percent. Given the fact that land-holding size is shrinking, tree farming combined with agriculture is perhaps the only way forward to optimize the farm productivity and thus, enhancing livelihood opportunities of small farmers, landless and the women. Agroforestry/Social forestry can become an important tool to build the resilience of farmers and rural people against the threats of climate change and natural calamities. Under this intervention, fallow lands, drylands, degraded farm and marginal lands, croplands, bunds, would be taken up under the plantation.

The Mission will support a program of nurseries for raising quality seedlings of agroforestry species for large-scale tree plantation on the farm land along with high

[21]https://pib.gov.in/newsite/PrintRelease.aspx?relid=176984

agricultural productivity and improved soil nutrient regime. Bamboo and NTFP based models would be promoted to enhance the incomes of farmers and to enhance carbon sequestration. The Mission may also consider dovetailing institutional financial support to farmers to go in for farm-forestry on their fallow lands/unproductive lands. The use of bio-fertilizers and bio-pesticides would be encouraged.

Showcasing effective and efficient Sustainable Land and Ecosystem Management (SLEM) models will also form a part of the Mission's interventions. It is a crosscutting and multi-sectoral approach which deals with land management and biodiversity conservation which will help in adaptation to climate change and sustain ecosystem services. Soil and Water Conservation activities will also form a key component under the Mission to sustain and enhance the land and ecosystem productivity.

Agroforestry and farm forestry shall be taken up in the contiguous landscape of the areas selected for the other submissions to create a larger and synergistic impact on the interventions. These plantations shall further be explored for financing under the voluntary carbon markets to provide additional incentives to the farmers and landowners. Necessary support for enabling the same would be provided under the Mission.

The private sector, especially those companies which use wood or wood based raw materials, will be the partners in the development of agroforestry activities. Such companies may be facilitated to have a three- or two-party agreement with society depending on whether public funds are available with the local Panchayat/ JFM

•Key Interventions

- •Commercial farm forestry may also be promoted by producing the raw material for industry or for urban needs.
- •Planting of suitable tree species including fruit and NTFP species, and setting up of Nutrition gardens in the vilages.
- •Promotion of Bamboo Based Agroforestry Models.
- •Planting of native grass species to restore the productivity of the dry/fallow lands.
- •Promotion of High Yielding Variety (HYV) seeds.
- •Development of Quality Seedling production through research oriented Nurseries.
- •Regionally conducive and adoptable practices to be promoted taking due regard to the traditional knowledge.

Committees and DCF for development of suitable plantations on village non-forest land that can be harvested for raw material and replanted. The companies may facilitate by providing high yielding planting material, tools and implements and buy back arrangement of the final produce from the local community.

Sub Mission 3: Enhancement of household incomes and diversification of livelihoods for forest dependent communities

The National Mission for Green India encourages the enhancement of livelihood income, food security, health security, etc. besides promoting and supporting the community institutions towards enhancing sustainable livelihoods of the poor. The Mission also encourages skill development and capacity building of the communities through improving their access to knowledge, skills, technology, market intelligence, risk management products and credit support through their SHGs and Federations to individual members/households, thereby contributing to enhancing their livelihoods. The Mission would also emphasize promoting and facilitating successful, small-scale projects that would enhance women's participation and productivity in agriculture and allied activities with the help of NGOs, CBOs and other government agencies across the country. It is envisaged that these projects would emerge as resource centres, with the focus on –

1. Inclusion of the poorest of poor
2. Community Managed Environmentally Sustainable practices.
3. Supporting institutions around natural resource management and allied activities to strengthen livelihoods of the poor, and
4. Developing a wide pool of community practitioners (CRPs) to ensure participatory service delivery and country-wide scaling up of best practices.

Thematic Interventions under the Sub-Mission

Component 3.1: Livelihood Diversification and Enhancement of Incomes: Setting up of Livelihood Improvement Training Centres (LITCs)

The Mission acknowledges that the promotion of a large number of livelihoods, especially for the rural poor and women has emerged as the most significant development challenge of the century. The Mission recognizes the bottlenecks of inadequacy of knowledge base on how to support/ promote large numbers of livelihoods; and inadequate availability of trained human resources who can participate in this work effectively as the major impediments in the livelihood enhancement of the communities.

The Mission seeks to establish a comprehensive network of Livelihood Improvement Training Centres (LITCs) in key forest landscapes for the diversification of a large number of livelihoods, especially for the rural poor and women. The LITCs will act as multipurpose centers to offer training on major livelihood options to enhance the skills and productivity of the rural youth. The LITCs will be equipped with suitable and

relevant facilities and information which would help in ensuring that the farmers, producers, and the general local population are benefitted through the facilities

Major outcomes of Livelihood Improvement Training Centers will be

- Livelihood enhancement by enhancing and expanding existing skilling and tapping new opportunities in farm and nonfarm sectors,
- Enabling an increase in per capita income through skill generation, and
- Provision of self-employment and entrepreneurship opportunities to the rural population

This sub-mission would be implemented in coordination and collaboration with the Livelihood and Skill development programmes of the government where intervention in gaps areas would be financed under the Mission.

Component 3.2: NTFP Processing Centres

The country has rich and diverse forest resources and a significant proportion of the population is dependent on these natural resources. Non-Timber Forest Produce (NTFP) is a key output of these forest resources and plays a crucial role in providing subsistence for communities which rely on forests and forest produce for their livelihood and domestic requirements. Besides, NTFPs have a massive demand in the global medicinal market.

The Mission recognizing the importance of NTFPs seeks to support a sustainable model for the cultivation of the NTFPs outside the conventional forest areas to enhance the livelihood opportunities for the forest dependent communities and also to reduce their dependence on the forests. The Mission in convergence with the Van Dhan Centers will establish NTFP Processing Centers as a single window source to enhance the skills of the forest-dependent communities for the sustainable harvesting of NTFPs, their processing and marketing. These centers will also provide adequate infrastructure for the processing and marketing of NTFPs collected by the members of JFMCs. These centers would also help in the value addition of forest produce and ensure the incomes of farmers, producers and local population increase substantially by diversifying their livelihoods.

The NTFP processing centers shall -

- Function as multipurpose centers for providing avenues for the cultivation, harvest, production, processing and marketing of NTFP produce.
- Aim to establish NTFP as a high-end product and the preferred species under community and agroforestry practices.
- Be equipped with facilities and information for marketing, forward and backward linkages, productivity enhancement, and packaging of produce.

This sub-mission would be implemented in coordination and collaboration with the Pradhan Mantri Van Dhana Yojana.

Component 3.3: Integrated Nursery and Research Centres

The Green India Mission shall support in the establishment of Integrated Nursery and Research Centers, to provide quality planting material and support research and extension to both forestry and agroforestry interventions. The objective of this intervention is also to demonstrate model nurseries that could be adopted by the States in due course for afforestation activities.

These Centers would help in:

- Raising of "Quality Seedlings" to meet the demands of farmers and will include Agroforestry tree species, horticultural species etc.
- Providing institutional support to farmers for farm-forestry on their fallow lands/unproductive lands.
- Functioning as Knowledge and experience sharing platforms among the farmers/ tree growers.

Support would be given for upgrading the existing nurseries to the standards envisaged under the Mission. In case not suitable existing nurseries are found eligible for support, new nurseries may be developed under the Mission.

Component 3.4: Support to Research Centers for bridging the gap between research and field practices under forestry and agroforestry

Field trials of the outcome of the research in forestry and agroforestry are needed so that they are widely adopted by the farmers and tree growers. The Green India Mission envisages actively engaging with the Research Institutions for developing suitable agroforestry species for various agro-climatic zones and capacity building of farmers and forest field staff for the implementation. Eco-restoration and threat to biodiversity are the critical areas that require immediate attention. Forestry and Research institutions shall work in tandem with the implementation agencies in the field to address these problems.

The National Agroforestry Policy 2014 emphasizes on the need for undertaking and investing in the research and development, extension and capacity building and related activities based on the appropriateness and the suitability of the various agroforestry models for the different agro-climatic regions of the country. The Policy further reiterates the need to encourage agroforestry research specifically for the increased availability of the quality planting stock and also of the multi-purpose indigenous species with higher nitrogen-fixing ability to meet the local needs for fuel, fodder and timber as well as enhancing the soil health and productivity. The Research Centers so established under the Mission would

- Identify best Agroforestry Models and suitable species interlinking the traditional knowledge.
- Identify suitable agroforestry species which can be grown on farmlands for the economic and ecological benefits of the farming communities, and which can be taken up for planting on a large scale by the farmers on their land in conjunction with agriculture practices.
- Undertake field trials of suitable species for better Land Management Practices to enhance land productivity.

7. Enhancing Implementation Efficiency

The Mission adopts a decentralized model of operation and has an effective planning, implementation and monitoring of various interventions. A three-tier approach of operation is being adopted at the village level in synergy with the State and the Central Government. A Bottom-Up Model will delegate greater decision making and implementing powers to the Joint Forest Management Committee (JFMC) at village level along with giving them greater ownership and accountability for the interventions undertaken in their landscape.

Joint Forest Management Committees (JFMCs) will be a body of the Gram Sabha headed by the President elected from the members of the JFMCs. The Executive Committee of the JFMC will form the fundamental implementing unit of the Mission's interventions at the grassroots level. The JFMC will prepare site specific micro-plans for the landscapes identified for undertaking various afforestation and support activities and it will be approved by the Gram Sabha in case of village and by Urban Local bodies for urban areas. The JFMCs with the assistance of forest department officials will select the suitable species for plantation and ensure their survival.

Forest Development Agency (FDA) will be the implementation unit at the District level/ Divisional level. The Executive Committee of FDA will be chaired by the Divisional Forest Officer and the Steering Committee will be headed by the Collector, with the district level officers of line departments its members. The Divisional Forest Officer will coordinate the progress of different afforestation activities under the Green India Mission and will report to the SFDA at regular intervals. He will follow the advisories issued by the State Forest Development Agency for the identification and the implementation of the Mission's interventions as per the approved APOs. The Divisional Forest Officer would also facilitate the involvement of the private players including the non-government organizations, civil society organizations etc. for undertaking and implementing the Mission's interventions in the identified landscape and plantations by different government departments, PSUs, civil societies etc.

State Forest Development Agency (SFDA) will act as the highest body at the state level to guide and approve the perspective Plan and Annual Plans of Operations (APOs) at the level of the State Mission Directorate. The Executive Committee of SFDA will be chaired by the Principal Chief Conservator of Forests and HOFF of the State. The officers

of various line departments will be its members. The Chief Secretary of the State will be the Chairman of the Governing body of SFDA and Principal Secretaries of the line departments and PCCFs will be its members. The Member-Secretary of SFDA will be an Additional PCCF rank officer in the State. The SFDA shall be the nodal agency and will formulate the comprehensive plan for afforestation in the State encompassing all the schemes to saturate the identified vulnerable landscapes. The State level comprehensive plan shall incorporate the cumulative details of the afforestation activities for the state including under the Mission and also under other afforestation schemes being implemented in the State.

The National Governing Council of the Mission will be chaired by the Hon'ble Minister of Environment, Forest and Climate Change and the National Executive Council will be headed by the Secretary EF&CC to provide overall guidance and synergy of actions. There will be a Mission Director of Green India Mission who will be the Member-Secretary of the National Governing Council. The Mission Directorate chaired by the Mission Director will have overall accountability for the Mission deliverables at the National level and will be supported by a team of experts and secretarial staff.

The implementation structure of the Mission is depicted in the chart below-

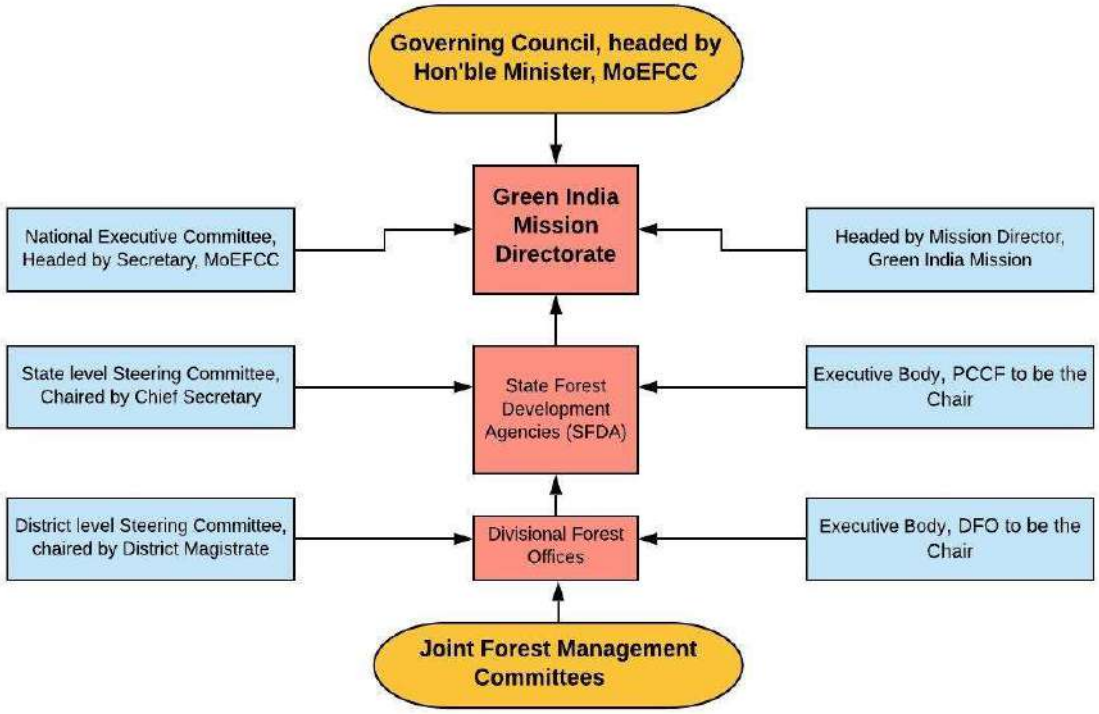


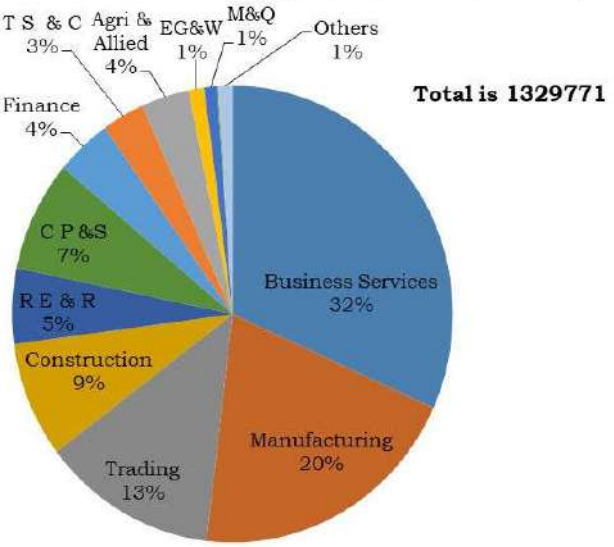
Figure 1Operational Structure of Revised Green India Mission

7.1: Enhanced Role of Private Players and Agencies

Nationally Determined Contribution provides an opportunity to fast-track the much-needed momentum to move towards the goal of 33% of forest and tree cover. Rehabilitating degraded open forests and improving green cover over non- forest areas by creating additional tree cover through agroforestry, farm forestry, urban and peri-urban forests, roadside avenues, etc. would be the most effective tools. Agro-forestry activities on non-forest lands will have many "spin-off benefits including improving the income of the farmers". It will provide an "opportunity to create viable business models for farmers to get more income from tree cropping, cultivation of NTFP and its marketing, simultaneously meeting the requirements of the industry and the community."

In India, the total number of active companies as on 28th February, 2021 is about 13. 30 Lakh, out of which Maharashtra has the maximum number of active companies (259110), followed by Delhi (215266) and West Bengal (131492) as on 28th February, 2021[22]. As such there exists a huge scope to explore the concordance between the environmental and the developmental paradigms. The Mission will seek to evolve sustainable business models for agro-forestry and tree cultivation to be supported by the rationalized policy and regulatory regime, for enabling multi-stakeholder convergence and proactive participation especially with Private Sector Companies/ PSUs on the PPP model and also with the local bodies, municipal corporations, etc. These business models shall be initiated on a pilot basis to shift from the practice of project-based funding to create self-sustaining market models[23]. The activities on the private and non-forest lands may be undertaken on the co-financing basis with the responsibility of the implementation vesting with the Joint Forest Management Committees (JFMCs) and individual farmers. Support from Corporate Social and Environmental Responsibility and Corporate Environmental Liability would be envisaged from the sector.

Chart 1.1: Sector-wise Active Companies as on 28th February, 2021



[22] http://www.mca.gov.in/Ministry/pdf/MIBFebruary_10032021.pdf
[23] https://ntps.nic.in/writereaddata/EXPERT-COMMITTEE-REPORT-ON-TOF-18112018.pdf

The details of the implementation arrangement, the mechanism and its extent shall be worked out in consultation with the State Forest Departments, based and guided by the development of appropriate policy framework during the Mission's implementation period. The Mission will also add "value" to ongoing programs/schemes on "greening" taken up by multiple agencies. Such value addition will come through a) technical inputs on species mix from climate adaptation/mitigation angle, b) improved policy regime to help multiple agencies plant, protect and manage forests and tree growth, and c) advisory services for benefits under carbon funds/ bonds and would include support in outcome-level monitoring.

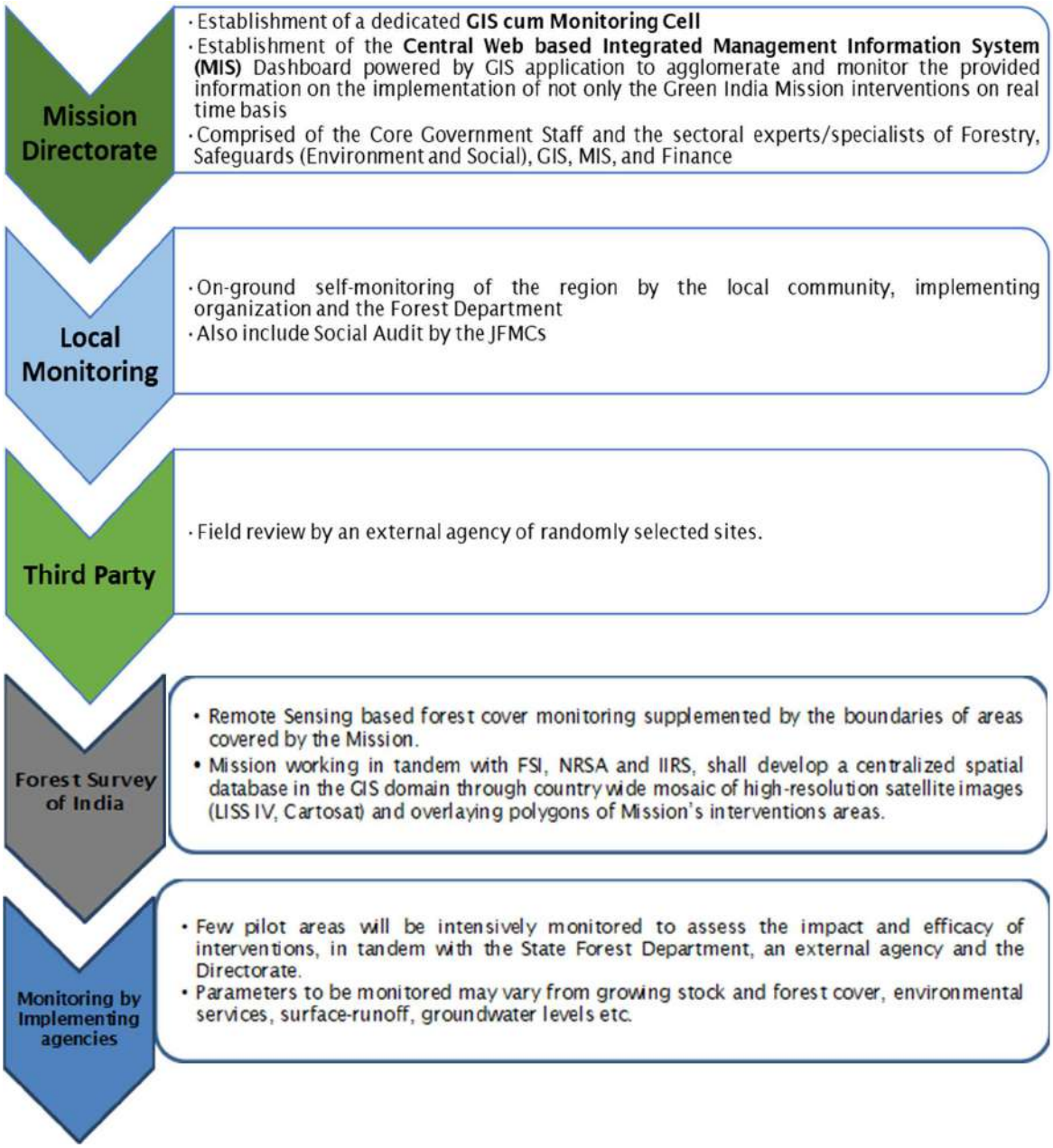
7.2 Monitoring and Auditing of the Green India Mission Interventions

A comprehensive monitoring framework at five different levels is envisaged under the Mission. In addition to on-ground self- monitoring by multiple agencies, including communities, the Mission will support the use of modern technologies like Geographic Information System based real time monitoring, Remote Sensing with GPS mapping of plot boundaries, coupled with satellite imageries for monitoring at the output/ outcome level. The Gram Sabha will carry out the social audit of the Mission activities at the village level. This information will also be disseminated in the public domain on a regular basis. Third party monitoring and long-term monitoring of certain ecosystem services at selected sites will be provided.

A Web based Integrated Management Information System platform powered by GIS application on real time basis will be developed for ensuring convergence of various afforestation schemes for robust financial planning, timely funding, mobilization of adequate resources and prudent utilization of funds. Web based portal will generate state wise progress report of numerous plantation activities undertaken under different Central and State sponsored schemes being implemented in the states and will generate information on cumulative nursery, soil and moisture conservation measures, their respective Annual plan of Operations, beneficiary details etc.

A dedicated Monitoring cum GIS cell would also be established at the Directorate level to ensure smooth functioning of the Web based Integrated Management Information System Dashboard and to monitor the progress of the Mission activities.

The various strata of Monitoring and Evaluation are depicted in the figure below:



8. Convergence with Cross-sectoral Programs; Adding value through support activities and relations with other Missions and Schemes

The Green India Mission is adopting a demonstrative approach to establish innovative afforestation/plantation models in the identified landscape through the micro-ecosystem approach. No specific model wise-targets have been fixed so as to enable the states to leverage funds as per the need and priority of restoration. These efforts shall be further strengthened through establishing synergies and integrating the targets and leveraging funds from all the ongoing afforestation schemes of the various Ministries and also the schemes under the different State plans. The convergence with ongoing program/ schemes will be secured by getting representation of the concerned department/ministry in the organizational structure of the Mission at different levels. At district level, it will be further reinforced through linkages with the district administration. Finally, at the village/sub watershed/ sub landscape level, the process will be taken up using the convergence route adopting the gap-filling methodology.

MoEF&CC will work in tandem with the following Ministries and their respective schemes agglomerating their targets and respective fund allocations.

9. State Perspective Plans

The State Forest Development Agency (SFDA) shall prepare the comprehensive State Afforestation Perspective Plan for undertaking the Afforestation activities in the state both in the forest and the non-forest areas. The interventions under the Green India Mission shall be undertaken in accordance with the Implementation Guidelines of GIM. The State Afforestation Plan shall be prepared by the SFDA through consultations with various stakeholders including the Forest Department, line departments of the State Govt., Gram Panchayat/Gram Sabha/ Municipalities, civil society, community groups, academia (Research Organizations and Universities), etc. taking due reference to the extent of the degraded land areas in each of the State. The SFDA will prepare the Perspective Plan in consonance with the State Action Plan on Climate Change, and other Central and State Governments schemes/programs like CAMPA, MGNREGS, SMAF, NBM, etc. in the identified landscapes. Wasteland Atlas of India, 2019 and Envi Stats India 2020[24], may serve as good reference points for estimation of the degraded areas in the State for the preparation of the perspective plan of the Mission. These Perspective Plans will provide a clear roadmap for the implementation of GIM activities and measurable indicators and outcomes.

10. Implementation Guidelines

The Implementation Guidelines for GIM will facilitate the State Governments for selection of Landscape by detailing the planning process for implementation of various activities and interventions under different sub-missions and the detailed cost implications. Implementation guidelines will lay down modalities and procedures for the site-specific bottom- up planning processes at the level of Gram Sabha/Municipalities and various Committees under the Mission. It will provide the linkage between traditional knowledge and scientific forest management to ensure sustainable management of both forests and natural resources. The Ministry will update these implementation guidelines at the time of mid-term evaluation and will incorporate suggestions and feedback from Implementing Agencies.

11. Timeframe and Deliverables

The Green India Mission will be implemented over a period of 10 years (2021-2030) with the provision of mid-term review after five years of implementation. Afforestation over 24 million hectares will be taken up through convergence with ongoing Central and State Government Schemes and funds available under CAMPA. Annual Afforestation/ tree Plantation at the current trend of over 2 million hectares in the country will be taken up through convergence to achieve the target of 12 mha during 2021-25 and another 12 mha during 2025-30. Afforestation over 1.0 million hectare will be taken up under Mission specific interventions to establish regionally

[24] http://mospi.nic.in/publication/envistats-india-2020-vol-1-environment-statistics

conducive, innovative and demonstrable models for afforestation and eco-restoration activities in identified intervention areas within the larger landscapes, as an Additionality during the period 2021-2030.

12. Mission Costs

The financial outlay under the Mission is Rs. 12,190 crores for implementation of afforestation activities over 1.0 million hectare during the period of 10 years (2021-30). The Mission costs will be met partly from the budget (Rs. 5000 Crores) under ongoing Green India Mission CSS scheme and balance from funds available under National fund of CAMPA (Rs. 7,190 Crores). This is an indicative cost to be funded specifically under the GIM. The landscape wise cost would be specific to the state and different plantation models. The funds available under state CAMPA, Centrally Sponsored Schemes, Externally Aided Projects, CSR funds, State Plan Schemes etc. will be utilized as per the APOs towards the attainment of targets of 24.0 million hectare envisaged under the Mission.

Sl. No.	Mission Interventions	Afforestation Target (in mHa)	Total Cost (in Crores)
Sub Mission 1: Enhanced Quality of Forest Cover and Improved Ecosystem Services		**0.30**	**3000**
1	Restoration of Degraded Open Forest Ecosystems		
2	Restoration of Degraded Aravalli Range		
3	Restoration of Western Ghats		
4	Greening of Arid Regions of North-West India		
5	Restoration of Mangroves		
6	Regenerating and Revegetating Himalayan mountains		
7	Eco-Restoration of Degraded Bamboo Forest in the North-East & Central India		
Sub Mission 2: Ecosystem Restoration and Increase in Forest and Tree Cover		**0.70**	**7000**
1	Treatment of River Catchments and Ravine Reclamation		
2	Eco-Restoration of Wetlands		
3	Restoration of abandoned Mining Areas		
4	Plantation over vacant land under the control of PSUs		
5	Plantation in Urban Areas and Peri-Urban Areas		
6	Plantation along the National/State Highways and Railway tracks		
7	Agro-Forestry and Social Forestry		
	TARGET AREA	**1.00 mHa**	
Sub Mission 3: Enhancement of Household Incomes and Diversification of Livelihoods for Forest Dependent Communities (in numbers)			**600**
1	Livelihood Improvement Training Centres and enhancement activities	**50**	
2	Integrated Nursery and Research Centre	**50**	
3	NTFP Processing Centres	**100**	
	TARGET NUMBERS	**200**	
		SUB-TOTAL (A)	**10600**
SUPPORT ACTIVITIES		**Cost (in crores)**	**1590**
1	Soil and Water Conservation Activities @ 10% of A	**1060**	
2	Research & Development, Innovative projects @ 2% of A	**212**	
3	Monitoring and Evaluation @ 1% of A	**106**	
4	Strengthening of JFMC, Awareness and Publicity @ 1% of A	**106**	
5	Mission Organization @ 1% of A	**106**	
		SUB-TOTAL (B)	**1590**
	TOTAL (A+B)		**12190**

13. Process with Sectoral Experts and Stakeholder Consultations

Stakeholders are people or organizations invested in the program, interested in the results of the evaluation, and/or with a stake in what will be done with the results of the evaluation. Representing their needs and interests throughout the process is fundamental to good program evaluation. Stakeholders provide a reality check on the appropriateness and feasibility of the interventions besides providing a detailed insight on and suggest methods to access the target populations, provide ongoing feedback and recommendations, and help make program deliverables actionable.

Mission's implementation structure involved numerous stakeholders including the State Forest Departments as the primary implementation agencies, research institutions and academia as the key advisory bodies and the community institutions as the primary beneficiaries. As such the stakeholders formed an important component of the process of the revision of Mission Document. The learnings from the experiences of the Mission's 5 years of implementation from 2015-16 to 2020, and on the basis of the feedback received from the implementing partner States, formed an important component in the revision of the Mission document to achieve efficiency and efficacy in its implementation.

Inputs and suggestions were invited from pioneer institutes like IISc, IIFM, ICFRE, WII, BSI, CEE, TERI, IIT- Delhi, FSI for inviting preliminary suggestions to undertake the stipulated revision of the Mission Document and also the PCCF's and HOFFs of all the states. The inputs were received from Indian Institute of Science, Bengaluru, IIT- Delhi, The Energy and Resources Institute (TERI), ICFRE, Forest Survey of India; Climate Change, Desertification Cell, Forest Policy Divisions of the MoEF&CC, and the 14 GIM Implementing States of Andhra Pradesh, Chhattisgarh, Himachal Pradesh, Jammu and Kashmir, Kerala, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Nagaland, Odisha, Punjab, Sikkim and Uttarakhand and also including the inputs from Ernst and Young LLP ltd.

The inputs received were consolidated in alignment with the need for syncing the Mission's approaches and strategies with the commitments to Paris agreement along the following major lines-

a.) **Simplicity and coherence** to impart effective comprehensibility
b.) **Ease of implementation** to improve implementation efficiency
c.) **Flexibility and Open-ended approach** to accommodate and include the highly vulnerable and otherwise neglected landscapes and micro-ecosystems
d.) **Devolution and decentralization of implementation** responsibility to the community institutions
e.) **Effective Convergence** of all the Central and State specific afforestation schemes
f.) **Skill Enhancement and Capacity building** of the forest dependent communities for augmentation of livelihoods, and

g.) **Inclusive Development** along with proactive multi-stakeholder involvement including emphasized role of **private players and agencies** and **corporates** etc.

Recognizing the due importance of the stakeholders, the Mission seeks to establish proactive multi-stakeholder engagement in the preparation of the State Afforestation Plans including the Forest Department, line departments of the State Govt., Gram Panchayat/Gram Sabha/ Municipalities, civil society, community groups, academia (Research Organizations and Universities). The officers of various line departments will also be involved as members in the State Forest Development Agencies, which shall be the nodal agency in the preparation of these plans.

The Mission would also emphasize promoting and facilitating successful, small-scale projects that would enhance women's participation and productivity in agriculture and allied activities with the help of NGOs, CBOs and other government agencies across the country. The involvement of the private sector, PSUs, CPSEs, NGOs, RWAs etc will be explored in the upkeep of the created green spaces.

The Mission thus envisages to foster the spirit and establish workable models of convergence through establishment of multi-stakeholder fora for each of its interventions. Emphasis would be on effective knowledge and expertise sharing to achieve the foremost objective of the Mission.

Directorate of Green India Mission

Ministry of Environment Forest and Climate Change

Government of India

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Annexure A-4

NATIONAL ACTION PLAN ON CLIMATE CHANGE

GOVERNMENT OF INDIA

PRIME MINISTER'S COUNCIL ON CLIMATE CHANGE

CONTENTS

National Action Plan on Climate Change

1. Overview

India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. This threat emanates from accumulated greenhouse gas emissions in the atmosphere, anthropogenically generated through long-term and intensive industrial growth and high consumption lifestyles in developed countries. While engaged with the international community to collectively and cooperatively deal with this threat, India needs a national strategy to firstly, adapt to climate change and secondly, to further enhance the ecological sustainability of India's development path.

Climate change may alter the distribution and quality of India's natural resources and adversely affect the livelihood of its people. With an economy closely tied to its natural resource base and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat because of the projected changes in climate.

India's development path is based on its unique resource endowments, the overriding priority of economic and social development and poverty eradication, and its adherence to its civilizational legacy that places a high value on the environment and the maintenance of ecological balance.

In charting out a developmental pathway which is ecologically sustainable, India has a wider spectrum of choices precisely because it is at an early stage of development. Our vision is to create a prosperous, but not wasteful society, an economy that is self-sustaining in terms of its ability to unleash the creative energies of our people and is mindful of our responsibilities to both present and future generations.

Recognizing that climate change is a global challenge, India will engage actively in multilateral negotiations in the UN Framework Convention on Climate Change, in a positive, constructive and forward-looking manner. Our objective will be to establish an effective, cooperative and equitable global approach based on the principle of common but differentiated responsibilites and respective capabilities, enshrined in the United Nations Framework Convention on Climate Change (UNFCCC). Such an approach must be based on a global vision inspired by Mahatma Gandhi's wise dictum—The earth has enough resources to meet people's needs, but will never have enough to satisfy people's greed. Thus we must not only promote sustainable production processes, but equally, sustainable lifestyles across the globe.

Finally, our approach must also be compatible with our role as a responsible and enlightened member of the international community, ready to make our contribution to the solution of a global challenge, which impacts on humanity as a whole. The success of our national efforts would be significantly enhanced provided the developed countries

affirm their responsibility for accumulated greenhouse gas emissions and fulfill their commitments under the UNFCCC, to transfer new and additional financial resources and climate friendly technologies to support both adaptation and mitigation in developing countries.

We are convinced that the principle of equity that must underlie the global approach must allow each inhabitant of the earth an equal entitlement to the global atmospheric resource.

In this connection, India is determined that its per capita greenhouse gas emissions will at no point exceed that of developed countries even as we pursue our development objectives.

2. Principles

Maintaining a high growth rate is essential for increasing living standards of the vast majority of our people and reducing their vulnerability to the impacts of climate change. In order to achieve a sustainable development path that simultaneously advances economic and environmental objectives, the National Action Plan for Climate Change (NAPCC) will be guided by the following principles:

- Protecting the poor and vulnerable sections of society through an inclusive and sustainable development strategy, sensitive to climate change.

- Achieving national growth objectives through a qualitative change in direction that enhances ecological sustainability, leading to further mitigation of greenhouse gas emissions.

- Devising efficient and cost-effective strategies for end use Demand Side Management.

- Deploying appropriate technologies for both adaptation and mitigation of greenhouse gases emissions extensively as well as at an accelerated pace.

- Engineering new and innovative forms of market, regulatory and voluntary mechanisms to promote sustainable development.

- Effecting implementation of programmes through unique linkages, including with civil society and local government institutions and through public-private-partnership.

- Welcoming international cooperation for research, development, sharing and transfer of technologies enabled by additional funding and a global IPR regime that facilitates technology transfer to developing countries under the UNFCCC.

3. Approach

The NAPCC addresses the urgent and critical concerns of the country through a directional shift in the development pathway, including through the enhancement of the current and planned programmes presented in the Technical Document.

The National Action Plan on Climate Change identifies measures that promote our development objectives while also yielding co-benefits for addressing climate change effectively. It outlines a number of steps to simultaneously advance India's development and climate change-related objectives of adaptation and mitigation.

4. The Way Forward: Eight National Missions

In dealing with the challenge of climate change we must act on several fronts in a focused manner simultaneously. The National Action Plan hinges on the development and use of new technologies. The implementation of the Plan would be through appropriate institutional mechanisms suited for effective delivery of each individual Mission's objectives and include public private partnerships and civil society action. The focus will be on promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation.

There are Eight National Missions which form the core of the National Action Plan, representing multi-pronged, long-term and integrated strategies for achieving key goals in the context of climate change. While several of these programmes are already part of our current actions, they may need a change in direction, enhancement of scope and effectiveness and accelerated implementation of time-bound plans.

4.1. National Solar Mission

A National Solar Mission will be launched to significantly increase the share of solar energy in the total energy mix while recognizing the need to expand the scope of other renewable and non-fossil options such as nuclear energy, wind energy and biomass.

India is a tropical country, where sunshine is available for longer hours per day and in great intensity. Solar energy, therefore, has great potential as future energy source. It also has the advantage of permitting a decentralized distribution of energy, thereby empowering people at the grassroots level. Photovoltaic cells are becoming cheaper with new technology. There are newer, reflector-based technologies that could enable setting up megawatt scale solar power plants across the country. Another aspect of the Solar Mission would be to launch a major R&D programme, which could draw upon international cooperation as well, to enable the creation of more affordable, more convenient solar power systems, and to promote innovations that enable the storage of solar power for sustained, long-term use.

4.2. National Mission for Enhanced Energy Efficiency

The Energy Conservation Act of 2001 provides a legal mandate for the implementation of the energy efficiency measures through the institutional mechanism of the Bureau of Energy Efficiency (BEE) in the Central Government and designated agencies in each state. A number of schemes and programmes have been initiated and it is anticipated that these would result in a saving of 10,000 MW by the end of 11th Five Year Plan in 2012.

To enhance energy efficiency, four new initiatives will be put in place. These are:

- A market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification of energy savings that could be traded.
- Accelerating the shift to energy efficient appliances in designated sectors through innovative measures to make the products more affordable.
- Creation of mechanisms that would help finance demand side management programmes in all sectors by capturing future energy savings.
- Developing fiscal instruments to promote energy efficiency

4.3. National Mission on Sustainable Habitat

A National Mission on Sustainable Habitat will be launched to make habitat sustainable through improvements in energy efficiency in buildings, management of solid waste and modal shift to public transport. The Mission will promote energy efficiency as an integral component of urban planning and urban renewal through three initiatives.

i. The Energy Conservation Building Code, which addresses the design of new and large commercial buildings to optimize their energy demand, will be extended in its application and incentives provided for retooling existing building stock.

ii. Recycling of material and Urban Waste Management will be a major component of ecologically sustainable economic development. India already has a significantly higher rate of recycling of waste compared to developed countries. A special area of focus will be the development of technology for producing power from waste. The National Mission will include a major R&D programme, focusing on bio chemical conversion, waste water use, sewage utilization and recycling options wherever possible.

iii. Better urban planning and modal shift to public transport. Making long term transport plans will facilitate the growth of medium and small cities in ways that ensure efficient and convenient public transport.

In addition, the Mission will address the need to adapt to future climate change by improving the resilience of infrastructure, community based disaster management, and measures for improving the warning system for extreme weather events. Capacity building would be an important component of this Mission.

4.4. National Water Mission

A National Water Mission will be mounted to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within states. The Mission will take into account the provisions of the National Water Policy and develop a framework to optimize water use by increasing water use efficiency by 20% through regulatory mechanisms with differential entitlements and pricing. It will seek to ensure that a considerable share of the water needs of urban areas are met through recycling of waste water, and ensuring that the water requirements of coastal cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for the use of ocean water.

The National Water Policy would be revisited in consultation with states to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change. This will include enhanced storage both above and below ground, rainwater harvesting, coupled with equitable and efficient management structures.

The Mission will seek to develop new regulatory structures, combined with appropriate entitlements and pricing. It will seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with a special effort to increase storage capacity. Incentive structures will be designed to promote water-neutral or water-positive technologies, recharging of underground water sources and adoption of large scale irrigation programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation.

4.5. National Mission for Sustaining the Himalayan Ecosystem

A Mission for sustaining the Himalayan Ecosystem will be launched to evolve 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 the extent to which, the Himalayan glaciers are in recession and how the problem could be addressed. This will require the joint effort of climatologists, glaciologists and other experts. We will need to exchange information with the South Asian countries and countries sharing the Himalayan ecology.

An observational and monitoring network for the Himalayan environment will also be established to assess freshwater resources and health of the ecosystem. Cooperation with neighbouring countries will be sought to make the network comprehensive in its coverage.

The Himalayan ecosystem has 51 million people who practice hill agriculture and whose vulnerability is expected to increase on account of climate change. Community-based management of these ecosystems will be promoted with incentives to community organizations and panchayats for protection and enhancement of forested lands. In mountainous regions, the aim will be to maintain two-thirds of the area under forest cover in order to prevent erosion and land degradation and ensure the stability of the fragile eco-system.

4.6. National Mission for a Green India

A National Mission will be launched to enhance ecosystem services including carbon sinks to be called Green India. Forests play an indispensable role in the

preservation of ecological balance and maintenance of bio-diversity. Forests also constitute one of the most effective carbon-sinks.

The Prime Minister has already announced a Green India campaign for the afforestation of 6 million hectares. The national target of area under forest and tree cover is 33% while the current area under forests is 23%.

The Mission on Green India will be taken up on degraded forest land through direct action by communities, organized through Joint Forest Management Committees and guided by the Departments of Forest in state governments. An initial corpus of over Rs 6000 crore has been earmarked for the programme through the Compensatory Afforestaion Management and Planning Authority (CAMPA) to commence work. The programme will be scaled up to cover all remaining degraded forest land. The institutional arrangement provides for using the corpus to leverage more funds to scale up activity.

4.7. National Mission for Sustainable Agriculture

The Mission would devise strategies to make Indian agriculture more resilient to climate change. It would identify and develop new varieties of crops and especially thermal resistant crops and alternative cropping patterns, capable of withstanding extremes of weather, long dry spells, flooding, and variable moisture availability.

Agriculture will need to be progressively adapted to projected climate change and our agricultural research systems must be oriented to monitor and evaluate climate change and recommend changes in agricultural practices accordingly.

This will be supported by the convergence and integration of traditional knowledge and practice systems, information technology, geospatial technologies and biotechnology. New credit and insurance mechanisms will be devised to facilitate adoption of desired practices.

Focus would be on improving productivity of rainfed agriculture. India will spearhead efforts at the international level to work towards an ecologically sustainable green revolution.

4.8. Natinal Mission on Strategic Knowledge for Climate Change

To enlist the global community in research and technology development and collaboration through mechanisms including open source platforms, a Strategic Knowledge Mission will be set up to identify the challenges of, and the responses to, climate change. It would ensure funding of high quality and focused research into various aspects of climate change.

The Mission will also have, on its research agenda, socio-economic impacts of climate change including impact on health, demography, migration patterns and livelihoods of coastal communities. It would also support the establishment of dedicated climate change related academic units in Universities and other academic and scientific research institutions in the country which would be networked. A Climate Science Research Fund would be created under the Mission to support research. Private sector initiatives for development of innovative technologies for adaptation and mitigation would be encouraged through venture capital funds. Research to support policy and implementation would be undertaken through identified centres. The Mission will also focus on dissemination of new knowledge based on research findings.

5. Implementation of Missions

These National Missions will be institutionalized by respective ministries and will be organized through inter-sectoral groups which include in addition to related Ministries, Ministry of Finance and the Planning Commission, experts from industry, academia and civil society. The institutional structure would vary depending on the task to be addressed by the Mission and will include providing the opportunity to compete on the best management model.

Each Mission will be tasked to evolve specific objectives spanning the remaining years of the

11th Plan and the 12th Plan period 2012-13 to 2016-17. Where the resource requirements of the Mission call for an enhancement of the allocation in the 11th Plan, this will be suitably considered, keeping in mind the overall resources position and the scope for re-prioritisation.

Comprehensive Mission documents detailing objectives, strategies, plan of action, timelines and monitoring and evaluation criteria would be developed and submitted to the Prime Minister's Council on Climate Change by December 2008. The Council will also periodically review the progress of these Missions. Each Mission will report publicly on its annual performance.

Building public awareness will be vital in supporting implementation of the NAPCC. This will be achieved through national portals, media engagement, civil society involvement, curricula reform and recognition/ awards, details of which will be worked out by an empowered group. The Group will also consider methods of capacity building to support the goals of the National Missions.

We will develop appropriate technologies to measure progress in actions being taken in terms of avoided emissions, wherever applicable, with reference to business as usual scenarios. Appropriate indicators will be evolved for assessing adaptation benefits of the actions.

These Eight National Missions, taken together, with enhancements in current and ongoing programmes included in the Technical Document, would not only assist the country to adapt to climate change, but also, importantly, launch the economy on a path that would progressively and substantially result in mitigation through avoided emissions.

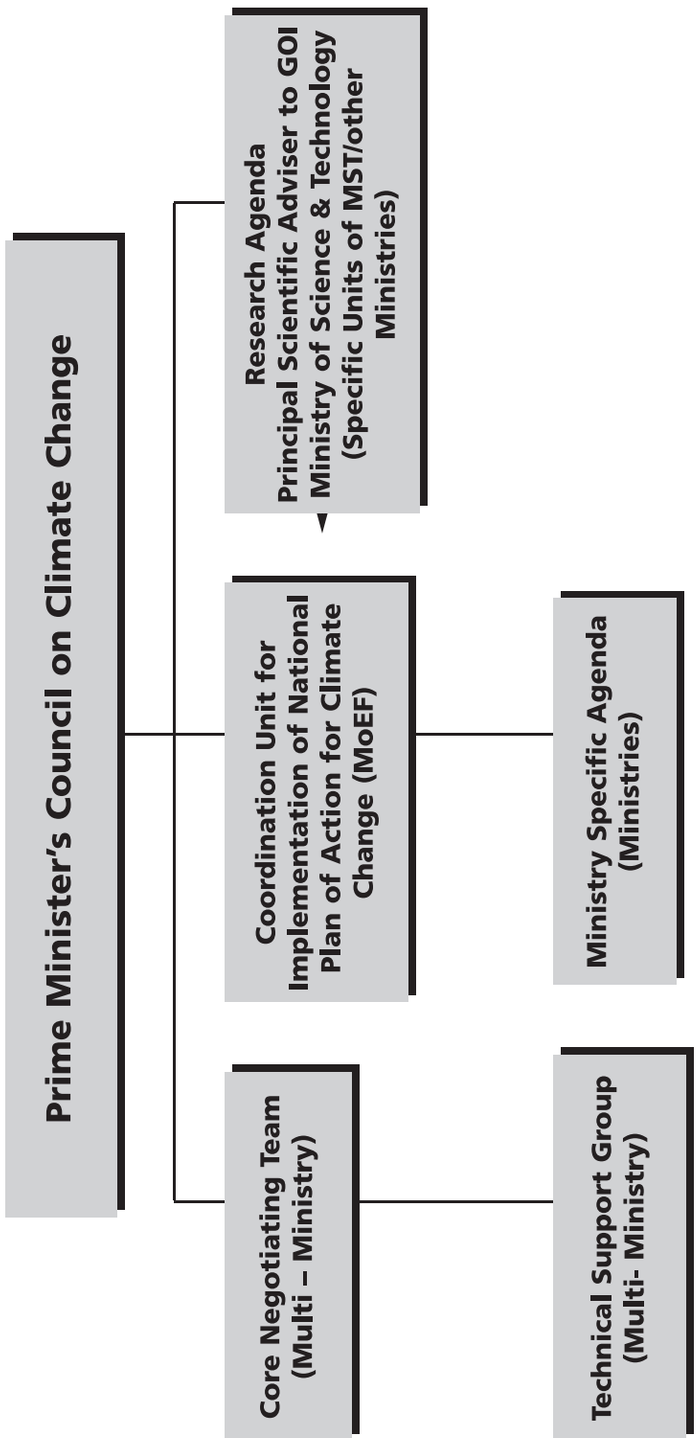
5.1. Institutional Arrangements for Managing Climate Change Agenda

In order to respond effectively to the challenge of climate change, the Government has created an Advisory Council on Climate Change, chaired by the Prime Minister. The Council has broad based representation from key stake-holders, including Government, Industry and Civil Society and sets out broad directions for National Actions in respect of Climate Change. The Council will also provide guidance on matters relating to coordinated national action on the domestic agenda and review of the implementation of the National Action Plan on Climate Change including its R&D agenda.

The Council chaired by the Prime Minister would also provide guidance on matters relating to international negotiations including bilateral, multilateral programmes for collaboration, research and development. Details of the institutional arrangement are at Annexure 1.

The NAPCC will continue to evolve, based on new scientific and technical knowledge as they emerge and in response to the evolution of the multilateral climate change regime including arrangements for international cooperation.

Annexure - I


Prime Minister's Council on Climate Change
Research Agenda
Principal Scientific Adviser to GOI
Ministry of Science & Technology
(Specific Units of MST/other Ministries)
Coordination Unit for Implementation of National Plan of Action for Climate Change (MoEF)
Ministry Specific Agenda (Ministries)
Core Negotiating Team (Multi – Ministry)
Technical Support Group (Multi- Ministry)

TECHNICAL DOCUMENT

CONTENTS

1. Background to India's National Action Plan on Climate Change

The Fourth Assessment report of the Intergovernmental Panel on Climate Change (IPCC-AR4)[1] concluded from direct observations of changes in temperature, sea level, and snow cover in the northern hemisphere during 1850 to the present, that the warming of the earth's climate system is unequivocal. The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005. Multi-model averages show that the temperature increases during 2090-2099 relative to 1980-1999 may range from 1.1 to 6.4°C and sea level rise from 0.18 to 0.59 meters. These could lead to impacts on freshwater availability, oceanic acidification, food production, flooding of coastal areas and increased burden of vector borne and water borne diseases associated with extreme weather events..

The Prime Minister's Council on Climate Change, in its first meeting on 13th July, 2007, had decided that "*A National Document compiling action taken by India for addressing the challenge of Climate Change, and the action it proposes to take*" be prepared.

The National Action Plan for Climate Change responds to the decision of the PM's Council, as well as updates India's national programmes relevant to addressing climate change. It identifies measures that promote our development objectives, while also yielding co-benefits for addressing climate change effectively. It lists specific opportunities to simultaneously advance India's development and climate related objectives of both adaptation as well as greenhouse gas (GHG) mitigation.

India's development agenda focuses on the need for rapid economic growth as an essential precondition to poverty eradication and improved standards of living. Meeting this agenda, which will also reduce climate –related vulnerability, requires large-scale investment of resources in infrastructure, technology and access to energy. Developing countries may lack the necessary financial and technological resources needed for this and thus have very low coping capacity to meet threats from climate changes. Only rapid and sustained development can generate the required financial, technological and human resources. In view of the large uncertainties concerning the spatial and temporal magnitude of climate change impacts, it is not desirable to design strategies exclusively for responding to climate change. Rather, the need is to identify and prioritize strategies that promote development goals while also serving specific climate change objectives.

It is imperative to identify measures that promote our development objectives, while also yielding co-benefits for addressing climate change effects. Cost- effective energy efficiency and energy conservation measures are of particular importance in this connection. Similarly, development of clean energy technologies, though primarily designed to promote energy security, can also generate large benefits in terms of reducing carbon emissions. Many health – related local pollution controls can also generate significant co-benefits in terms of reduced greenhouse gas emissions. This document identifies specific opportunities to simultaneously advance India's development and climate related objectives of adaptation and GHG mitigation.

It also describes India's willingness and desire, as a responsible member of the global community, to do all that is possible for pragmatic and practical solutions for all, in accordance with the principle of common but differentiated responsibilities and respective capabilities. The purpose of this document is also to create awareness among representatives of the public at large, different agencies of the government, scientists, industry – in short, the community as a whole – on the threat posed by climate change and the proposed steps to counter it.

1.1. The Imperative of Poverty Alleviation

Economic reforms, implemented since 1991, have resulted in faster growth of the Indian economy. GDP growth rates have averaged roughly 8% during 2004-2008. However, 27.5% of the population still lived below the poverty line in 2004-05 and 44% are still without access to electricity. The Approach Paper to the Eleventh Plan emphasizes that rapid economic growth is an essential prerequisite to reduce poverty. The poor are the most vulnerable to climate

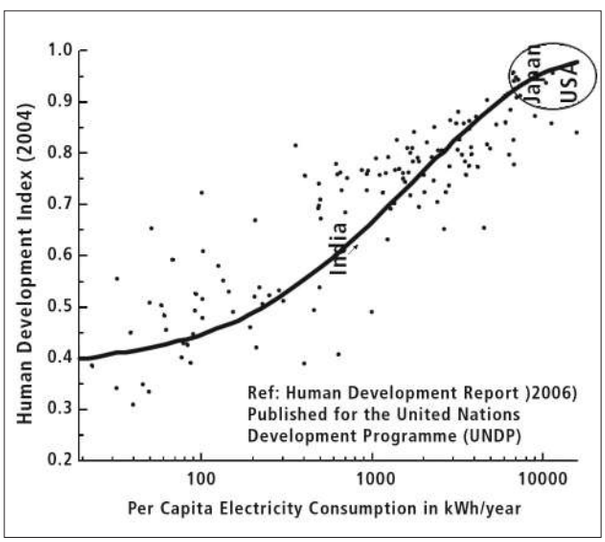
change. The former Prime Minister, late Smt. Indira Gandhi, had stated: '*poverty is the worst polluter*'. Therefore, development and poverty eradication will be the best form of adaptation to climate change.

The impacts of climate change could prove particularly severe for women. With climate change, there would be increasing scarcity of water, reduction in yields of forest biomass, and increased risks to human health with children, women and the elderly in a household becoming the most vulnerable. With the possibility of decline in availability of foodgrains, the threat of malnutrition may also increase. All these would add to deprivations that women already encounter and so in each of the Adaptation programmes, special attention should be paid to the aspects of gender.

1.2 Relationship between Human Development Index and Energy Consumption

The strong positive correlation between energy use and human development is well recognized (Figure 1.2.1). It is obvious that India needs to substantially increase its per capita energy consumption to provide a minimally acceptable level of well being to its people.

Figure 1.2.1: Human Development Index versus per capita electricity consumption



1.3 Current Carbon Dioxide Emissions in India

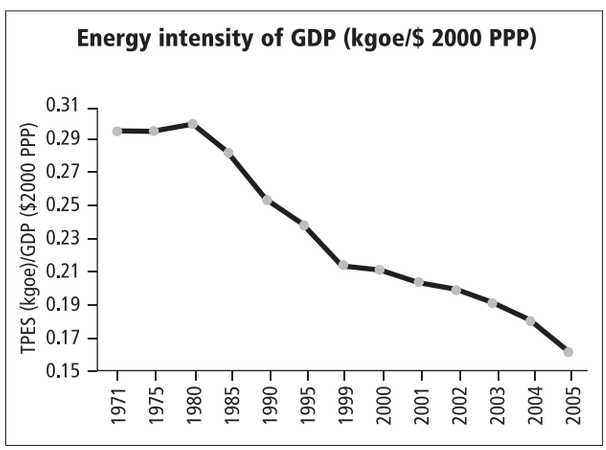
India's CO_2 emissions per capita are well below the world's average[2]. Per capita carbon dioxide emissions of some regions in the world in 2004 are as follows:

Table 1.3.1: A comparison of India's per capita GHG emissions with some other countries

Country	Per-Capita Carbon-dioxide emissions (metric tons)
USA	20.01
EU	9.40
Japan	9.87
China	3.60
Russia	11.71
India	*1.02*
World Average	**4.25**

India has a well-developed policy, legislative, regulatory, and programmatic regime for promotion of energy efficiency, renewable energy, nuclear power, fuel switching, energy pricing reform, and addressing GHG emissions in the energy sector. As a consequence of these measures, India's energy intensity of the economy has come down sharply since the 1980s and compares favourably with the least energy intensive developed countries[3].

Figure 1.3.2: India's Energy intensity of GDP based on International Energy Agency data[4]



1.4. Observed Changes in Climate and Weather Events in India

There are some observed changes in climate parameters in India. India's Initial National Communication, 2004 (NATCOM 1)[5] to UNFCCC has consolidated some of these. Some highlights from NATCOM I and others are listed here. No firm link between the documented changes described below and warming due to anthropogenic climate change has yet been established.

• Surface Temperature

At the national level, increase of ~ 0.4° C has been observed in surface air temperatures over the past century. A warming trend has been observed along the west coast, in central India, the interior peninsula, and north-eastern India. However, cooling trends have been observed in north-west India and parts of south India.

• Rainfall

While the observed monsoon rainfall at the all-India level does not show any significant trend, regional monsoon variations have been recorded. A trend of increasing monsoon seasonal rainfall has been found along the west coast, northern Andhra Pradesh, and north-western India (+10% to +12% of the normal over the last 100 years) while a trend of decreasing monsoon seasonal rainfall has been observed over eastern Madhya Pradesh, north-eastern India, and some parts of Gujarat and Kerala (–6% to –8% of the normal over the last 100 years).

• Extreme Weather Events

Instrument records over the past 130 years do not indicate any marked long-term trend in the frequencies of large-scale droughts and floods. Trends are however observed in multi-decadal periods of more frequent droughts, followed by less severe droughts. There has been an overall increasing trend in severe storm incidence along the coast at the rate of 0.011 events per year. While the states of West Bengal and Gujarat have reported increasing trends, a decline has been observed in Orissa. Goswami[6] et al, by analysing a daily rainfall data set, have shown (i) a rising trend in the frequency of heavy rain events, and (ii) a significant decrease in the frequency of moderate events over central India from 1951 to 2000.

• Rise in Sea Level

Using the records of coastal tide gauges in the north Indian Ocean for more than 40 years, Unnikrishnan and Shankar[7] have estimated, that sea level rise was between 1.06-1.75 mm per year. These rates are consistent with 1-2 mm per year global sea level rise estimates of IPCC.

• Impacts on Himalayan Glaciers

The Himalayas possess one of the largest resources of snow and ice and its glaciers form a source of water for the perennial rivers such as the Indus, the Ganga, and the Brahmaputra. Glacial melt may impact their long-term lean-season flows, with adverse impacts on the economy in terms of water availability and hydropower generation.

The available monitoring data on Himalayan glaciers indicates that while recession of some glaciers has occurred in some Himalayan regions in recent years, the trend is not consistent across the entire mountain chain. It is accordingly, too early to establish long-term trends, or their causation, in respect of which there are several hypotheses.

Under the National Action Plan, these data will be updated and refined continuously and additional reliable data will be collected.

1.5. Some Projections of Climate Change over India for the 21st Century

Some modelling and other studies have projected the following changes due to increase in atmospheric GHG concentrations arising from increased global anthropogenic emissions:

• Annual mean surface temperature rise by the end of century, ranging from 3 to 5° C under A2 scenario and 2.5 to 4° C under B2 scenario of IPCC, with warming more pronounced in the northern parts of India, from simulations by Indian Institute of Tropical Meteorology (IITM), Pune.

• Indian summer monsoon (ISM) is a manifestation of complex interactions between land, ocean and atmosphere. The simulation of ISM's mean pattern as well as variability on interannual and intraseasonal scales has been a challenging ongoing problem. Some simulations by IITM, Pune, have indicated that summer monsoon intensity may increase beginning from 2040 and by 10% by 2100 under A2 scenario of IPCC.

• Changes in frequency and/ or magnitude of extreme temperature and precipitation events. Some results show that fine-scale snow albedo influence the response of both hot and cold events and that peak increase in extreme hot events are amplified by surface moisture feedbacks.

1.6. Possible Impacts of Projected Climate Change

1.6.1. Impacts on Water Resources

Changes in key climate variables, namely temperature, precipitation, and humidity, may have significant long-term implications for the quality and quantity of water. River systems of the Brahmaputra, the Ganga, and the Indus, which benefit from melting snow in the lean season, are likely to be particularly affected by the decrease in snow cover. A decline in total run-off for all river basins, except Narmada and Tapti, is projected in India's NATCOM I. A decline in run-off by more than two-thirds is also anticipated for the Sabarmati and Luni basins. Due to sea level rise, the fresh water sources near the coastal regions will suffer salt intrusion.

1.6.2. Impacts on Agriculture and Food Production

Food production in India is sensitive to climate changes such as variability in monsoon rainfall and temperature changes within a season. Studies by Indian Agricultural Research Institute (IARI) and others indicate greater expected loss in the Rabi crop. Every 1 °C rise in temperature reduces wheat production by 4-5 Million Tonnes. Small changes in temperature and rainfall have significant effects on the quality of fruits, vegetables, tea, coffee, aromatic and medicinal plants, and basmati rice. Pathogens and insect populations are strongly dependent upon temperature and humidity, and changes in these parameters may change their population dynamics. Other impacts on agricultural and related sectors include lower yields from dairy cattle and decline in fish breeding, migration, and harvests. Global reports indicate a loss of 10-40% in crop production by 2100.

1.6.3. Impacts on Health

Changes in climate may alter the distribution of important vector species (for example, malarial mosquitoes) and may increase the spread of such diseases to new areas. If there is an increase of 3.8 °C in temperature and a 7% increase in relative humidity the transmission windows i.e., months during which mosquitoes are active, will be open for all 12 months in 9 states in India. The transmission windows in Jammu and Kashmir and in Rajasthan may increase by 3–5 months. However, in Orissa and some southern states, a further increase in temperature is likely to shorten the transmission window by 2–3 months.

1.6.4. Impacts on Forests

Based on future climate projections of Regional Climate Model of the Hadley Centre (HadRM3) using A2 and B2 scenarios and the BIOME4 vegetation response model, Ravindranath et. al.[8] show that 77% and 68% of the forest areas in the country are likely to experience shift in forest types, respectively under the two scenarios, by the end of the century, with consequent changes in forests produce, and, in turn, livelihoods based on those products. Correspondingly, the associated biodiversity is likely to be adversely impacted. India's NATCOM I projects an increase in the area under xeric scrublands and xeric woodlands in central India at the cost of dry savannah in these regions.

1.6.5. Vulnerability to Extreme Events

Heavily populated regions such as coastal areas are exposed to climatic events,such as cyclones, floods, and drought, and large declines in sown areas in arid

and semi-arid zones occur during climate extremes. Large areas in Rajasthan, Andhra Pradesh, Gujarat, and Maharashtra and comparatively small areas in Karnataka, Orissa, Madhya Pradesh, Tamil Nadu, Bihar, West Bengal, and Uttar Pradesh are frequented by drought. About 40 million hectares of land is flood-prone, including most of the river basins in the north and the north-eastern belt, affecting about 30 million people on an average each year. Such vulnerable regions may be particularly impacted by climate change

1.6.6. Impacts on Coastal Areas

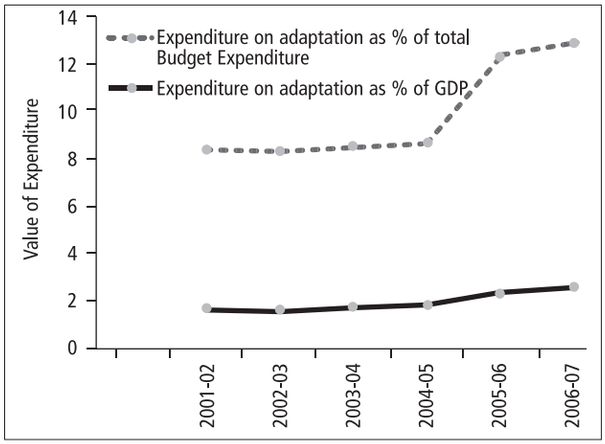
A mean Sea Level Rise (SLR) of 15–38 cm is projected along India's coast by the mid 21st century and of 46–59 cm by 2100. India's NATCOM I assessed the vulnerability of coastal districts based on physical exposure to SLR, social exposure based on population affected, and economic impacts. In addition, a projected increase in the intensity of tropical cyclones poses a threat to the heavily populated coastal zones in the country (NATCOM, 2004).

2. Some Current Actions for Adaptation and Mitigation

Adaptation, in the context of climate change, comprises the measures taken to minimize the adverse impacts of climate change, e.g. relocating the communities living close to the sea shore, for instance, to cope with the rising sea level or switching to crops that can withstand higher temperatures. Mitigation comprises measures to reduce the emissions of greenhouse gases that cause climate change in the first place, e.g. by switching to renewable sources of energy such as solar energy or wind energy, or nuclear energy instead of burning fossil fuel in thermal power stations.

Current government expenditure in India on adaptation to climate variability, as shown in Figure 2.1, exceeds 2.6% of the GDP, with agriculture, water resources, health and sanitation, forests, coastal-zone infrastructure and extreme weather events, being specific areas of concern.

Figure 2.1: Expenditure on Adaptation Programmes in India



2.1 Some Existing Adaptation related Programmes

2.1.1. Crop Improvement

The present programmes address measures such as development of arid-land crops and pest management, as well as capacity building of extension workers and NGOs to support better vulnerability reducing practices.

2.1.2. Drought Proofing

The current programmes seek to minimize the adverse effects of drought on production of crops and livestock, and on productivity of land, water and human resources, so as to ultimately lead to drought proofing of the affected areas. They also aim to promote overall economic development and improve the socio-economic conditions of the resource poor and disadvantaged sections inhabiting the programme areas.

2.1.3. Forestry

India has a strong and rapidly growing afforestation programme. The afforestation process was accelerated by the enactment of the Forest Conservation Act of 1980, which aimed at stopping the clearing and degradation of forests through a strict, centralized control of the rights to use forest land and

mandatory requirements of compensatory afforestation in case of any diversion of forest land for any non-forestry purpose. In addition an aggressive afforestation and sustainable forest management programme resulted in annual reforestation of 1.78 mha during 1985-1997, and is currently 1.1 mha annually. Due to this, the carbon stocks in Indian forests have increased over the last 20 years to 9 -10 gigatons of carbon (GtC) during 1986 to 2005.

2.1.4. Water

The National Water Policy (2002) stresses that non-conventional methods for utilization of water, including inter-basin transfers, artificial recharge of groundwater, and desalination of brackish or sea water, as well as traditional water conservation practices like rainwater harvesting, including roof-top rainwater harvesting, should be practised to increase the utilizable water resources. Many states now have mandatory water harvesting programmes in several cities.

2.1.5. Coastal Regions

In coastal regions, restrictions have been imposed in the area between 200m and 500m of the HTL (high tide line) while special restrictions have been imposed in the area up to 200m to protect the sensitive coastal ecosystems and prevent their exploitation. This, simultaneously, addresses the concerns of the coastal population and their livelihood. Some specific measures taken in this regard include construction of coastal protection infrastructure and cyclone shelters, as well as plantation of coastal forests and mangroves.

2.1.6. Health

The prime objective of these programmes is the surveillance and control of vector borne diseases such as Malaria, Kala-azar, Japanese Encephalitis, Filaria and Dengue. Programmes also provide for emergency medical relief in the case of natural calamities, and to train and develop human resources for these tasks.

2.1.7. Risk Financing

Two risk-financing programmes support adaptation to climate impacts. The Crop Insurance Scheme supports the insurance of farmers against climate risks, and the Credit Support Mechanism facilitates the extension of credit to farmers, especially for crop failure due to climate variability.

2.1.8. Disaster Management

The National Disaster Management programme provides grants-in-aid to victims of weather related disasters, and manages disaster relief operations. It also supports proactive disaster prevention programmes, including dissemination of information and training of disaster-management staff.

2.2. Some of India's Actions Relating to GHG Mitigation

2.2.1. India's Policy Structure Relevant to GHG Mitigation

India has in place a detailed policy, regulatory, and legislative structure that relates strongly to GHG mitigation: The Integrated Energy Policy was adopted in 2006. Some of its key provisions are:

- Promotion of energy efficiency in all sectors
- Emphasis on mass transport
- Emphasis on renewables including biofuels plantations
- Accelerated development of nuclear and hydropower for clean energy
- Focused R&D on several clean energy related technologies

Several other provisions relate to reforming energy markets to ensure that energy markets are competitive, and energy prices reflect true resource costs. These include: Electricity Act 2005, Tariff Policy 2003, Petroleum & Natural Gas Regulatory Board Act, 2006, etc. The provisions taken together are designed to:

- Remove entry barriers and raise competition in

exploration, extraction, conversion, transmission and distribution of primary and secondary energy
- Accomplish price reform, through full competition at point of sale
- Promote tax reform to promote optimal fuel choices
- Augment and diversify energy options, sources and energy infrastructure
- Provide feed-in tariffs for renewables (solar, wind, biomass cogeneration)
- Strengthen, and where applicable, introduce independent regulation

The Rural Electrification Policy, 2006, promotes renewable energy technologies where grid connectivity is not possible or cost-effective. The New and Renewable Energy Policy, 2005, promotes utilization of sustainable, renewable energy sources, and accelerated deployment of renewables through indigenous design, development and manufacture.

The National Environment Policy, 2006, and the Notification on Environment Impact Assessment (EIA), 2006, reform India's environmental assessment regime. A number of economic activities are required to prepare environment impact assessments, and environment management plans, which are appraised by regulatory authorities prior to start of construction. The EIA provisions strongly promote environmental sustainability.

2.2.2. Introduction of Labelling Programme for Appliances

An energy labelling programme for appliances was launched in 2006, and comparative star-based labelling has been introduced for fluorescent tubelights, air conditioners, refrigerators, and distribution transformers. The labels provide information about the energy consumption of an appliance, and thus enable consumers to make informed decisions. The Bureau of Energy Efficiency has made it mandatory for refrigerators to display energy efficiency label and is expected to do so for air conditioners as well. The standards and labelling programme for manufacturers of electrical appliances is expected to lead to significant savings in electricity annually.

2.2.3. Energy Conservation Building Code

An Energy Conservation Building Code (ECBC) was launched in May, 2007, which addresses the design of new, large commercial buildings to optimize the buildings' energy demand based on their location in different climatic zones. Commercial buildings are one of the fastest growing sectors of the Indian economy, reflecting the increasing share of the services sector in the economy. Nearly one hundred buildings are already following the Code, and compliance with the Code has been incorporated into the mandatory Environmental Impact Assessment requirements for large buildings. It has been estimated that if all the commercial space in India every year conform to ECBC norms, energy consumption in this sector can be reduced by 30-40%.Compliance with ECBC norms is voluntary at present but is expected to soon become mandatory.

2.2.4. Energy Audits of Large Industrial Consumers

In March 2007 the conduct of energy audits was made mandatory in large energy-consuming units in nine industrial sectors. These units, notified as "designated consumers" are also required to employ "certified energy managers", and report energy consumption and energy conservation data annually.

2.2.5. Mass Transport

The National Urban Transport Policy emphasizes extensive public transport facilities and non-motorized modes over personal vehicles. The expansion of the Metro Rail Transportation System in Delhi and other cities and other mass transit systems, such as the Metro Bus project in Bangalore, are steps in its implementation. The state government of Maharashtra recently announced that it will impose a congestion tax to discourage the use of private cars in cities where it has created "sufficient public transport capacity".

2.2.6. Clean Air Initiatives

In urban areas, one of the major sources of air pollution is emissions from transport vehicles. Steps taken

to reduce such pollution include (i) introduction of compressed natural gas (CNG) in Delhi and other cities; (ii) retiring old, polluting vehicles; and (iii) strengthening of mass transportation as mentioned above. Some state governments provide subsidies for purchase and use of electric vehicles. For thermal power plants, the installation of electrostatic precipitators is mandatory. In many cities, polluting industrial units have either been closed or shifted from residential areas.

2.2.7 Promotion of Energy Saving Devices

The Bureau of Energy efficiency has introduced "The Bachat Lamp Yojana", a programme under which households may exchange incandescent lamps for CFLs (compact fluorescent lamps) using clean development mechanism (CDM) credits to equate purchase price. Some states have made mandatory the installation of solar water heaters in hospitals, hotels and large government and commercial buildings. Subsidy is provided for installation of solar water heaters in residential buildings.

2.2.8. Promotion of Biofuels

The Biodiesel Purchase Policy mandates biodiesel procurement by the petroleum industry. A mandate on Ethanol Blending of Gasolene requires 5% blending of ethanol with gasolene from 1st January, 2003, in 9 States and 4 Union Territories.

3. The Way Forward: Eight National Missions

The experience gained so far enables India to embark on an even more proactive approach. The following subsections describe the various programmes that may be taken up under the National Action Plan.

3.1. National Solar Mission

The National Solar Mission would promote the use of solar energy for power generation and other applications. Where necessary for purposes of system balance or ensuring cost-effectiveness and reliability, it would also promote the integration of other renewable energy technologies, for example, biomass and wind, with solar energy options.

India is largely located in the equatorial sun belt of the earth, thereby receiving abundant radiant energy from the sun. The country receives about 5,000 trillion kWh/year equivalent energy through solar radiation. In most parts of India, clear sunny weather is experienced 250 to 300 days a year. The annual global radiation varies from 1600 to 2200 kWh/m^2, which is typical of the tropical and subtropical regions. The average solar insolation incident over India is about 5.5 kWh/m^2 per day. Just 1% of India's land area can meet India's entire electricity requirements till 2030.

Solar based power technologies are an extremely clean form of generation with practically no form of emissions at the point of generation. They would lead to energy security through displacement of coal and petroleum. T&D losses are very low in decentralized systems. Deployment can be done independently of the national grid and integrated with the national grid when needed.

3.1.1. Solar Thermal Power Generation

Solar Thermal Power Generating Systems (STPG) or Concentrating Solar Power (CSP) use concentrated solar radiation as high temperature energy source (> 500^{0}C) to produce electricity.

The working mechanism for solar heat to electricity is fundamentally similar to that of traditional thermal power plants. STPG technologies are now on the verge of significant scale commercialization. Major technologies include parabolic trough or dish, dish-engine system, central tower receiver system, and solar chimney (which drives an air draft turbine, and does not raise steam).

Solar power is, obviously available only during sunlight hours. There are also significant seasonal variations. Moreover, the need to track the movement of the sun during the day, as also the seasonal variations in orientation, although fully predictable, may add significantly to cost in respect of dish collector systems. However, design variants are available that require movement of only the heat collector at

the focus, or only of individual mirrors in an array, thus reducing costs.

The cyclical (diurnal, annual) and episodic (cloud cover) variations of solar insolation, and the impossibility of regulating the solar flux means that in order to ensure steady power supply, meet peaking requirements, as well as to ensure optimal utilization of steam turbines and generators, it is necessary to either hybridize solar thermal systems with alternative means of raising steam, or provide for high temperature thermal energy storage. The former may be accomplished by hybridization with conventional fuels, or by biomass combustion systems. The latter may be accomplished by insulated storage of molten salts; however, in their case the rate of heat loss may be significant, and storage for more than 10-12 hours is uneconomic.

The investment cost of stand-alone (i.e. without hybridization) solar thermal power plants are in the range of Rs 20-22 cr/MW. It usually includes the cost of the solar concentrators, balance of system (BOS), receiver (turbine) with generator and control equipments, etc. The estimated unit cost of generation is currently in the range of 20-25 Rs/KWh. (Source Scientific American, January 2008)

Proposed R&D activities in respect of Solar Thermal power generation would cover design and development of concentrating solar thermal power systems, including parabolic troughs, central receiver systems, and dish/engine systems. The R&D effort should be directed mainly at reducing costs of production and maintenance, and include both production design and fabrication/assembly techniques. In addition, R&D should cover balance of systems issues involved in hybridization with biomass combustion based systems and/or molten salts thermal storage.

3.1.2. Solar Photovoltaic Generation

In photovoltaic generation, solar energy is directly converted to electricity using a semi-conductor, usually a silicon diode. However, while there are other semi-conductors (e.g. cadmium telluride) that may be used for power generation, most of them are at various stages of R&D.

The investment costs of solar PV based power systems are in the range of Rs. 30-35cr/MW.This includes the cost of the solar panels and balance of system (BOS). The unit cost of generation is still in the range of Rs. 15-20 KWh, but may fall significantly for thin-film based systems.

Proposed R&D activities in respect of Solar Photovoltaic generation, for the near and medium term would include improvement in solar cell efficiency to 15% at commercial level; improvements in PV module technology with higher packing density and suitability for solar roofs; and development of lightweight modules for use in solar lanterns and similar applications.

3.1.3. R&D Collaboration, Technology Transfer, and Capacity Building

In specific areas of both solar thermal and solar PV systems, it would be useful to enter into collaboration with institutions working elsewhere, with sharing of the resulting IPRs.

Technology transfer in both Solar Thermal technologies and the PV technologies will be required in respect of cost-effective and efficient technologies suitable for use in India. Support to commercial demonstration by entrepreneurs of Solar Thermal and Solar PV, both stand-alone and distributed generation systems, in particular in remote locations, and using these as training facilities for local entrepreneurs and O&M personnel would also help develop this sector.

The National Solar Mission would be responsible for: (a) the deployment of commercial and near commercial solar technologies in the country; (b) establishing a solar research facility at an existing establishment to coordinate the various research, development and demonstration activities being carried out in India, both in the public and private sector; (c) realizing integrated private sector manufacturing capacity for solar material, equipment, cells and modules (d) networking of Indian research efforts with international initiatives with a view to promoting collaborative research and acquiring technology where necessary, and adapting the technology acquired to Indian conditions; (e) providing funding support for the activities foreseen under (a) to (d) through government grants duly leveraged by

funding available under global climate mechanisms, and earnings from deployment of research sponsored by the Mission. Policy and Regulatory measures for promotion of solar technologies would also be enhanced as common to all renewables based technologies.

Over the 11th and 12th Plan periods (till 2017) the Mission would aim to deliver at least 80% coverage for all low temperature (<150^{o} C), and at least 60% coverage for medium temperature (150^{o} to 250^{o} C) applications of solar energy in all urban areas, industries, and commercial establishments. Rural solar thermal applications would also be pursued under public-private partnerships where feasible. Commensurate local manufacturing capacity to meet this level of deployment, with necessary technology tie-ups, where desirable, would be established. Further, the Mission would aim for local Photovoltaic (PV) production from integrated facilities at a level of 1000 MW/annum within this time frame. It would also aim to establish at least 1000 MW of Concentrating Solar Power (CSP) generation capacity, again, with such technical tie-ups as essential within the stated time frame.

The untapped energy potential of each of the three generic solar based energy approaches (i.e. solar PV, solar thermal, and biomass) is well beyond current usage levels. In the long term the Mission would aim to network Indian research efforts in solar technology with global initiatives in these three areas, so as to enable delivery of solar solutions to India's energy needs in tandem with developments worldwide.

In the long-term, the Mission would direct Indian solar research initiatives to deliver truly disruptive innovations that cut across more than one approach or technology. These include: (a) getting the same electrical, optical, chemical and physical performance from cheap materials as that delivered by expensive materials; (b) developing new paradigms for solar cell design that surpass current efficiency limits; (c) finding catalysts that enable inexpensive, efficient conversion of solar energy into chemical fuel; (d) identify novel methods of self-assembly of molecular components into functionally integrated systems; and (e) developing new materials for solar energy conversion infrastructure, such as robust, and inexpensive, thermal management materials.

The ultimate objective of the Mission would be to develop a solar industry in India that is capable of delivering solar energy competitively against fossil options from the Kilowatt range of distributed solar thermal and solar PV to the Gigawatt scale of base load priced and dispatchable CSP within the next 20-25 years.

3.2. National Mission for Enhanced Energy Efficiency in Industry

The industry sector is the largest user of commercial energy in India, accounting for 42% of the country's total commercial energy use during 2004–05. The Indian industry sector, comprising large, medium, and small enterprises registered a growth of 10.6% in April–December 2006 (MoF, 2007). Since the industry sector is viewed as central for economic growth, it would continue to play a major role in the overall development of India.

The industrialization policies of the country have helped in setting up of several energy–intensive primary manufacturing facilities such as iron and steel, cement, fertilizer, refineries, with investment targets fixed in successive Five-year Plans of the Government of India. The planners also encouraged various small scale industries, providing huge employment. The small scale sector produces close to 7500 items in which 326 items are reserved by the Government of India (MoSSI, 2007) to be exclusively produced by small units.

As per the national greenhouse inventory, the direct CO_2 emissions from industrial sources accounted for nearly 31% of the total CO_2 emissions from the country (data for base year 1994) (NATCOM, I). The CO_2 emissions from the industrial sector can be broadly categorized into two heads, i.e. process related emissions, and emissions due to fuel combustion in industries. Of the total estimated 250 million tonnes of direct CO_2 emissions from the industry in 1994, nearly 60% were accounted for by energy use (NATCOM, I).

3.2.1. GHG Mitigation Options in the Industry Sector

GHG Mitigation options in the industry sector can be broadly grouped under three heads as given below:

- Sector specific technological options
- Cross–cutting technologies options
- Fuel switch options

3.2.2. Sector Specific Technological Options

Various GHG mitigation technology options in respect of the Chlor-Alkali, Cement, Aluminum, Fertilizer, Iron and Steel, Pulp and Paper, and Textile sectors are currently being investigated.

3.2.3. Cross-Cutting Technological Options

Apart from sector–specific options, there are certain cross-cutting energy efficient technological options that could be adopted in a wide range of industries. In general, in the industries sector, approximately 50% of the industrial energy use is accounted for by cross-cutting technologies.

The estimated energy saving potential for a large number of plants is of the order of 5% to 15%.

3.2.4. Fuel switch

With the increasing availability of natural gas in the country (both as imported LNG [liquefied natural gas] and likely increased domestic natural gas supply), industries may have the option to switch over from coal to the use of natural gas. Fuel–switch to natural gas generally leads to increase in energy use efficiency.

Another option is switching over from fossil fuels to producer gas from biomass fuels for various thermal applications. Industries with low temperature requirements (upto 100^0C) (for example, textiles and pharmaceuticals) may also use solar thermal systems for water heating.

3.2.5 Potential for emissions reduction

Although the efficiency of most large industrial sectors has been improving over time, and the specific energy consumption of many of the large plants compares well with the world's best, it is estimated that CO_2 emissions from fuel and electricity use in the industry sector could be further reduced by about 605 million tonnes (approximately 16% reduction from the BAU scenario) in the year 2031. However, this will involve major incremental investment costs, as well as, overall, large economic costs, besides technology transfer.

3.2.6. Co-benefits

Energy-efficiency measures in the industrial sector also have some co-benefits due to reduction in fuel and material use leading to reduced emission of air-pollutants, solid waste, and waste water. In addition, some options also lead to improvement in the quality of product.

3.2.7 Technology Transfer

Relevant technologies under development that would reduce specific energy consumption need to be transferred to India when commercially viable.

3.2.8. Financing

The move to efficient technologies in the industry sector generally involves significant incremental investment, and in many cases, economic costs. These would have to be provided by multilateral funding arrangements. In particular, special financing mechanisms would need to be put in place for the SMEs. Bundling and/or programmatic CDM could be a possible financing route for these units.

3.2.9. Capacity-building Needs

Cooperative approaches by the government and industry are needed to enhance awareness of energy-efficient options, and upgrade relevant technical knowledge. The financial sector also needs capacity building in appraisal of specific energy efficiency improvement investments in existing industries.

3.2.10. Policy and Regulatory Options

Under the Energy Conservation Act (2001), 9 energy intensive industrial sectors, i.e. thermal power stations, fertilizer, cement, iron and steel, chlor-alkali, aluminum, railways, textile and pulp and paper, are required to employ a certified energy manager, conduct energy audits periodically, and adhere to specific energy-consumption norms that may be prescribed.

Currently, almost every industrial sector is characterized by a wide band of energy efficiencies in different units. Several of them are at global frontier levels, but some others have relatively poor performance. As an approach to enhancement of overall energy efficiency in each sector, the efficiency band-width of the sector is divided into 4 bands. The energy efficiency improvement target, in percentage, from current levels for each unit varies with its band, being highest for the least energy efficient, and the least for the most efficient. These targets would have to be achieved within a period of 3 to 5 years within each group.

Given the fact of fertilizer subsidies, individual fertilizer units have little incentive to undertake energy-efficiency investments. It is, therefore, imperative that fertilizer subsidies be restructured to eliminate such absence of incentive.

To promote technology upgradation in the SME (small and medium enterprise) sector, it would be essential to evolve sector–specific integrated programmes for technology development. This would require external support for significantly longer durations to address various technological barriers and promote energy efficiencies at the unit level. The information or knowledge gap is more pronounced in case of small industries and "hand-holding" to help industries install energy efficient technologies as well as to ensure their optimum performance through best operating practices will be required.

Most of the energy-efficient equipment require higher upfront investment. An accelerated depreciation up to 80% in the first year on energy-efficient equipment would help their deployment. Further, reduced rate VAT (value added tax) on energy- efficient equipment would also help in reducing the required upfront investment.

To further enhance energy efficiency, four new initiatives may be considered. These are:

- Mandated specific energy consumption decreases in large energy consuming industries and facilities that have been notified as Designated Consumers under the Energy Conservation Act, and provide a framework to certify energy savings in excess of the mandated savings. The certified excess savings may be traded amongst companies to meet their mandated compliance requirements, or banked for the next cycle of energy savings requirements.

- Tax incentives for promotion of energy efficiency, including differential taxation on appliances that have been certified as energy efficient through energy labeling programme.

- Creation of energy efficiency financing platforms for enabling public-private-partnerships to capture energy savings through demand side management programmes in the municipal, buildings, and agricultural sectors.

- Fiscal Incentives

3.2.11. Delivery options

The key delivery options for energy efficiency in industry are:

- Projects, including retrofits, by the corporate sector, with institutional finance
- Activities related to cluster development, particularly in SMEs
- Promotion of ESCOs (Energy Service Companies) for providing energy efficiency solutions across industry sectors

The Energy Efficiency Financing Platform initiated by the Bureau of Energy Efficiency, in conjunction with a robust ESCO industry could provide the necessary impetus to energy efficiency. In respect of each delivery mode, carbon finance through the CDM would also be relevant.

3.3 National Mission on Sustainable Habitat

The Mission comprises three components, i.e. promoting energy efficiency in the residential and commercial sector, management of municipal solid waste, and promotion of urban public transport. These are presented below:

3.3.1. Promoting Energy Efficiency in the Residential and Commercial Sector

The residential sector accounts for around 13.3% of total commercial energy use in India. While several households, especially in the rural areas, continue to use biomass for cooking in traditional cookstoves, which leads to high levels of indoor air pollution and poses a major health risk especially to women and children, the use of modern fuels such as LPG (liquefied petroleum gas) and kerosene is increasing rapidly. During 1990–2003, consumption of LPG increased at an annual rate of 11.26%, while electricity use increased at 8.25% annually in the residential sector.

Electricity consumption in the residential sector is primarily for lighting, space conditioning, refrigeration, and other appliances. According to a study on energy consumption in the residential sector in the city of Delhi, while lighting accounted for around 8%–14% of total electricity consumption, space-conditioning accounted for nearly 52%, and refrigerators accounted for around 28% (in the summer months). Accordingly, energy saving measures related with space conditioning (heating and cooling), refrigeration, and lighting have great significance in moving towards sustainable residential energy use.

The commercial sector comprises various institutional establishments such as banks, hotels, restaurants, shopping complexes, offices, and public buildings. Electricity consumption has increased at the rate of 7.4% annually between 1990–2003 in the commercial sector. It is estimated that on average, in a typical commercial building in India around 60% of the total electricity is consumed for lighting, 32% for space conditioning, and 8% for refrigeration. However, the end-use consumption varies significantly with space conditioning needs. While a fully airconditioned office building could have about 60% of the total electricity consumption accounted for by air conditioning, followed by 20% for lighting, in a non-airconditioned building the consumption patterns would be significantly different.

Energy use in residential and commercial buildings also varies significantly across income groups, building construction typology, climate, and several other factors. There exists significant scope to reduce energy use, while also providing the requisite energy services in case of both existing as well as new constructions. Although the saving potential of each option may vary with typology, climate, space conditioning needs, and the initial base design proposed by the client/designer, on an average it is estimated that the implementation of energy efficient options would help in achieving around 30% electricity savings in new residential buildings and 40% electricity savings in new commercial buildings. In case of existing buildings, the energy saving potential for residential buildings is estimated to be around 20%, and that for commercial buildings around 30%.

Various studies have established that substantial energy savings can be achieved in the residential and commercial sectors. Implementing carbon mitigation options in buildings is associated with a wide range of co-benefits, including improved energy security and system reliability. Other co-benefits of energy efficiency investments include the creation of jobs and business opportunities, while the energy savings may lead to greater access to energy for the poor, leading to their improvement and well-being. Other co-benefits include improved indoor and outdoor air quality, and thereby improved health and quality of life.

3.3.1.1. *Costs and Financing*

The incremental cost of implementation of energy-efficient measures is estimated to vary between 3%-5% for residential buildings and 10%-15% for commercial buildings on a case-to-case basis. Economic savings over the lifetime of the appliances would depend upon the specific- usage patterns. Also, it is expected that in general, private home-owners would seek shorter pay-back periods than owners of commercial property.

While the use of more efficient appliances can play a key role in reducing final energy demands,

energy-efficient appliances typically have higher upfront costs than their non-labeled counterparts. Given that significant incremental investment costs are associated with the efficient technologies, appropriate financing mechanisms need to be adopted in order to promote these technologies.

Adoption of energy-efficient lighting and space-conditioning technologies should be integrated into housing finance schemes of financial institutions, appliance financing schemes need to incentivize purchase of energy-efficient equipment, and utility- based programmes should be put in place to pay for the higher upfront capital costs of lighting systems in the utility bills.

Carbon-market financing would enable access to these technologies where there are higher investment costs, or higher economic costs of the required energy service, or both. This may be especially useful in view of the "split incentive" problem in such cases, that is, the persons who incur the additional investment costs are different from those that might realize the energy savings.

3.3.1.2. *Research & Development*

The R&D needs for the residential and commercial sectors is mainly related to energy efficient technologies. It needs to focus on the development of energy-efficient products for the following applications:

- Energy-efficient buildings and building components
- Development of energy efficient windows
- Development of low-cost insulation material
- Development of simulation software to predict the energy used in buildings
- Energy efficient appliances
- Development of energy-efficient ceiling fans
- Development of very-low-energy-consuming circuits for stand-by power
- Development of low-cost light-emitting diode (LED)-based lamps for space lighting

The SAC-C (Scientific Advisory Committee of the Cabinet) has recommended the launch of a National Networked Initiative for R&D on the development of the next generation of LEDs, particularly white LEDs.

3.3.1.3. *Technology Transfer and Capacity Building*

The energy efficient lighting and space conditioning technologies developed internationally are generally superior as compared to those available within the country. There is therefore a need for technology transfer from the developed countries. However adopting these internationally developed technologies is associated with payment of additional costs due to the IPR component associated with these technologies. Mechanisms need to be put in place so that these costs do not impose an additional burden on the consumers.

Solar evacuated tubular panel technology is available internationally for solar water heating systems, but needs to be transferred for diffusion in the Indian market.

Lack of awareness of energy-saving options and potential among architects, engineers, interior designers, and professionals in the building industry including plumbers and electricians is a major barrier to the construction of low-energy buildings. Realizing the potential of energy saving requires an integrated design process involving all the stakeholders, with full consideration of opportunities for passively reducing building energy demands.

Builders and developers need to be trained and made aware of the options to save energy in new constructions. There is a need to create comprehensive integrated programmes at universities and other professional establishments to impart such training for designing and constructing low-energy buildings.

3.3.1.4. *Policy and Regulatory Enhancements*

A diverse portfolio of policy instruments would be required to address the barriers to efficient energy use in the residential and commercial sectors.

There is a need to continuously update appliance energy norms and building energy codes and labeling, move towards rational energy pricing based on long-term average economic cost, and provide fiscal benefits for efficiency improvements.

The ECBC (Energy Conservation Building Code) was developed after the adoption of the Energy Conservation Act (2001). The ECBC aims to reduce the baseline energy consumption by supporting adoption and implementation of efficiency sav-

ings and savings in GHG emissions, besides other benefits. ECBC intervention has encouraged design innovation in the building envelope and system design and specification, which have resulted in 50% energy savings (as measured in ECBC compliant buildings) when compared to conventional constructions.

Given the scale of energy savings that can be achieved by the implementation of ECBC, it is important to direct policy towards encouraging/mandating energy savings. As an example, it would be pertinent to address the cost of CFL (Compact Fluorescent Lamp) and T5 (Efficient Tube Light) which is a barrier to their wide spread use, and implement measures to increase the demand in order to reduce prices through scale effects. Large-scale availability of appropriate materials and equipment to meet the requirement of ECBC is also urgently needed. The energy codes are still new in India and the products (insulation, efficient glass, efficient HVAC systems, and so on) and services required by buildings to comply with the code requirements are not readily and abundantly available, or competitively priced. Market power monopoly of a handful of manufacturers of energy efficient products has resulted in a non-competitive market for products like insulations, chillers, and so on.

In addition to the above, the MoEF (Ministry of Environment and Forests) has developed a manual on norms and standards for environmental clearance for large construction projects after wide consultation with experts from different disciplines. The manual would be used as a technical guideline to assist the project proponents/ stakeholders/ consultants for the preparation environmental impact assessments of projects and obtain environmental clearance. Both the EACs (Expert Appraisal Committee) at MoEF and SEACs (State Expert Appraisal Committee) at the state/ UT level appraise and grade all new construction projects requiring environmental clearances on the basis of the manual. The state pollution control boards are required to verify the compliance of the Environmental Management Plan and the observance of the criteria of gradation by the project proponents.

Successful implementation of performance-based codes requires education and training of building officials and inspectors and demonstration projects. Setting flexible performance-based codes rather than technology/options prescriptions can help keep compliance costs low and may provide incentives for innovation.

3.3.1.5. Delivery Options

The BLY (Bachat Lamp Yojana) model needs to be pursued to promote energy efficient and high quality CFLs as replacement for incandescent bulbs in households. Comprehensive implementation of the BLY can lead to a reduction of 10,000 MW (Megawatt) of electricity demand. The BLY depends upon CDM (clean development mechanism) revenues to meet the incremental investment cost as well as the incremental economic cost that would be the case in many participating households.

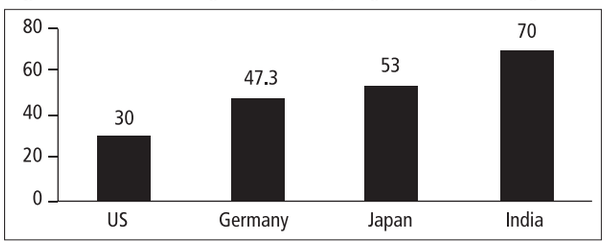
ESCOs (Energy Service Companies) need to be promoted as vehicles to deliver energy-efficiency improvements, in particular because of the "split incentives" problem, and facilitate access to carbon finance through bundled CDM projects.

The energy efficient options in the residential and commercial sectors should be promoted as bundles of programmatic CDM options.

3.3.2 Management of Municipal Solid Waste (MSW)

Municipal solid waste (MSW) generation reflects not just income levels, but also lifestyle choices. Recycling of materials is an important option for reducing environmental pressures. Figure 3.3.2.1 below indicates that India has a significantly higher rate of recycling of materials in MSW than developed countries.

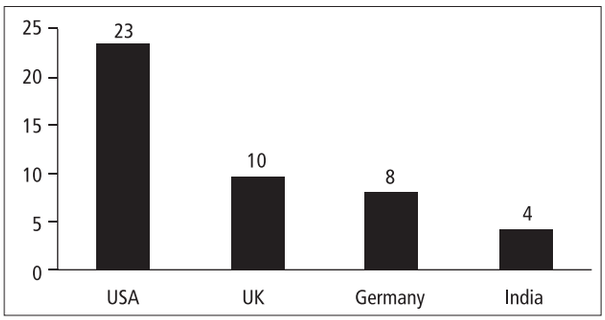
Figure 3.3.2.1: Average rate of recycling (in %), excluding re-use



Source: TERI (2006)

GHG emissions from MSW in India are also much lower than in developed countries, reckoned per unit of consumption (in $ 1000 at PPP), Figure 3.3.2.2 below:

Figure 3.3.2.2: GHG emissions intensity from waste generation (in gm/$1000 at PPP GDP)



Source: TERI (2006)

MSW generation in Indian cities (around 5100 ULBs) is estimated to have increased from 6 million tonnes in 1947 to 48 million tonnes in 1997, and to 69 million tonnes in 2006 (Central Pollution Control Board 2000, TERI 2001). In addition, Indian consumption of plastics is around 4 MTPA (million tonnes per annum). About 60% of this comprises polyolefins, which are primarily used as packaging material. About 2.0 MTPA of total consumption is generated as plastic waste of which around 70% is recycled, mostly by the informal sector. The decadal growth in consumption of plastics during the period 1991-2001 was around 14% (Indian Centre for Plastics in the Environment and Central Institute of Plastic Engineering Technology 2003). Although the quantity of plastic waste reaching disposal sites is fairly low (0.62% on a dry weight basis), testifying to the high rate of recycling/reuse, the management of thin plastic bags remains a matter of concern due to low collection efficiency in their case. The plastic waste-recycling sector therefore needs to be strengthened.

Table 3.3.2.1: Characteristics of MSW in 59 cities

Parameter	Unit	Range
Compostable	%	30 – 73
Recyclable (Plastics,		
Paper, Metal, Glass etc)	%	10 – 37
Moisture	%	17 – 65
Carbon/Nitrogen (C/N)	Ratio	14 – 53
HCV	kcal/kg	520 - 3766

Source: CPCB, 2005

There is a trend of increase in the percentage of recyclables, accompanied by decreases in the percentage of biodegradable matter in the waste stream.

Table 3.3.2.2: Change in waste composition in selected cities

City	Compostables (%)		Recyclables (%)	
	1982-1990	2005	1982-1990	2005
Lucknow	60.31	47.41	6.72	15.53
Kolkata	46.58	50.56	2.58	11.48
Kanpur	53.34	47.52	2.57	11.93
Mumbai	59.37	62.44	3.85	16.66
Delhi	57.71	54.42	8.24	15.52
Chennai	56.24	41.34	6.60	16.34
Bangalore	75.00	51.84	2.70	22.43
Ahemdabad	48.95	40.81	7.57	11.65

Source: 1982–90: Planning Commission; 1995, 2005: CPCB

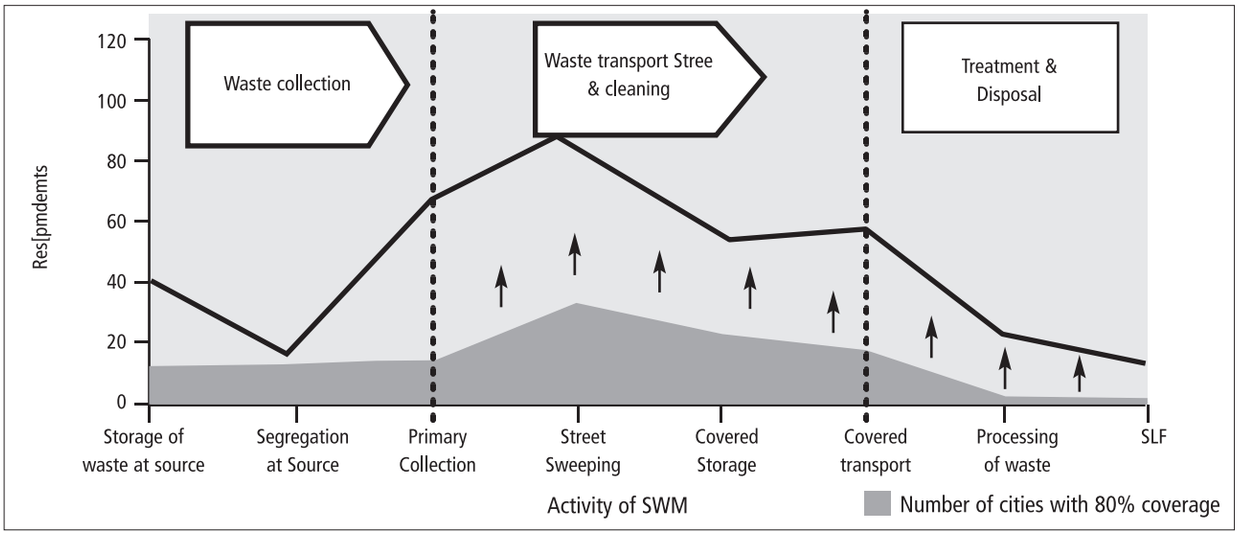
3.3.2.1 Policies and Regulations

The 74th Constitutional Amendment (1992) transferred the responsibility for collection, treatment and disposal of MSW from State Governments to the Urban Local Bodies (ULBs). The outbreak of plague at Surat (1994) focused policy attention on the importance of proper systems for MSW in the ULBs. In response to direction by the Supreme Court in a PIL (WP No. 888/1996) MSW Rules 2000 were promulgated, MSW service from generation to disposal was mandated, and Local Governments made responsible for compliance. Since then ULBs have gradually improved the systems of collection and transport of MSW. However, major gaps exist in respect of treatment and disposal. In particular, in respect of disposal, the compliance is poor (<5%), and while there are an increasing number of projects incorporating safe disposal, most have inadequate capacity.

Efforts at composting, and generating energy from waste have generally not been successful for a variety of systemic, technology, and pricing issues, including variable quality of waste, insufficient segregation of MSW, opposition to siting the facilities from local residents, and accordingly, the practice of open dumping continues. The dominant technology choice remains composting.

In addition, experience has made clear that

Figure 3.3.2.1: Compliance Status of MSW Rules (Survey: 2004)



Source: World Bank WSP, 2007

MSW operations cannot overall be profitable, and while cost-effectiveness and revenue streams should be pursued, MSW operations as a whole should be recognized as entailing the provision of a public good (or environmental service), generally requiring net fiscal expenditures by the concerned local bodies.

The MSW Rules under the Environment Protection Act are currently somewhat focused on specific treatment options, including the chain of collection, transport and disposal. This focus is unduly prescriptive, and prevents innovation in systems and procedures, as well as update on new technologies and techniques. The MSW Rules should be revised to focus instead on performance or outcome norms that are to be met, irrespective of particular systems and procedures, or technologies. This would provide benchmarks for monitoring and enforcement, as well as give space for innovation in systems, procedures, and technologies.

There is an emerging consensus that MSW Rules should enable (but not require) the sharing of infrastructure, including transport and treatment facilities, across a given region, including towns and villages. This would help realize scale economies, besides access to better and more cost-effective systems and treatment options for the smaller urban centres and habitations.

Broad guidelines for policy reform in the MSW sector include:

- Common Regional Facilities: In respect of smaller towns and villages located in a region, say a district, disposal facilities should be developed as a common regional facility.
- Integrated Systems for collection, transport, transfer, treatment, and disposal facilities: even if different organizations implement different components, as opposed to stand-alone facilities and open dumping.

MSW operations cannot be financially viable: ULBs should not expect to realize net royalties for treatment and disposal of MSW, and a tipping fee would be necessary (reckoned on tonnage of MSW or number of sources of different kinds) to be met from ULB revenues.

While there are several potential benefits in implementing MSW operations through public-private partnerships, including cost-effectiveness, as compared to operations carried out by the local bodies on their own, it is imperative that municipal finances are placed on a sound footing prior to outsourcing this function. While the issue of municipal finance reform is complex with many dimensions, and needs to be pursued independent of MSW issues, a pre-requisite is separation of the accounts of the local bodies in respect of their different responsibilities, such as MSW, water supply, sewage disposal and roads. This separation would firstly, provide

guidance to setting user charges (however collected), and a benchmark against which bids for provision of MSW services may be judged.

The National Environment Policy, 2006, provides for:

- Removal of barriers (incentives, regulation) for beneficial utilization of non-hazardous materials
- Implementing viable PPPs for operation of hazardous and non-hazardous waste disposal facilities on payment of user fees, taking into account concerns of local communities
- Survey and preparation of national inventory of toxic and hazardous waste sites and online monitoring of their movement
- Giving legal recognition to and strengthening informal sector systems of, collection and recycling and enhancing their access to finance and technology

The significance of the last is that while the informal recycling sector is the backbone of India's highly effective recycling system, unfortunately, a number of municipal regulations impede the operation of the recyclers, owing to which they remain at a tiny scale without access to finance or improved recycling technologies.

3.3.2.2. R&D Needs

Technological requirements are listed as follows:

- Biomethanation technology for waste to energy including its decentralised application for segregated waste streams like vegetable market waste, slaughterhouse waste and dairy waste.
- Development of indigenous gas engines for waste to energy applications to reduce the overall cost of the package.
- Upgrading plastic waste recycling technologies to reduce occupational and environmental hazards.
- Recycling technologies for construction and demolition wastes and e-waste streams.

3.3.2.3. Financing

The 10th Plan emphasized provision of important infrastructure facilities and 100% coverage of urban population with water supply facilities, and 75% of urban population with sewerage and sanitation by the end of the plan period. Under the JNURM, till January 2008, funds amounting to Rs 900 crores were released to ULBs. The required funding for upgrading MSW facilities in all cities and towns would be much greater.

3.3.3. Promotion of Urban Public Transport

An increase in the demand for transportation services for both passengers and freight is inevitable, given economic growth and increase of population. The total number of registered motor vehicles in India has increased from 21.4 million in 1991 to 72.7 million in 2004 at a CAGR of 9.9%, with the two wheeler segment comprising of motorcycles, scooters, and mopeds growing most rapidly amongst personalized modes of transportation. Road based transportation is the main source of GHG emissions in the transportation sector.

Various studies have estimated that policy and technological measures can lead to significant energy and thereby emission savings in the transport sector. Estimates of the Planning Commission indicate an energy saving potential of 115 mtoe (million tonnes of oil equivalent) in the year 2031/32 by increasing the share of railways and improving efficiencies of different modes of transport (Planning Commission, 2006). Similarly, TERI estimates indicate an energy saving of 144 mtoe in 2031 by including efficiency improvement across modes as well as considering enhanced use of public transportation and rail based movement, use of bio-diesel as compared to business-as-usual trends. The corresponding CO_2 emissions reduction is estimated at 433 million tonnes in 2031.

3.3.3.1. Transport Options

Mass transport options including buses, railways and mass rapid transit systems, etc. are the principal option for reducing energy use in the urban transport sector, and mitigating associated GHG emissions and air pollution. The use of CNG has helped reduce air pollution due to diesel use in some cities because of its lower particulates emissions. Regarding biofuels, ethanol blending of gasoline upto 5% is required in 9 states, and is expected that this limit would be increased to10%. R&D has to be carried out on the

combustion characteristics of motor engines for blending of higher content of ethanol in petrol. Bio-diesel production from *Jatropha curcas* and *Pongamia* shrubs is also increasing. The National Mission on Bio-diesel aims in the first (demonstration) phase to establish biodiesel plantations in 26 states, while the second phase will lead to the production of sufficient bio-diesel to enable a 20% blend in vehicle diesel in 2011/12. However, the oil content of bio-diesel crops from different parts of India is highly variable. R&D has to be carried to identify superior genotypes and collect seeds, which need to be inventorised, documented and stored under different agro-climatic zones. Introduction of bio-fuels should not divert land marked for food production and thus decrease the availability of food-grains to population. There is also some controversy about the net GHG emission of some biofuels.

Hydrogen has the potential to replace fossil fuels in the future. In recent years, significant progress has been reported by several countries for overcoming problems in its storage and production. In India, a National Hydrogen Energy Road Map has been prepared. Some organisations have already developed prototypes of two-and three-wheelers and buses to run on hydrogen fuel. However, large scale penetration of the market by hydrogen propelled vehicles is not expected till a few decades from now.

3.3.3.2. *Costs and financing*

Most of the energy-efficiency measures require huge investments in the creation of new infrastructure. Efforts to reduce CO_2 emissions by the way of introduction of MRTS (mass-rapid transit system) would involve diverting resources from other priority claims on fiscal resources.

Moreover, the possibility of substantially reducing the dependence on petroleum products is constrained by the significantly higher costs of most alternative fuel options as of now. The main barrier to the use of hydrogen based fuel cell vehicles (FCVs) is that of high FCV drive-train costs.

3.3.3.3. *Co-benefits*

Mitigation options such as enhanced shares of public transport or rail-based movement, efficiency improvements, and increased adoption of bio-diesel or CNG have important co-benefits at the regional and local levels.

Pricing, taxes, and charges, apart from raising revenue for governments, are expected to influence travel demand and choice of transportation modes, thereby decreasing fuel demand and GHG emissions. Transport pricing can offer important gains in social welfare by simultaneously reducing local pollution and GHG emissions, accidents, noise and congestion, as well as generating state revenue for enhancing social wel-being and/or infrastructure construction and maintenance.

FCVs fuelled by hydrogen have zero CO_2 emission and high efficiency, address air quality (zero tailpipe emissions), and may promote energy security since hydrogen can be produced from a wide range of sources.

With an expanding automobile sector, recycling of recoverable materials at end-of-life of automobiles would lead to considerable energy savings[9]. It is estimated that by 2020, recoverable materials annually will be of the order of 1.5 million tons of steel, 180,000 tons of aluminium and 75,000 tons each of rubber and plastics. Recycling of these materials will also reduce mining, depletion of natural resources, and degradation of environment. India has no formal regulations regarding recyclability and disposal of end-of-life vehicles.

The following actions are proposed for the transport sector:

- Promoting the use of coastal shipping and inland waterways, apart from encouraging the attractiveness of rail-based movement relative to long-distance road based movement
- Encouraging energy R&D in the Indian Railways
- Introducing appropriate transport pricing measures to influence purchase and use of vehicles in respect of fuel efficiency and fuel choice
- Tightening of regulatory standards such as enforcing fuel-economy standards for automobile manufacturers
- Establishing mechanisms to promote investments in development of high capacity public transport systems (e.g. offer equity participation and/or via-

bility gap funding to cover capital cost of public transport systems)
- Abandoning of old vehicles to be made illegal with suitable legislation and fixing the responsibility of handing over the end-of-life vehicle to collection centers on the last owner of the vehicle
- Setting up of a demonstration unit to take up recycling of vehicles, especially two wheelers, which require new techniques
- Setting up a Combustion Research Institute to facilitate R&D in advanced engine design
- Providing tax benefits and investment support for recovery of materials from scrap vehicles

3.4. National Water Mission

India gets on an average 1197 mm of rainfall every year. This amounts to a total precipitation of 4000 billion m^3. However, 3000 billion m^3 of this is lost due to run off, and only 1000 billion m^3 is available as surface and ground water sources, amounting to c.1000 m^3 per year per capita water availability. This is about $1/5^{th}$ – $1/10^{th}$ of that of many industrialised countries. Many parts of India are water stressed today and India is likely to be water scarce by 2050. The problem may worsen due to climate change impacts. It is therefore important to increase the efficiency of water use, explore options to augment water supply in critical areas, and ensure more effective management of water resources. New regulatory structures with appropriate entitlements and pricing and incentives to adopt water-neutral and water positive technologies may be required. Integrated water policies will help to cope with variability in rainfall and river flows at the basin level. Some specific aspects related to water resources are discussed in more detail below.

3.4.1 Studies on Management of Surface Water Resources

Rivers and lakes, the most visible sources of surface water, often indicate the state of the environment more clearly than many other indicators. Such resources also have economic significance in the form of waterways for transport, sources of clean energy in the form of hydropower, and vital inputs to agriculture in the form of irrigation. Key elements on surface water studies include the following:
- Estimating river flows in mountainous areas
- Customizing climate change models for regional water basins
- Extending isotopic-tracer-based techniques of monitoring river water discharge to all major river monitoring stations
- Developing digital elevation models of flood-prone areas for forecasting floods
- Mapping areas likely to experience floods and developing schemes to manage floods
- Strengthening the monitoring of glacial and seasonal snow covers to assess the contribution of snowmelt to water flows of Indian rivers that originate in the Himalayas
- Establishment of a wider network of automatic weather status and automated rain gauge stations
- Planning of watershed management in mountain ecosystems

3.4.2. Management and Regulation of Groundwater Resources

Groundwater accounts for nearly 40% of the total available water resources in the country and meets nearly 55% of irrigation requirements, 85% of rural requirements and 50% of urban and industrial requirements. However, overexploitation of the resource has sharply lowered the water table in many parts of the country, making them increasingly vulnerable to adverse impacts of climate change. Key areas in this programme may include the following:
- Mandating water harvesting and artificial recharge in relevant urban areas
- Enhancing recharge of the sources and recharge zones of deeper groundwater aquifers
- Mandatory water assessments and audits; ensuring proper industrial waste disposal
- Regulation of power tariffs for irrigation

3.4.3. Upgrading Storage Structures for Fresh Water and Drainage Systems for Wastewater

To address the problems of droughts and floods triggered by extreme weather events, it is essential to

both augment storage capacity and improve drainage systems. Effective drainage is also essential to reclaim waterlogged and saline-alkali lands and to prevent the degradation of fertile lands. Key areas are listed below:

- Prioritizing watersheds vulnerable to flow changes and developing decision support systems to facilitate quick and appropriate responses
- Restoration of old water tanks
- Developing models of urban storm water flows and estimating drainage capacities for storm-water and for sewers based on the simulations
- Strengthen links with afforestation programmes and wetland conservation
- Enhancing storage capacities in multipurpose hydro projects, and integration of drainage with irrigation infrastructure

3.4.4. Conservation of Wetlands

Wetlands provide a range of ecological services, including water conservation, recharge of groundwater, and preservation of flora and fauna, including species and varieties at risk and are a source of livelihood to many. Wetlands face the threat of conversion to other uses, which means a loss of their ecological services, making those who depend on them vulnerable. Actions identified for conserving wetlands are listed below:

- Environmental appraisal and impact assessment of developmental projects on wetlands
- Developing an inventory of wetlands, especially those with unique features
- Mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conversion of mangrove areas, human settlements, and human activities and their impact on catchments and water bodies.
- Creating awareness among people on importance of wetland ecosystems
- Formulating and implementing a regulatory regime to ensure wise use of wetlands at the national, the state, and district levels

3.4.5. Development of Desalination Technologies

In India, desalination has been recognized as a possible means to argument the water supply through natural resources for meeting the growing needs of water due to population and industrial growth. Since desalination is an energy intensive process (the energy required may vary from about 3 kWh to 16 kWh for separating 1000 litres depending on the type of process used), the application of desalination technology for increasing regional water supplies strongly links to energy issues and thus GHG emissions. Development activities have been initiated in various laboratories in the country. Desalination has been recognized as an important cross disciplinary technology area for R&D in the 11^{th} Plan. Technologies are being developed for the following:

- Seawater desalination using Reverse Osmosis and multistage flash distillation to take advantage of low-grade heat energy e.g. from power plants located in the coastal regions or by using renewable energy such as solar
- Brackish water desalination
- Water recycle and reuse
- Water purification technologies

3.5. National Mission for Sustaining the Himalayan Ecosystem

The Himalayan ecosystem is vital to the ecological security of the Indian landmass, through providing forest cover, feeding perennial rivers that are the source of drinking water, irrigation, and hydropower, conserving biodiversity, providing a rich base for high value agriculture, and spectacular landscapes for sustainable tourism. At the same time, climate change may adversely impact the Himalayan ecosystem through increased temperature, altered precipitation patterns, and episodes of drought.

Concern has also been expressed that the Himalayan glaciers, in common with other entities in the global cryosphere, may lose significant ice-mass, and thereby endanger river flows, especially in the lean season, when the North Indian rivers are largely fed by melting snow and ice. Studies by

several scientific institutions in India have been inconclusive on the extent of change in glacier mass, and whether climate change is a significant causative factor.

It is accordingly, necessary to continue and enhance monitoring of the Himalayan ecosystem, in particular the state of its glaciers, and the impacts of change in glacial mass on river flows. Since several other countries in the South Asian region share the Himalayan ecosystem, appropriate forms of scientific collaboration and exchange of information may be considered with them to enhance understanding of ecosystem changes and their effects.

It is also necessary, with a view to enhancing conservation of Himalayan ecosystems, to empower local communities, in particular through the Panchayats, to assume greater responsibility for management of ecological resources.

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 adoption of "best practice" norms for tourism facilities and access to ecological resources, and multistakeholder 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

3.6. National Mission for a "Green India"

Forests are repositories of genetic diversity, and supply a wide range of ecosystem services thus helping maintain ecological balance. Forests meet nearly 40% of the energy needs of the country overall, and over 80% of those in rural areas, and are the backbone of forest-based communities in terms of livelihood and sustenance. Forests sequester billions of tons of carbon dioxide in the form of biomass and soil carbon. The proposed national programme will focus on two objectives, namely increasing the forest cover and density as a whole of the country and conserving biodiversity.

3.6.1. Increase in Forest Cover and Density

The report of the Working Group on Forests for the 11^{th} Five-Year Plan puts the annual rate of planting during 2001/02 to 2005/06 at 1.6 million hectares and proposes to increase it to 3.3 million hectares during the 11^{th} Plan. The final target is to bring one-third of the geographic area of India under forest cover.

The Greening India Programme has already been announced. Under the programme, 6 million hectares of degraded forest land would be afforested with the participation of Joint Forest Management Committees (JFMCs), with funds to the extent of Rs 6000 crores provided from the accumulated additional funds for compensatory afforestation under a decision of the Supreme Court in respect of forest lands diverted to non-forest use.

The elements of this Programme may include the following:

- Training on silvicultural practices for fast- growing and climate- hardy tree species
- Reducing fragmentation of forests by provision of corridors for species migration, both fauna and flora
- Enhancing public and private investments for raising plantations for enhancing the cover and the density of forests
- Revitalizing and upscaling community-based initia-

tives such as Joint Forest Management (JFM) and Van Panchayat committees for forest management
- Implementation of the Greening India Plan
- Formulation of forest fire management strategies

3.6.2. Conserving Biodiversity

Conservation of wildlife and biodiversity in natural heritage sites including sacred groves, protected areas, and other biodiversity 'hotspots' is crucial for maintaining the resilience of ecosystems. Specific actions in this programme will include:

- In-situ and ex-situ conservation of genetic resources, especially of threatened flora and fauna
- Creation of biodiversity registers (at national, district, and local levels) for documenting genetic diversity and the associated traditional knowledge
- Effective implementation of the Protected Area System under the Wildlife Conservation Act
- Effective implementation of the National Biodiversity Conservation Act, 2001

3.7. National Mission for Sustainable Agriculture

Contributing 21% to the country's GDP, accounting for 11% of total exports, employing 56.4% of the total workforce, and supporting 600 million people directly or indirectly, agriculture is vital to India's economy and the livelihood of its people. The proposed national mission will focus on four areas crucial to agriculture in adapting to climate change, namely dryland agriculture, risk management, access to information, and use of biotechnology.

3.7.1. Dryland Agriculture

Out of the net cultivated area of approximately 141 million hectares , about 85 million hectares (60%) falls under the dryland/rain-fed zone. Accordingly, to realise the enormous agricultural growth potential of the drylands in the country and secure farm-based livelihoods, there is a need to prevent declines in agricultural yields during climatic stress. Priority actions on dryland agriculture with particular relevance to adaptation will be as follows:

- Development of drought- and pest-resistant crop varieties
- Improving methods to conserve soil and water
- Stakeholder consultations, training workshops and demonstration exercises for farming communities, for agro-climatic information sharing and dissemination
- Financial support to enable farmers to invest in and adopt relevant technologies to overcome climate related stresses

3.7.2. Risk Management

The agricultural sector may face risks due to extreme climatie events. Priority areas are as follows:

- Strengthening of current agricultural and weather insurance mechanisms
- Development and validation of weather derivative models (by insurance providers ensuring their access to archival and current weather data)
- Creation of web-enabled, regional language based services for facilitation of weather-based insurance
- Development of GIS and remote-sensing methodologies for detailed soil resource mapping and land use planning at the level of a watershed or a river basin
- Mapping vulnerable eco-regions and pest and disease hotspots
- Developing and implementing region-specific contingency plans based on vulnerability and risk scenarios

3.7.3. Access to Information

Although many information channels are available to farmers, none of them offers need-based information in an interactive mode. Supplying customized information can boost farm productivity and farm incomes, and the following areas deserve priority:

- Development of regional databases of soil, weather, genotypes, land-use patterns and water resources.
- Monitoring of glacier and ice-mass, impacts on

water resources, soil erosion, and associated impacts on agricultural production in mountainous regions
- Providing information on off-season crops, aromatic and medicinal plants, greenhouse crops, pasture development, agro-forestry, livestock and agro-processing.
- Collation and dissemination of block-level data on agro-climatic variables, land-use, and socio-economic features and preparation of state-level agro-climatic atlases

3.7.4 Use of Biotechnology

Biotechnology applications in agriculture relate to several themes, including drought proofing, taking advantage of elevated CO2 concentrations, increased yields and increased resistance to disease and pests. Priority areas include:

- Use of genetic engineering to convert C-3 crops to the more carbon responsive C-4 crops to achieve greater photosynthetic efficiency for obtaining increased productivity at higher levels of carbon dioxide in the atmosphere or to sustain thermal stresses
- Development of crops with better water and nitrogen use efficiency which may result in reduced emissions of greenhouse gases or greater tolerance to drought or submergence or salinity
- Development of nutritional strategies for managing heat stress in dairy animals to prevent nutrient deficiencies leading to low milk yield and productivity

3.8. National Mission on Strategic Knowledge for Climate Change

This national mission envisages a broad-based effort that would include the following key themes:

- Research in key substantive domains of climate science where there is an urgent need to improve the understanding of key phenomena and processes, including, for example, monsoon dynamics, aerosol science and ecosystem responses
- Global and regional climate modelling to improve the quality and specificity of climate change projections over the Indian sub-continent, including changes in hydrological cycles
- Strengthening of observational networks and data gathering and assimilation, including measures to enhance the access to and availability of relevant data
- Creation of essential research infrastructure, such as high performance computing and very large bandwidth networks to enable scientists to access and share computational and data resources

These broad themes are elaborated in the sub-sections below:

3.8.1. Climate Modelling and Access to Data

Although the IPCC-AR4 has addressed the general global trends on climate change, spatially detailed assessments are not available for India. This is because of inadequate computing power available, difficulties in getting climate related data, and dearth of trained human resources amongst climate modelling research groups in India. The following actions will be taken:

3.8.2. Enhanced Research on Climate Modelling in India

There is a need to develop high resolution Air Ocean General Circulation Models (AOGCM) and nested Regional Climate Models (RCM) that simulate regional climate change, in particular monsoon behaviour, by pooling institutional capabilities and computational resources.

In respect of General Circulation Models (GCM), there is a need to build national level core climate modelling groups to develop high resolution coupled AOGCM that effectively simulate monsoon behaviour. These would be employed for multi-ensemble and multi-year simulations of the present and future climate. Indigenous Regional Climate Models (RCM) are necessary to generate accurate future climate projections upto (at least) district level. Regional data re-analysis projects should be encouraged. A Regional Model Inter-comparison

Project (RMIP) for climate is required to minimize uncertainty in future climate projections.

3.8.3. Promoting Data Access

There are several databases that are relevant for climate research, along with the respective agencies that are responsible for collecting and supplying that data. It is suggested that each of these Ministries and Departments may appoint a 'facilitator', who will provide access to the data. A concept of 'registered users' has been proposed, who will have easier access to climate related data held by the various scientific Ministries and Departments of the Government. There is a need to review the restrictions on data access. The Ministries and their agencies should also take action to digitize the data, maintain databases of global quality, and streamline the procedures governing access. Existing databases that will need to be expanded and improved are listed below.

Table 3.8.3 Some Databases for Climate Research

S. No.	Database	Data Collecting and Supplying Agency	Facilitator reporting to
1	**Oceans** Sea surface temperature Salinity Sea level rise	Ministry of Earth Sciences	Secretary, Ministry of Earth Sciences
2	**Cryosphere** Snow cover Glacial data	a) National Remote Sensing Agency (NRSA) b) Geological Survey of India c) Snow and Avalanche Studies Establishment (SASE), Defence Research and Development Organization	a) Secretary, Department of Space b) Secretary, Ministry of Mines c) Secretary, Department of Defence Research and Development
3	**Meteorology** Precipitation Humidity Surface temperature Air temperature Evaporation data	India Meteorological Department, Ministry of Earth Sciences.	Secretary, Ministry of Earth Sciences
4	**Land Surface** Topography Erosion Imagery (vegetation map) Forest cover	a) Survey of India b) National Remote Sensing Agency (NRSA)	a) Secretary, Department of Science and Technology b) Secretary, Department of Space
5	**Hydrological** Ground water Water quality River water Water utilization	a) Central Water Commission b) State Water Resource Organizations	a) Secretary, Ministry of Water Resources b) Chief Secretaries of the respective States
6	**Agriculture** Soil profile Area under cultivation Production and yield Cost of cultivation	Ministry of Agriculture	a) Secretary, Department of Agriculture and Co-operation b) Secretary, Department of Agricultural Research and Education
7	**Socio-Economic** Demography Economic status	Census of India	Registrar General India, Ministry of Home Affairs
8	**Forests** Forest resources Plant and animal species distribution	a) Forest Survey of India b) State Forest Department c) Botanical Survey of India d) Zoological Survey of India e) Department of Space	a) Secretary, Ministry of Environment and Forests b) Chief Secretaries of the respective States c) Secretary, Ministry of Environment and Forests d) Secretary, Ministry of Environment and Forests e) Secretary, Department of Space
9	**Health Related Data**	Department of Health Research	Secretary, Department of Health Research

3.8.4. Strengthening Networks

The creation of an integrated National Knowledge Network (scalable and ultimately of multi-10 Gbps capacity) as suggested by the National Knowledge Commission and the Principal Scientific Adviser's Office would obviously benefit climate modellers. The upcoming Grid Computing stands out as a unique technology for handling terabytes of experimental data requiring hundreds of teraflops of computing power. Various Ministries of the Government are also taking steps to augment their super-computing resources in the Eleventh Plan.

3.8.5. Human Resource Development

In order to meet the new challenges related to climate change, human resources would require to be enhanced through changes in curricula at the school and college levels, introduction of new programmes at the university level, and training of professionals and executives in relevant fields. An overall assessment of additional skills required will have to be carried out at the national, state and local levels, so that necessary measures can be undertaken for enhancing the quality and quantum of human resource required in the coming years and decades. The latter would have to be viewed also in the context of the current difficulties faced in attracting young people to careers in science in general, to overcome which steps are being taken during the 11th Plan.

4. Other Initiatives

4.1. GHG Mitigation in Power Generation

The present energy mix in India for electricity generation is shown in Table 4.1 below:

Table 4.1: Present Energy Mix in Electricity Generation in India

Source	Percentage
Coal	55
Hydropower	26
Oil and gas	10
Wind and solar power	6
Nuclear power	3

At present, fossil fuels account for 66% of the total, and are responsible for most of the GHG emissions from the energy sector. During the 11th Five-Year Plan, utility-based generation capacity is expected to increase by 78,000 MW. A significant proportion of this increase will be thermal-coal based. While the new investments in the thermal power sector, which are substantial, have high efficiencies, the aggregate efficiency of the older plants is low. In addition, high ATCL (aggregate technical and commercial loss) in power transmission and distribution is a key concern

There are three ways of lowering the emissions from coal based plants: increasing efficiency of existing power plants; using clean coal technologies (relative emissions are c.78% of conventional coal-thermal), and switching to fuels other than coal, where possible. These measures are complementary and not mutually exclusive. Another option that has been suggested is carbon capture and sequestration (CCS). However, feasible technologies for this have not yet been developed and there are serious questions about the cost as well permanence of the CO_2 storage repositories.

Approximately 5000 MW out of total of 73,500 MW of present installed capacity (at the end of November, 2007) of coal thermal plants have low capacity utilization of less than 5%, as well as low conversion efficiency. During the 11th Plan, these units would be retired, and during the 12th Plan, an additional 10,000 MW of the least efficient operating plants would be retired, or reconditioned to improve their operating efficiency.

4.1.1. Supercritical Technologies

Supercritical and ultra-supercritical plants can achieve efficiencies of ~ 40 and ~ 45% respectively, compared to about 35% achieved by subcritical plants. Since coal-based power generation will continue to play a major role in the next 30–50 years, it would be useful, wherever cost-effective and otherwise suitable, to adopt supercritical boilers, which is a proven technology, in the immediate future, and ultra-supercritical boilers when their commercial viability under Indian conditions is established. At present, construction of several supercritical coal based power projects is in progress.

Research and development with regard to ultra-supercritical technology needs to focus on the following areas:

- Development of materials for use in steam generator tubes, main steam piping, and high-pressure turbines that can withstand high pressure and high temperatures of more than 600°C, and are resistant to oxidation, erosion, and corrosion
- Development of know-how related to heat transfer, pressure drop, and flow stability at ultra-supercritical conditions

4.1.2. Integrated Gasification Combined Cycle (IGCC) Technology

Integrated gasification combined cycle technology can make coal-based power generation ~ 10% more efficient. For every 1% rise in efficiency, there is a 2% decrease in CO_2 release. Besides, there is a substantial reduction in NOx emissions. Demonstration of plants using high-ash, low-sulphur Indian coal needs to be pursued, while recognizing constraints such as high costs and availability of superior imported coal. Recent research has shown that these plants should be based on the Pressurized Fluidized Bed (PFB) approach.

Bharat Heavy Electricals Ltd. (BHEL) already has 3 R&D plants based on PFB, which have provided design information to scale up this technology[10]. BHEL and APGENCO have signed an agreement recently to set up a 125 MW plant at Vijayawada using indigenous IGCC technology.

4.1.3. Natural Gas Based Power Plants

Natural gas based power generation is cleaner than coal-based generation as CO_2 emissions are only ~ 50% compared to coal. Besides, natural gas can be used for electricity generation by adopting advanced gas turbines in a combined cycle mode. Introduction of advance class turbines with inlet temperature in the range 1250 °C – 1350° C has led to combined cycle power plant efficiency of about 55% under Indian conditions. Many such plants are in operation in India. With the discovery of significant reserves of natural gas in the Godavari basin, setting up more combined cycle natural gas plants is an attractive GHG mitigation option in India.

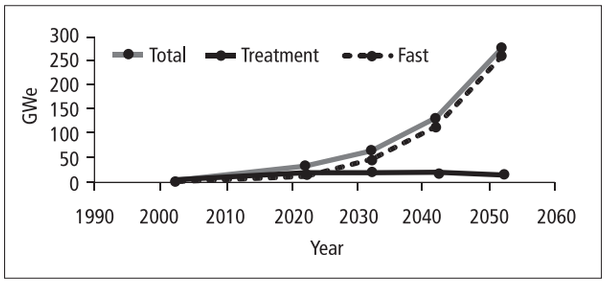
4.1.4. Closed Cycle Three Stage Nuclear Power Programme

Promotion of nuclear energy through enhancing nuclear capacity and adoption of fast breeder and thorium-based thermal reactor technology in nuclear power generation would bring significant benefits in terms of energy security and environmental benefits, including GHG mitigation.

India's uranium resources are limited but the country has one of the largest resources of thorium in the world. Therefore, right from inception, India has adopted a programme that will maximize the energy yield from these materials. This is the three-stage nuclear power programme. The first stage of nuclear power generation is based on PHWR (Pressurized Heavy Water Reactor) technology using indigenous natural uranium. The second stage is based on FBR (Fast Breeder Reactor) technology using plutonium extracted by reprocessing of the spent fuel obtained from the first stage. The third stage consists of using thorium resources.

The current installed capacity of nuclear power plants is 4200 MW, accounting for nearly 3% of total installed capacity. A 500 MW fast breeder reactor is under construction and is expected to go on stream in about three years. A 300 MW Advanced Heavy Water Reactor (AHWR) has been designed. Its construction is due to begin in the 11th Plan. The projected installed nuclear power by Department of Atomic Energy (DAE) is shown in Figure 4.1 below.

Figure 4.1.4: Nuclear Power Generation Projections upto 2050 by DAE



For sustainability of nuclear energy as a mitigation option in the long term, it is important to close the nuclear fuel cycle[11]. In this way one can produce several tens of times more energy from the existing uranium resources if the plutonium from the spent fuel is recycled in fast breeder reactors and this potential can be increased by another order of magnitude by closing the nuclear fuel cycle with thorium. Therefore, the three stage nuclear programme of India based on the closed fuel cycle philosophy assumes greater significance in the context of climate change mitigation. The closed fuel cycle, in comparison to the once-through cycle, also reduces the volumes of radioactive waste requiring treatment and disposal.

4.1.5. Efficient Transmission and Distribution

India's current technical losses during transmission and distribution are as high as 16%–19%. By adopting HVAC (high voltage AC) and HVDC (high voltage DC) transmission, the figure can be brought down to 6%–8% by using amorphous core transformers and up-grading the distribution system (avoiding congestion etc.). Distribution losses can also be reduced by adopting energy-efficient transformers, which use high-grade steel in the transformer core.

4.1.6. Hydropower

The CEA (Central Electricity Authority) has estimated India's hydropower potential at 148,700 MW. The hydroelectric capacity currently under operation is about 28,000 MW, while 14,000 MW capacity is under various stages of development. The CEA has also identified 56 sites for pumped storage schemes with an estimated aggregate installed capacity of 94,000 MW. In addition, a potential of 15,000 MW in terms of installed capacity is estimated from small, mini, and micro-hydel projects. Of this only about 2000 MW has been exploited at present. These projects are important, in particular, for electrification of remote hilly areas, where it may not be feasible for the grid electricity to reach. Large-scale hydropower with reservoir storage is the cheapest conventional power source in India. However, resettlement of displaced population due to submergence of large areas of habitation lands has to be attended to with care.

4.2. Other Renewable Energy Technologies Programmes

Renewable energy sources, i.e. based on primary energy sources that are regenerated naturally in time-spans that are meaningful in terms of policy and planning horizons, represent genuine supply side sustainability of global energy systems.

Renewable energy technologies (RETs) have several well-recognized advantages in relation to conventional, largely fossil fuels based, energy systems. First, by displacing use of fossil fuels, in particular, petroleum based fuels, they promote energy security. Second, they are amenable to adoption at different scales – from hundreds of megawatts capacity to a few kilowatts. In many cases they may be deployed in modular, standardized designs. This enables RETS to be matched closely with end-use scales, enabling decentralized deployment, and thus avoiding the risk of failures, and unauthorized access to large networks, which leads to non-commercial losses. The feasibility of location close to the load or consuming centres enables reduction of technical transmission and distribution losses. However, where centralized grids (networks) exist, they may be inserted as individual modules in the grid (network) supply. Third, they can help promote sustainable development, broadly defined, through increased opportunities for local employment, especially the rural poor, and environmental improvement through reducing GHG emissions, local air pollutants, solid waste and waste-water generation, and (in case of forestry-based sources), soil and water conservation, and maintaining habitats of wild species.

On the other hand, several RETs also have disadvantages. First, some primary energy flows (e.g. solar, wind) are intermittent, and insufficiently predictable, requiring hybridization with systems more under human control. For another, some RETs forms, such as biofuels compete with arable land and irrigation water with food crops. If not implemented with great care, they may have adverse social and economic consequences,

RETs easily have the potential to replace all current and foreseeable use of fossil fuels, for power generation, transportation, and industrial use, for all time to come. RETs represent a range of specific conversion pathways and technologies. These are at different stages of deployment, innovation, and basic research. Some that are fully established commercially, e.g. biomass combustion and gasification based power generation need up-scaling through policies and regulations that would permit some unique deployment models to be operationalized. In other cases, where commercial scale operation has been demonstrated, but costs are still high, with the possibility that increased scale and further innovation in both technology and deployment models will reduce costs, tariff and regulatory support for a limited period may be needed. Where technologies have been demonstrated at laboratory scale, further R&D to enable pilot and commercial scale demonstration may involve facilitation of industry and research laboratory partnerships, and may also involve public fiscal (investment) support.

4.2.1. RETs For Power Generation

Power generation technologies based on renewable energy flows comprise the following major primary sources: Biomass, Hydropower, Solar, and Wind. Technologies in each of these primary sources have already been deployed in India at commercial scale, but there remain several challenges in respect of policies and regulations, R&D and transfer of technologies, costs and financing, and deployment models, that need to be addressed in order to ensure their mainstreaming in the commercial power sector.

4.2.1.1. Biomass Based Power Generation Technologies

Biomass based technologies include those involving primary biomass combustion, and those that do not involve direct biomass combustion, but may involve conversion to a secondary energy form.

Historically, primary biomass combustion has been the main source of energy for India. The Integrated Energy Policy (Planning Commission, 2006) has estimated that around 80 mtoe is currently used in the rural household sector. In addition, the Ministry of New and Renewable Energy has estimated state-wise gross and net availability of agro-residues for power generation.

There are two basic technology pathways for biomass for power options currently being implemented. These technologies are *Straight Biomass Combustion* and Biomass *Gasification.*

4.2.1.1.1. Costs and Financing

Plant capacities for straight primary biomass combustion are not very large due to limited radius of economic biomass collection. Investment cost for biomass combustion based power projects or co-generation projects varies between Rs. 4 to Rs. 5 crores per MW, depending upon project site, design and operation related factors. The cost of electricity generation is around Rs. 3/kWh depending upon specific fuel consumption, which in turn depends on type of fuel and operating pressure of the boiler and steam turbine. This technology is, thus, generally cost-competitive with conventional power delivered by the grid to rural areas.

In respect of biomass gasification technologies, the investment cost, with IC engines as source of power generation, comes between Rs. 25,000 – 60,000 / kW, depending on the type of gasification system and type of fuel, including costs of gasifier and IC engine. The cost of electricity generation cost varies between Rs.3 kWh to Rs. 5/kWh for the currently available technologies in India.

In both cases, the costs of biomass collection and transportation are key issues, which limit scale of operation of individual units.

4.2.1.1.2. Co-benefits

Biomass based power technologies avoid problems associated with ash disposal from coal based plants. The ash from the biomass combustion may be returned to the fields to enhance agricultural productivity. If the biomass is grown in energy plantations on wastelands or common/panchayat lands, there would be increase in rural employment, besides water, and soil conservation. T&D losses would be very low especially in decentralized systems, and deployment can be done independently of

the national grid and integrated with the national grid when extended.

4.2.1.1.3 Research & Development

The technology for power generation through straight primary biomass combustion is mature, with significant commercial deployment. R&D is required for compacting different types of biomass for transportation, and improved boiler design to enable the use of multiple biomass feedstocks.

One significant area of R&D is development of hot gas cleaning systems and optimum integration with the gasifiers. Another is the development of gasifier systems based on charcoal and pyrolized biomass, since volatile distillates of biomass feedstock may have significant economic value, which would be lost if the biomass is directly burned.

4.2.1.1.4. Technology Transfer and Capacity Building

Biomass gasifiers available in the country are of very low capacity compared to European and American gasifiers, where the capacities vary from 1 MW to 100 MW. Biomass gasifiers with capacities upto 100 MW based on Circulating Fluidised Bed (CFB), Bubbling Fluidised Bed (BFB) and Pressurised Fluidised bed (PFB) are available in the USA, Finland and UK. Transfer of these technologies, and where necessary adaptive R&D, would enable deployment models involving energy plantations on wastelands or common/panchayat lands which would not compete with food crops.

Capacity building needs include support to commercial demonstration by entrepreneurs of biomass based distributed generation systems and using these as training facilities for local entrepreneurs and O&M personnel. Such demonstration and skills development would enable accelerated deployment of these technologies.

***4.2.1.2.** Small-scale Hydropower*

Hydropower, both large (reservoir storage) and small scale, accounts for 18% of the total electricity generated in India. Of the total estimated large hydropower potential of 148,700 MW (storage and run-of-river), so far only 35,000 MW has been utilized. In addition, there are 56 assessed sites for pumped storage hydropower, totaling 94,000 MW. The total small hydropower (upto 25 MW) potential is 15,000 MW, of which only 1905 MW has been utilized. Large-scale hydropower with reservoir storage is the cheapest conventional power source in India. Small-scale hydropower is cost competitive with conventional generation options, in particular for rural electrification. In remote rural locations far away from the grid, it may be the only feasible and economic power option.

The technology options for hydropower at all scales are commercially well established, except in the pico-turbine ranges i.e. < 1 kW.

4.2.1.2.1. Costs and Financing

The cost of generation ranges from Rs. 2 to 4 per kWh. The capital costs are higher than for conventional power, and usually in the range of Rs. 7 crore per MW.

4.2.1.2.2. Co-benefits

Small hydropower displaces diesel gensets, thereby avoiding local pollution. By thus avoiding consumption of petroleum products, it also promotes energy security. Small hydropower is generally more predictable than solar or wind based sources, with variations occurring over the year, rather than on a hourly or daily basis.

4.2.1.2.3. Research & Development and Capacity Building

The following are priorities for R& D:

- Design of pico turbines (< 500W range): This would enable very small scale generation at the household level, based on local hydro resources
- Electronic Load Controller for micro hydro: This would enable supply of power from micro-hydel sources to village level grids
- Cost reductions in E&M
- Standardizing the modules and optimizing the usage of materials is critical for reducing equipment, and hence generation, costs
- Support to commercial demonstration by entrepre-

neurs of small/micro-hydel based distributed generation systems, in particular in remote locations, and using these as training facilities for local entrepreneurs and O&M personnel would help develop this sector.

4.2.1.3. Wind Energy

The installed capacity for using wind energy has gone up rapidly during the last few years (presently about 8000 MW). However, the capacity utilization factors are low due to the variations in the wind flow. Action is required to design, develop and manufacture small wind energy generators (WEGs) upto 10 kW capacity, that can generate power at very low speeds (~ 2 to 2.5 m/sec). Effort is also required for the development of low weight carbon fiber and other new generation composites, etc. for use in wind turbines.

An encouraging sign is the strong interest of the private sector in the wind area. Some Indian private companies are involved in setting up wind turbines in other countries in a big way.

4.2.2 Grid Connected Systems

The Electricity Act, 2003 and the National Tariff Policy, 2006, provide for both the Central Electricity Regulatory Commission (CERC) and the State Electricity Regulatory Commissions (SERC) to prescribe a certain percentage of total power purchased by the grid from renewable based sources. It also prescribes that a preferential tariff may be followed for renewables based power.

The following enhancements in the regulatory/tariffs regime may be considered to help mainstream renewables based sources in the national power system:

- (i) A dynamic minimum renewables purchase standard (DMRPS) may be set, with escalation each year till a pre-defined level is reached, at which time the requirements may be revisited. It is suggested that starting 2009-10, the national renewables standard (excluding hydropower with storage capacity in excess of daily peaking capacity, or based on agriculture based renewables sources that are used for human food) may be set at 5% of total grids purchase, to increase by 1% each year for 10 years. SERCs may set higher percentages than this minimum at each point in time.

- (ii) Central and state governments may set up a verification mechanism to ensure that the renewables based power is actually procured as per the applicable standard (DMRPS or SERC specified). Appropriate authorities may also issue certificates that procure renewables based power in excess of the national standard. Such certificates may be tradeable, to enable utilities falling short to meet their renewables standard obligations. In the event of some utilities still falling short, penalties as may be allowed under the Electricity Act 2003 and rules thereunder may be considered.

- (iii) Procurement of renewables based power by the SEBs/other power utilities should, in so far as the applicable renewables standard (DMRPS or SERC specified) is concerned, be based on competitive bidding, without regard to scheduling, or the tariffs of conventional power (however determined). Further, renewables based power may, over and above the applicable renewables standard, be enabled to compete with conventional generation on equal basis (whether bid tariffs or cost-plus tariffs), without regard to scheduling (i.e. renewables based power supply above the renewables standard should be considered as displacing the marginal conventional peaking capacity). All else being equal, in such cases, the renewables based power should be preferred to the competing conventional power.

4.2.3. RETs for Transportation and Industrial Fuels

Internal combustion engine based power plants for transportation modes require liquid or gaseous fuels. In addition, rail (inc. LRT) modes, and some niche personal transportation modes are based on storage battery power, which may be recharged from mains outlets. The focus in this section is on liquid fuels of biological origin for transportation, and industrial applications (prime-movers, heating fuels).

4.2.3.1. Technology Pathways

There are several possible pathways for deriving transportation and industrial fuels (not being feedstocks where the chemical composition rather than energy content is the main consideration).

At present, only biodiesel sourced from Jatropha or Pongamia plantations, and bioethanol using spoilt foodgrains are cost-effective in relation to petroleum based fuels. While significant R&D is being carried out in several countries, including in India, in respect of technologies based on several of the above pathways, at present, the costs are not competitive with petroleum. However, it is probable that several biofuels technologies would eventually become competitive with petroleum, and the policy/regulatory regime must enable them to be commercially deployed when that happens.

4.3. Disaster Management Response to Extreme Climate Events

With projected increases in the frequency and intensity of extreme events including cyclones, droughts, and floods attributable to climate change, disaster management needs greater attention. In the 11th Plan, the approach towards disaster management has moved from relief to prevention, mitigation, and preparedness. Two main planks of the new approach are mainstreaming disaster risk reduction into infrastructural project design and strengthening communication networks and disaster management facilities at all levels.

4.3.1. Reducing Risk to Infrastructure through Better Design

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 Programme may include:

- Disaster-specific vulnerability assessments and sectoral impacts assessments at the state and district level for preparing contingency plans
- Maintenance of critical facilities such as health care services and water supplies
- 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
- Capacity building among design engineers, project planners and financial institutions on incorporating elements of disaster management
- Development of prefabricated structures instead of cast-in-place construction in vulnerable areas
- Enforcement of building codes; better urban planning and zoning of vulnerable areas

4.3.2. Strengthening Communication Networks and Disaster Management Facilities

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:

- Upgrading forecasting, tracking and early warning system for cyclones, floods, storms and tsunami
- Monitoring river flows and mapping flood zones
- Generation of regional scenarios based on single or multi-hazard mapping
- 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

4.4. Protection of Coastal Areas

The coastal areas are an important and critical region for India not only because of the vast 7500-km coast-

line but also because of the density of population and livelihoods dependant on coastal resources. Coastal zones are particularly vulnerable and sensitive to such impacts of climate change as rise in the sea level, rise in the high-tide level, and cyclones and storms, which are projected to become more frequent and intense. The programme will focus on two elements, namely (1) coastal protection and (2) early warning systems. Priority areas on coastal zones include:

- Development of a regional ocean modelling system especially in the Bay of Bengal and the Arabian Sea
- High-resolution coupled ocean–atmosphere variability studies in tropical oceans, in particular the Indian Ocean
- Development of a high-resolution storm surge model for coastal regions
- Development of salinity-tolerant crop cultivars
- Community awareness on coastal disasters and necessary action; plantation and regeneration of mangroves
- Timely forecasting, cyclone and flood warning systems
- Enhanced plantation and regeneration of mangroves and coastal forests

4.5 Health Sector

The proposed programme comprises two main components, namely provision of enhanced public health care services and assessment of increased burden of disease due to climate change. Areas that can contribute to enhanced health care services include the following:

- Providing high-resolution weather and climate data to study the regional pattern of disease
- Development of a high-resolution health impact model at the state level
- GIS mapping of access routes to health facilities in areas prone to climatic extremes
- Prioritization of geographic areas based on epidemiological data and the extent of vulnerability to adverse impacts of climate change
- Ecological study of air pollutants and pollen (as the triggers of asthma and respiratory diseases) and how they are affected by climate change
- Studies on the response of disease vectors to climate change
- Enhanced provision of primary, secondary, and tertiary health care facilities and implementation of public health measures, including vector control, sanitation, and clean drinking water supply

4.6. Creating Appropriate Capacity at Different Levels of Government

In view of several new initiatives that would be required, both in respect of adaptation and mitigation, creation of knowledge and suitable capacity at each level of Government to facilitate implementation of appropriate measures assumes great importance.

At the level of the central government, there would be a need to carry out the following:

There should be support to relevant policy research to ensure that adaptation and mitigation takes place in a manner that enhances human well-being, while at the same time minimizing societal costs. This should lead to the design of suitable legal, fiscal and regulatory measures.

Appropriate capacity for implementing R&D activities and promoting large-scale public awareness and information dissemination on various aspects of climate change is required. For adequate R&D activities a proactive approach favouring partnerships between research organizations and industry would be efficient and productive.

At the level of state governments, several agencies would need to enlarge and redefine their goals and areas of operation. For instance, State Electricity Regulatory Commissions would need to concern themselves with regulatory decisions that ensure higher energy efficiency, greater use of renewable energy, and other low carbon activities that would ensure energy security, reduced local pollution, and increased access to energy in areas where distributed and decentralized forms of energy production would be economically superior to conventional methods. State governments may also employ

fiscal instruments to promote appropriate options and measures.

Local bodies would need to create capacity on regulatory measures, particularly for ensuring energy efficiency in new buildings as well as through a programme of retrofits. In respect of adaptation measures, local capacity and the involvement of communities in actions to adapt to the impacts of climate change would be crucial.

Public awareness on climate change would have to be spearheaded and driven by government at all levels. Emphasis on schools and colleges is essential.

In some cases legislation may be required at the central and state levels to arrive at appropriate delegation of responsibility and authority for meeting some of the goals mentioned above.

5. International Cooperation: the Multilateral Regime on Climate Change

As a party to the UN Framework Convention on Climate Change and its Kyoto Protocol, India plays an active role in multilateral cooperation to address climate change. These agreements are based on the principle of "*common but differentiated responsibilities and respective capabilities*" of Parties. Thus, they incorporate certain common commitments for all Parties, including an obligation to "*formulate and implement programmes containing measures to mitigate climate change*". Additionally, the Convention requires the developed countries (listed in its Annex I) to stabilize and reduce their greenhouse gas emissions and the Kyoto Protocol establishes quantified, time-bound targets in this regard. Countries with the most advanced economies (listed in Annex II of the convention) are also required to transfer financial resources and technology to developing countries for purposes of mitigation and adaptation.

The Convention specifically notes that "*per capita emissions in developing countries are still relatively low and…the share of global emissions originating in developing countries will rise to meet their social and development needs.*" The Convention also recognizes that "*economic and social development and poverty eradication are the first and overriding priorities of the developing country parties*." Thus, developing countries are not required to divert resources from development priorities by implementing projects involving incremental costs – unless these incremental costs are borne by developed countries and the needed technologies are transferred.

The Global Environmental Facility (GEF) finances implementation of projects in developing countries under the Convention. Additionally, the Kyoto Protocol created the Clean Development Mechanism (CDM), which allows developed countries to meet part of their emission reduction commitments by purchasing credits from emission reduction projects in developing countries, thus serving the dual objective of facilitating compliance by developed countries of their emission reduction commitments and of assisting developing countries to achieve sustainable development.

5.1. Some Technology Development and Transfer Issues

In the move towards a low-carbon economy, technology has a vital role to play. Technology solutions are also very important for enhancing adaptive capacity and reducing vulnerability to climate change and its impacts. In this respect, international cooperation in science and technology assumes great significance.

It is important to ensure that within the multilateral process under the UNFCCC, the menu of cooperation mechanisms is not constrained, and indeed, proactive measures are taken for these mechanisms to be used. The stage of the technology in terms of its progression from research to widespread market adoption will play an important role in determining the mechanisms that are appropriate and relevant.

For example, when the technology solutions are at a very early stage of development, the primary focus is usually on cooperation in basic scientific research. India has always been very actively engaged in, and is making key contributions to international scientific programmes that may have significant implications for the transition to a sustainable

energy future, such as the International Thermonuclear Experimental Reactor (ITER). At the individual and institutional level, Indian participation in scientific networks is also very strong. From a long-term perspective, this scientific cooperation will remain very important.

As ideas progress from the laboratory closer towards the market, the focus shifts towards technology design and development. Mechanisms that enable joint technology development involving public and private sector entities and with suitable norms for financing and IPR-sharing would be important for ensuring that the process of technology development and commercialization happens more rapidly and effectively.

For the final stage of deployment and market adoption of technologies in developing countries, two different contexts may be identified. For technologies that are already mature and deployed in the developed countries, appropriate financing models are essential, which may become operational through multilateral institutions, carbon markets and mechanisms like the CDM. However, as was noted earlier, given the somewhat limited role that the CDM appears to have played with regard to technology transfer, this issue will merit detailed examination.

However, the transition to a more sustainable energy future will require a much more rapid progression towards a variety of newer, low-carbon and energy efficient technologies in different areas. The usual mechanism considered for this purpose is that of technology transfer from the developed to the developing countries. The conventional model of technology transfer, considers that technology developed in the North is first established there, before it is supplied to the South. The rapid changes in the global economic and technology environment are making this model less applicable. As the experience so far also suggests, this model may be inadequate in terms of satisfying the scale and scope of the technology response required. New models and mechanisms for technology transfer will need to incorporate at least three key elements: appropriate funding modalities and approaches; a facilitative IPR environment, and enhancing the absorptive capacity within developing countries.

New multilateral technology cooperation funds may be required that would finance the development, deployment, diffusion and transfer of technologies for both mitigation and adaptation to developing countries.

One of the main barriers to technology adoption lies in the low absorptive capacities of developing countries. It is vital that mechanisms for technology transfer include measures that will enable the enhancement of absorptive capacities, keeping in mind the targets of such technology interventions.

5.2. Clean Development Mechanism

India has given host-country approval for 969 CDM projects as of June 2008. Renewable energy, including renewable biomass, accounted for the largest number of projects (533), followed by energy efficiency (303). Very few projects in the forestry (6) and municipal solid waste (18) sectors were included, despite their large potential. The expected investments in these 753 projects (if all go on stream) is about Rs. 106,900 crores.

Of the 969 projects, 340 projects have been registered by the multilateral Executive Board (CDM EB). India accounts for about 32% of the world total of 1081 projects registered with the CDM EB, followed by China (20%), Brazil (13%), and Mexico (10%) (Source: UNFCCC). About 493 million certified emission reductions (CERs) are expected to be generated until 2012 if all these host-country approved projects in India go on stream (National CDM Authority, November 2007). As of June 2008, 152.4 million CERs had been issued to projects worldwide, of which India accounted for 28.16%%, China (29.25%), Korea (17.87%), and Brazil (14.13%).

Some cross-cutting challenges in CDM implementation in India are listed below:

- The projects from India are generally small. Of the 283 projects registered with the CDM EB till October 2007, 63% are small-scale projects (in terms of the Protocol definition)
- The portfolio is dominated by unilateral projects,

i.e. the investors are Indian parties, employ locally available technologies, and use domestic financial resources. While this has provided a significant impetus to local innovation, CDM has not led to the technology transfer from industrialized to developing countries envisaged by the Protocol

- Industrialized countries have not participated significantly in project financing and the project risks are mostly taken up by the host industries
- Insurance companies in general have shown little interest in CDM, which is unfortunate since they can catalyse carbon trading by providing risk and financial analysis skills
- There is much subjectivity in the multilateral CDM process, and divergent interpretations are given by different designated operating entities (DOEs) accredited by the CDM EB
- High transactions costs prevent the small-scale sector (in the Indian definition) from participating in CDM
- In the absence of an international transactions log (ITL), there is lack of reliable information in the carbon market on CDM transactions

Despite the above, there is encouraging response from Indian entrepreneurs to the CDM across different sectors. Besides, several recent enhancements of CDM such as bundling and programmatic CDM need to be mainstreamed. Alongside the carbon market under the Kyoto Protocol, a voluntary (non-compliance) carbon market is emerging involving trades in VERs (verified emission reductions). This market may grow substantially in the future.

5.3. Enhanced Implementation of the UNFCCC

India looks forward to enhanced international cooperation under the UNFCCC. Overall, future international cooperation on climate change should address the following objectives:

- Minimizing the negative impacts of climate change through suitable adaptation measures in the countries and communities affected and mitigation at the global level
- Provide fairness and equity in the actions and measures
- Uphold the principle of common but differentiated responsibilities in actions to be taken, such as concessional financial flows from the developed countries, and access to technology on affordable terms

India as a large democracy, with the major challenge of achieving economic and social development and eradicating poverty, will engage in negotiations and other actions at the international level in the coming months that would lead to efficient and equitable solutions at the global level.

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