Forest Department,
Government of Tamil Nadu, India

# THE PREPARATORY SURVEY
# ON
# TAMIL NADU BIODIVERSITY CONSERVATION AND GREENING PROJECT

# FINAL REPORT

**SEPTEMBER 2010**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

---

**Nippon Koei Co., Ltd.**

| SAD |
| --- |
| CR (3) |
| 10-017 |

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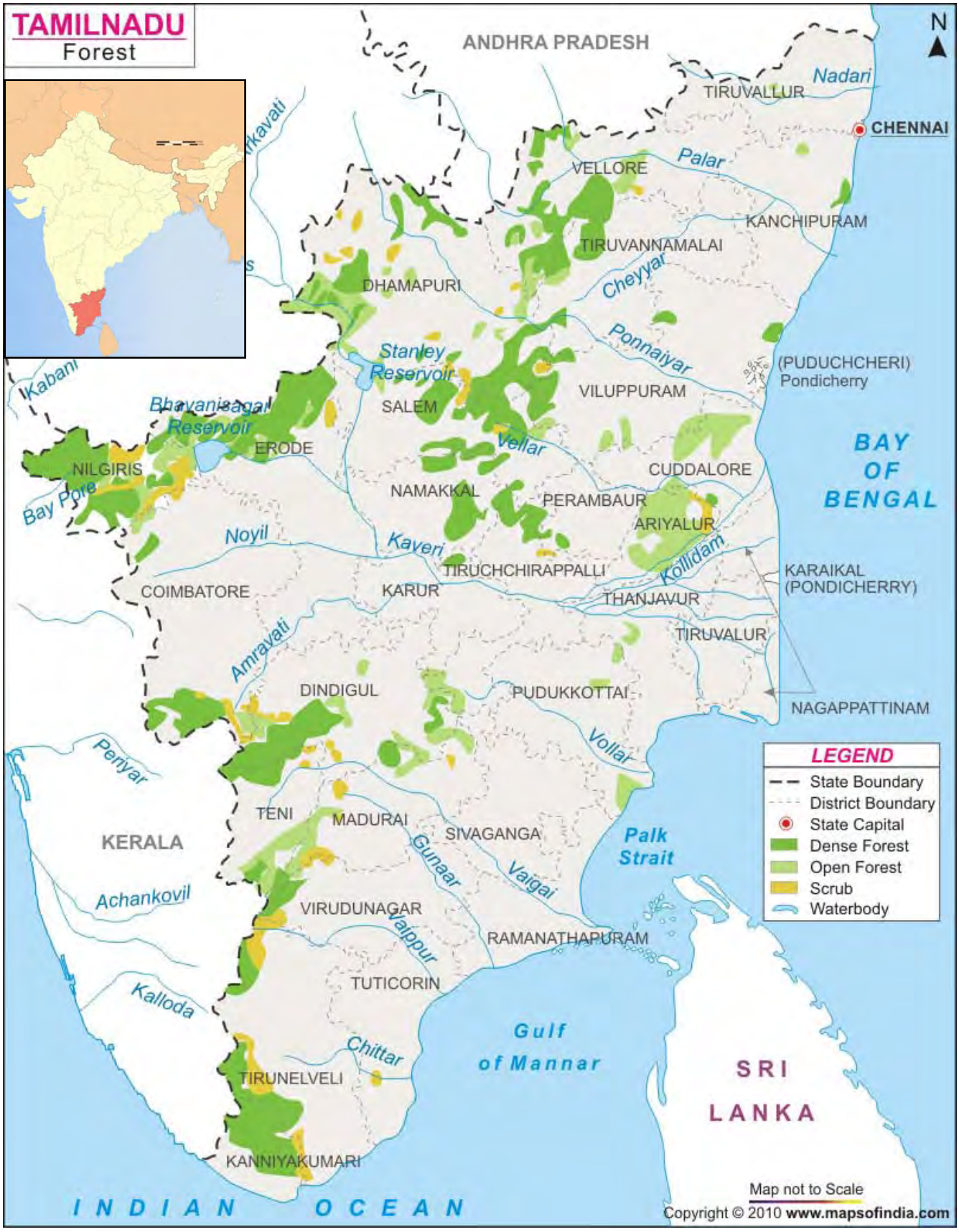
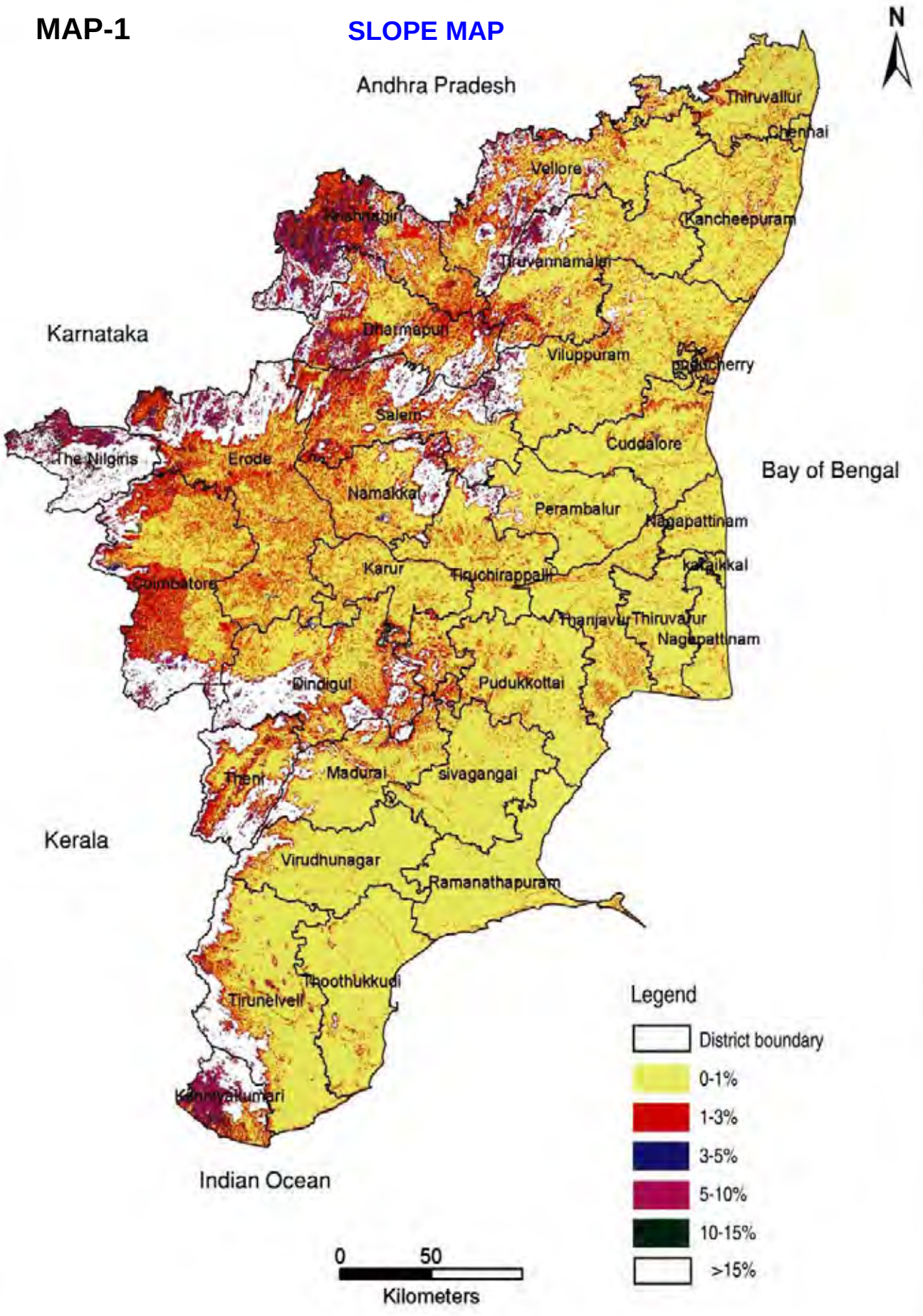
| Currency |
| --- |
| **US$ 1.0 = ¥ 87.7=INR 46.6**<br>**(Rates for JICA appraisal as of 6 August 2010)** |
| US$ = United State Dollar |
| ¥ = Japanese Yen |
| INR = Indian Rupee |




**Location Map**

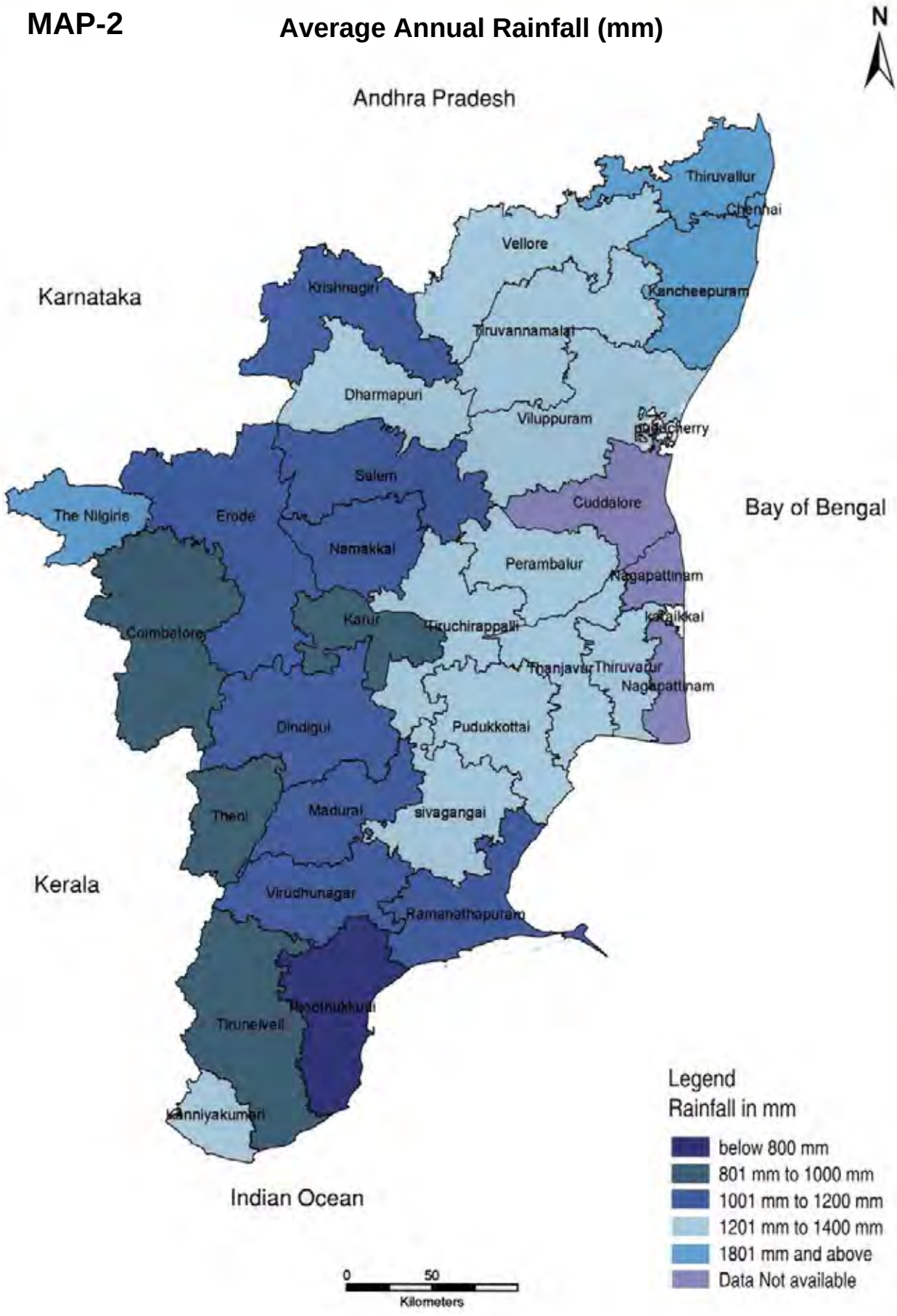
**MAP-1**

# SLOPE MAP



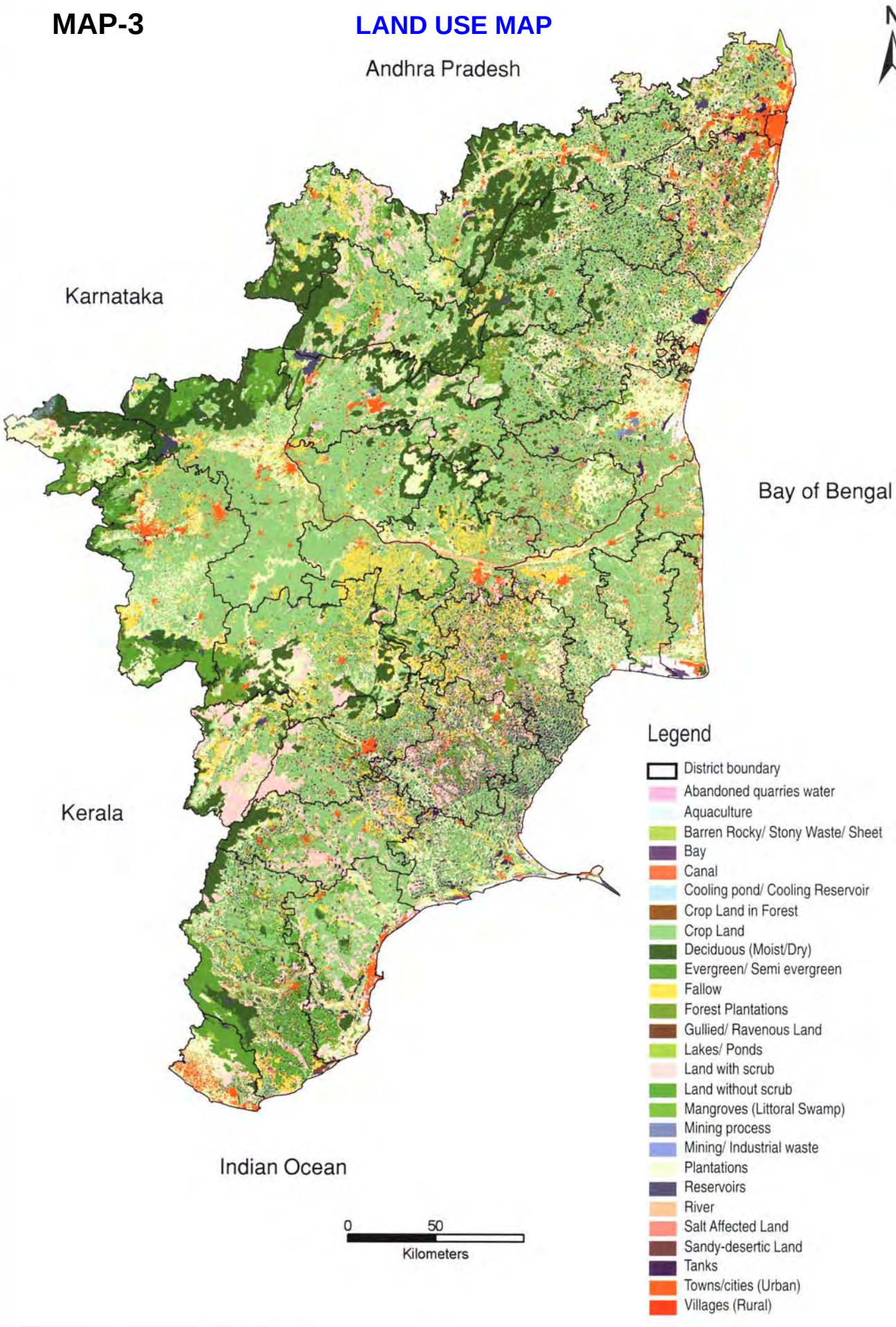
**MAP-2**

## Average Annual Rainfall (mm)



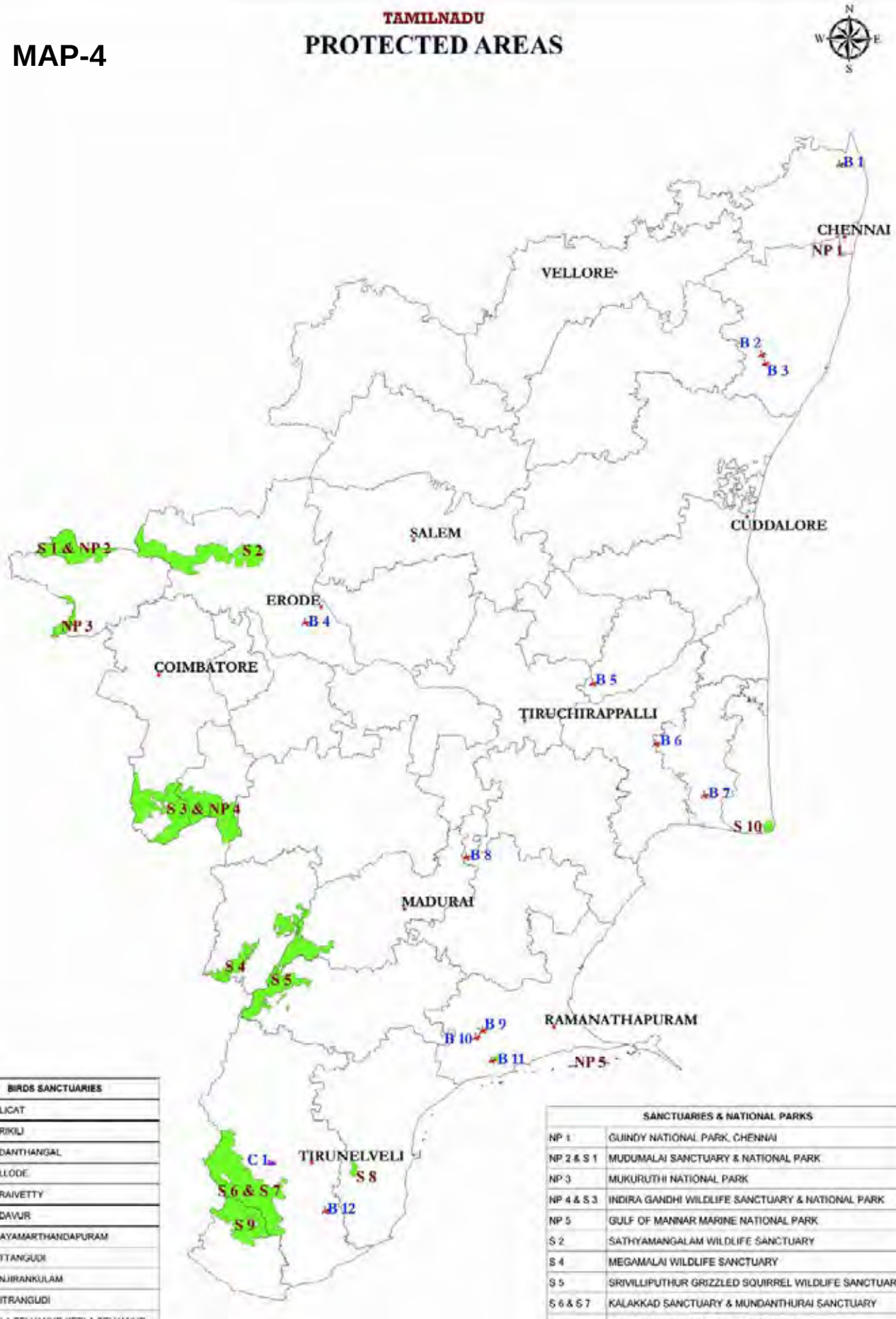
**MAP-3**

# LAND USE MAP



**MAP-4**

# TAMILNADU
# PROTECTED AREAS

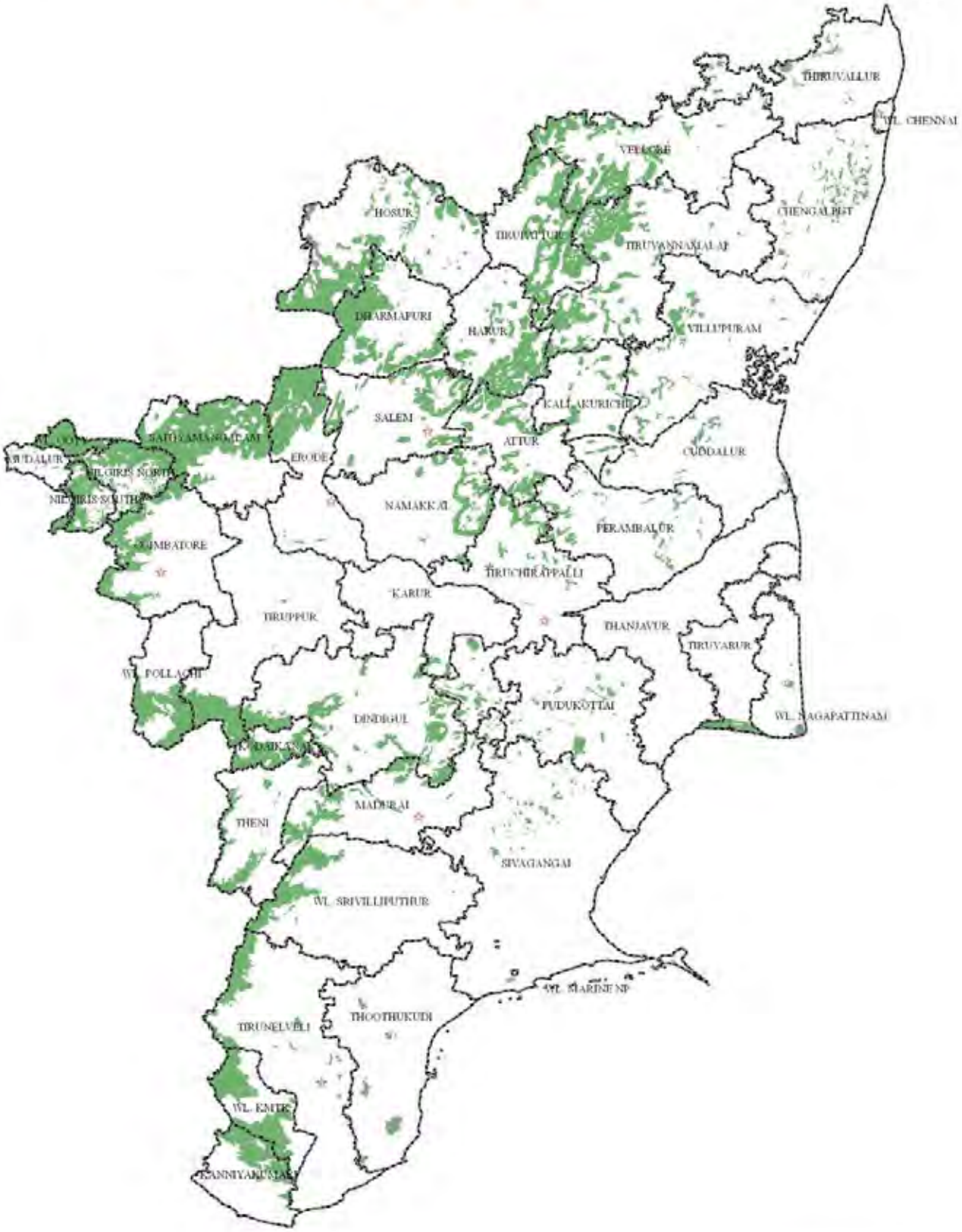



| BIRDS SANCTUARIES | |
|---|---|
| B 1 | PULICAT |
| B 2 | KARIKILI |
| B 3 | VEDANTHANGAL |
| B 4 | VELLODE |
| B 5 | KARAIVETTY |
| B 6 | VADAVUR |
| B 7 | UDAYAMARTHANDAPURAM |
| B 8 | VETTANGUDI |
| B 9 | KANJIRANKULAM |
| B 10 | CHITRANGUDI |
| B 11 | MELA SELVANUR-KEELA SELVANUR |
| B 12 | KOONTHANKULAM-KADANKULAM |
| C 1 | THIRUPPADIMARUTHUR C.R |

| SANCTUARIES & NATIONAL PARKS | |
|---|---|
| NP 1 | GUINDY NATIONAL PARK, CHENNAI |
| NP 2 & S 1 | MUDUMALAI SANCTUARY & NATIONAL PARK |
| NP 3 | MUKURUTHI NATIONAL PARK |
| NP 4 & S 3 | INDIRA GANDHI WILDLIFE SANCTUARY & NATIONAL PARK |
| NP 5 | GULF OF MANNAR MARINE NATIONAL PARK |
| S 2 | SATHYAMANGALAM WILDLIFE SANCTUARY |
| S 4 | MEGAMALAI WILDLIFE SANCTUARY |
| S 5 | SRIVILLIPUTHUR GRIZZLED SQUIRREL WILDLIFE SANCTUARY |
| S 6 & S 7 | KALAKKAD SANCTUARY & MUNDANTHURAI SANCTUARY |
| S 8 | VALLANADU BLACKBUCK SANACTUARY |
| S 9 | KANIYAKUMARI WILDLIFE SANCTUARY |
| S 10 | POINT CALIMERE SANCTUARY |

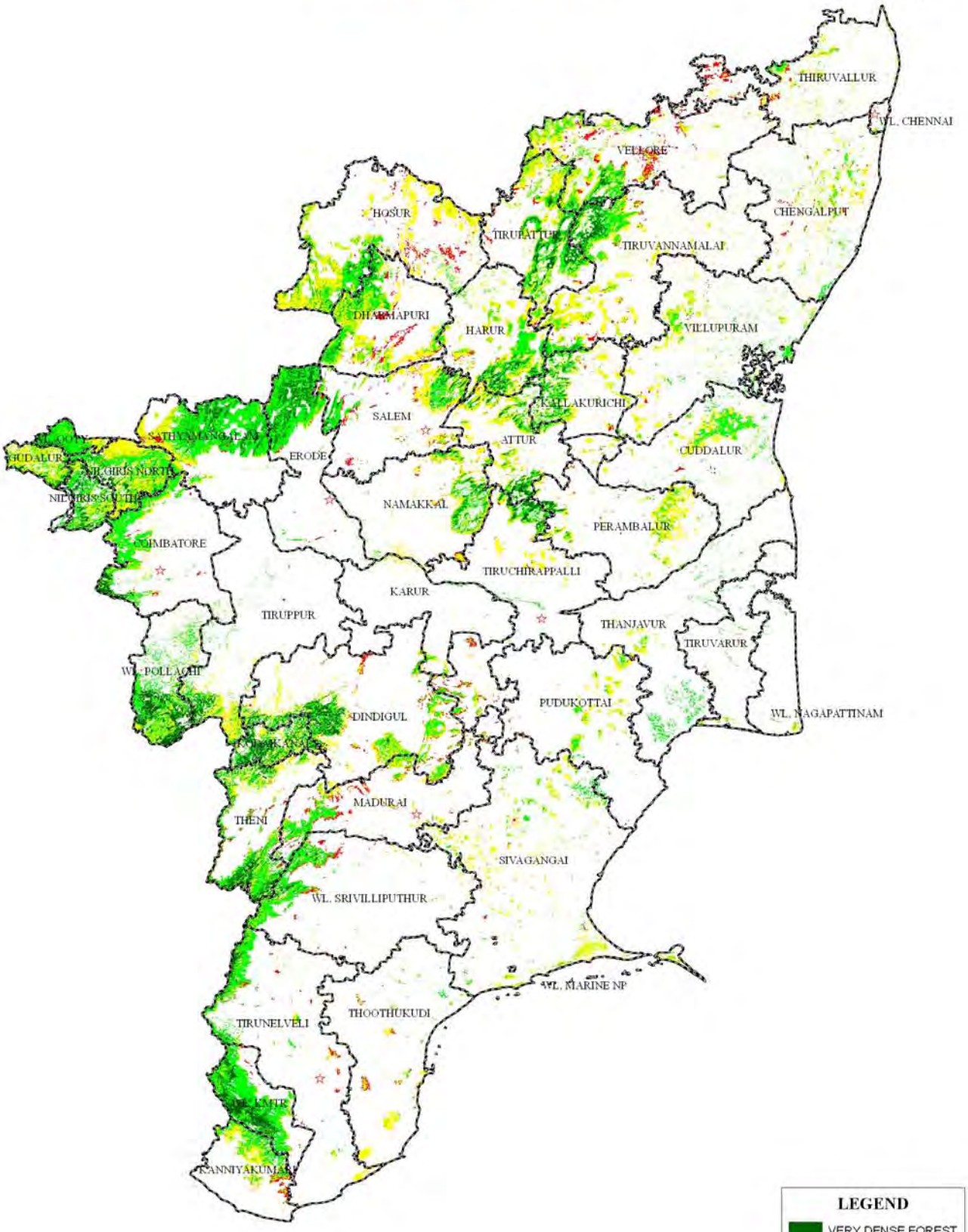
**MAP-5**

# TAMILNADU
## RESERVED FORESTS



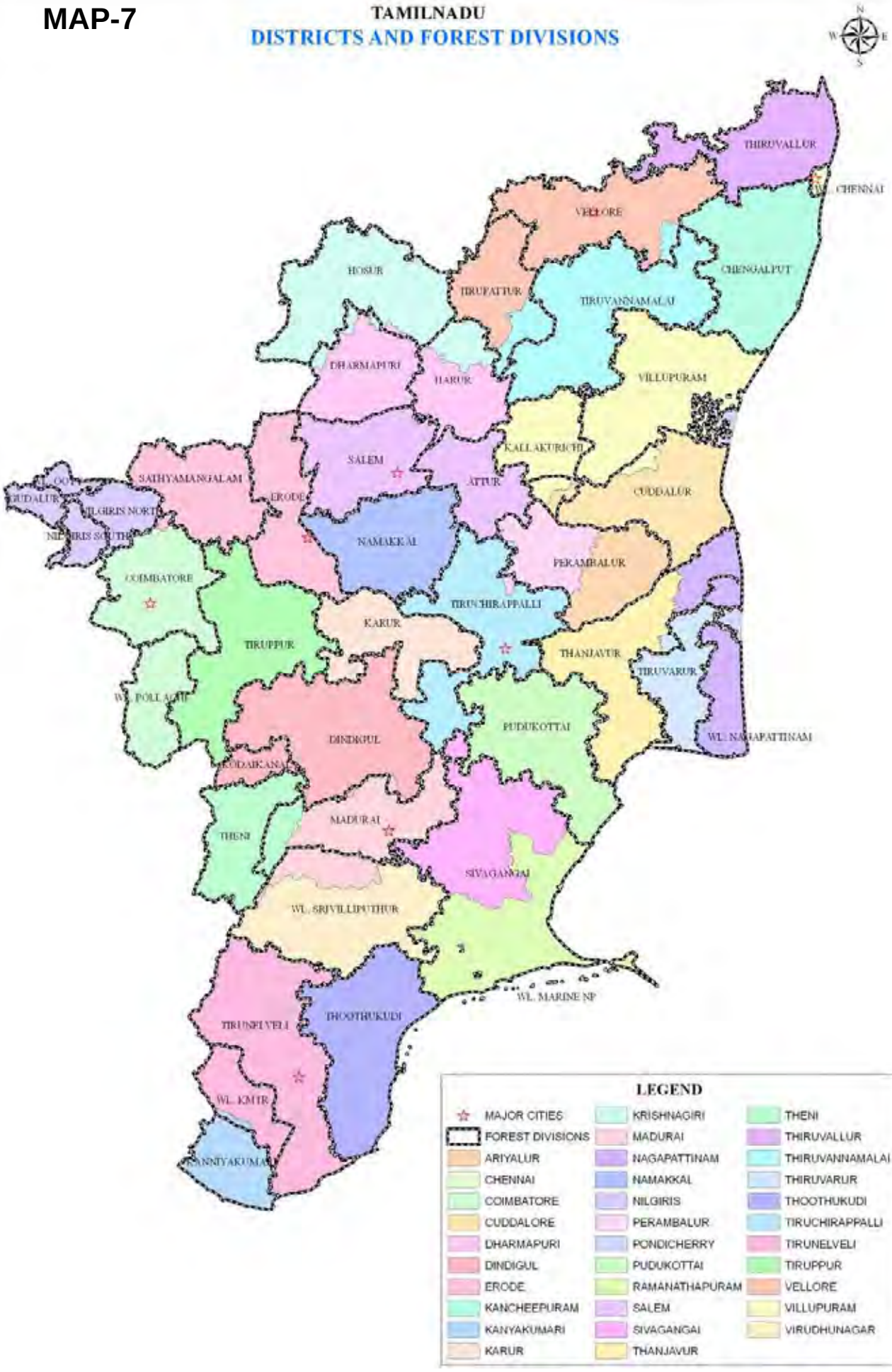
**MAP-6**

# TAMILNADU
## FOREST AND TREE COVER



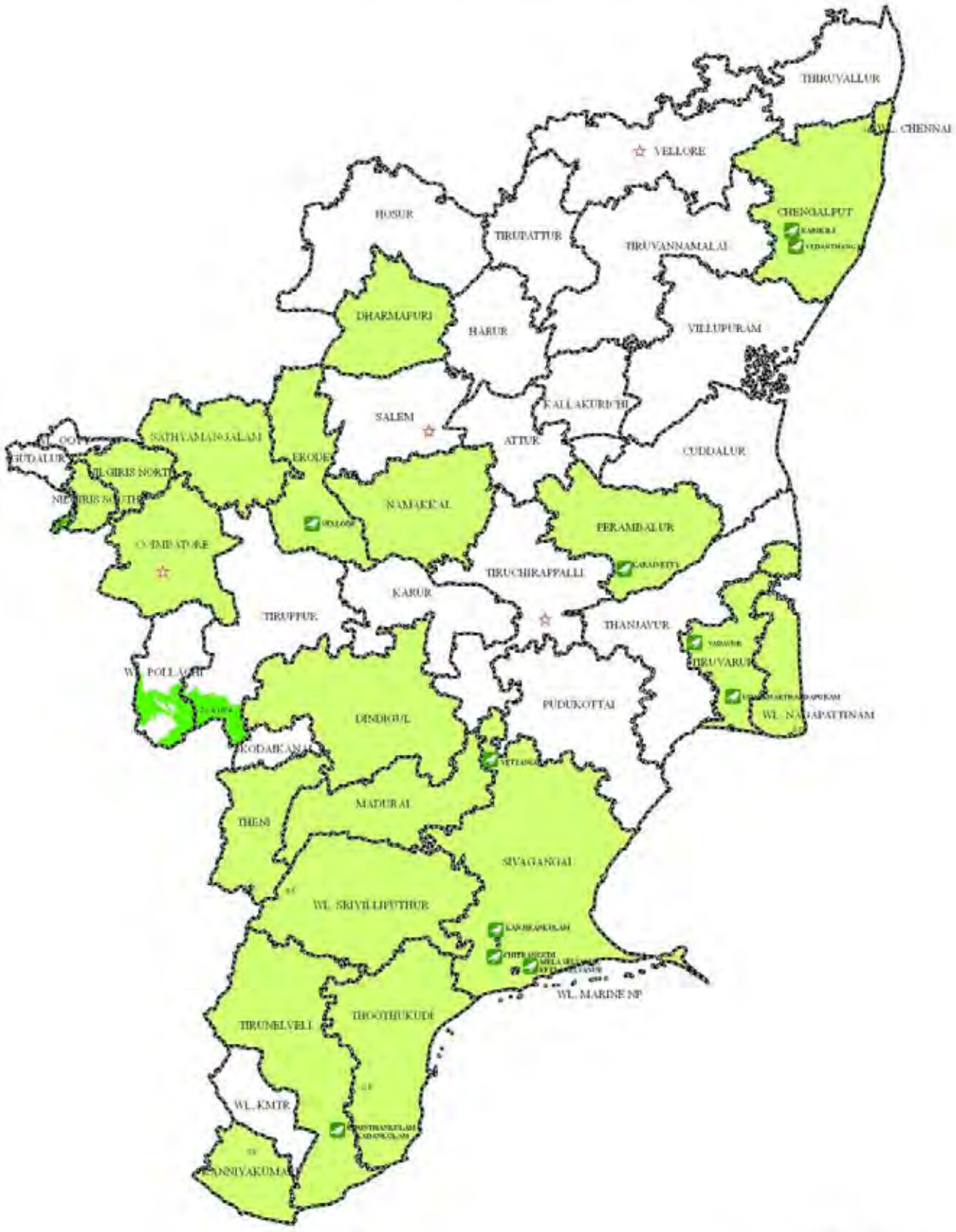
**MAP-7**

# TAMILNADU
## DISTRICTS AND FOREST DIVISIONS



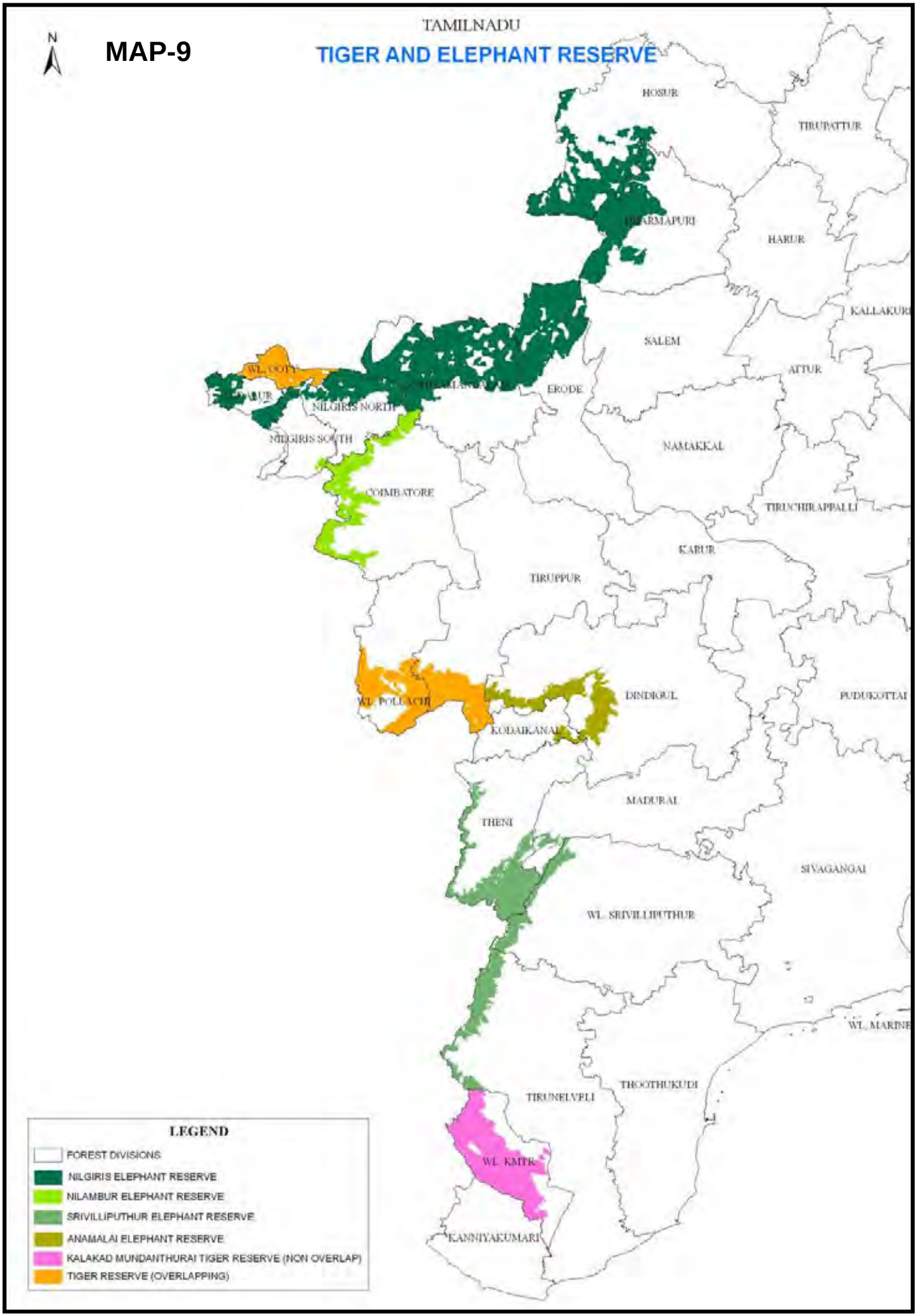
**MAP-8**

# TAMILNADU
## PROPOSED AREAS UNDER BIODIVESITY




**LEGEND**

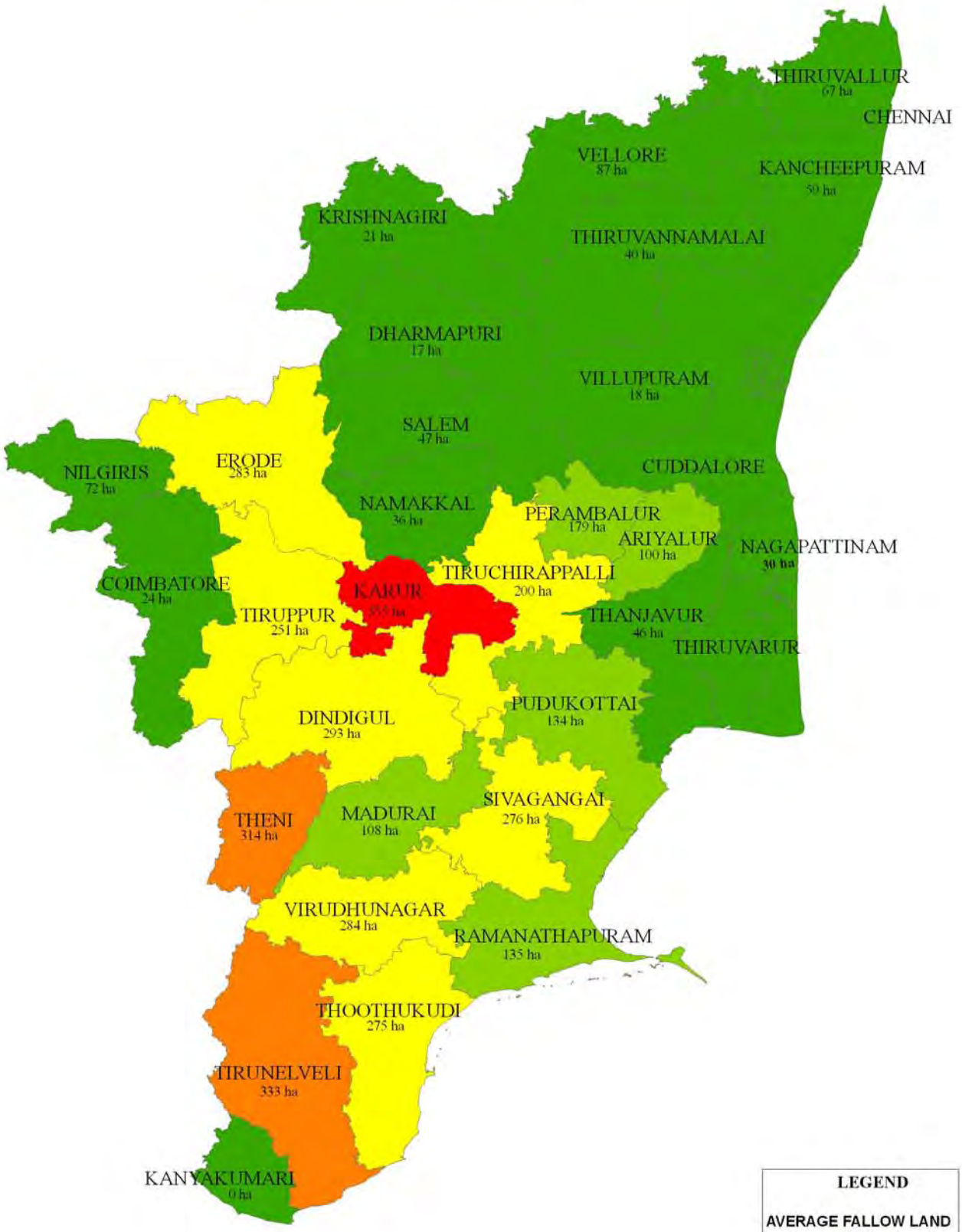
- ☆ MAJOR CITIES
- DIVISION BOUNDARY
- BIRDS SANCTUARYS
- SANCTUARIES & NATIONAL PARKS
- TARGET DIVISIONS-BIO DIVERSITY


TAMILNADU
TIGER AND ELEPHANT RESERVE
MAP-9
N
HOSUR
TIRUPATTUR
DHARMAPURI
HARUR
KALLAKURI
SALEM
ATTUR
ERODE
NAMAKKAL
NILGIRIS NORTH
NILGIRIS SOUTH
COIMBATORE
TIRUCHIRAPPALLI
KARUR
TIRUPPUR
DINDIGUL
PUDUKOTTAI
KODAIKANAL
MADURAI
THENI
SIVAGANGAI
WL. SRIVILLIPUTHUR
WL. MARINE
THOOTHUKUDI
TIRUNELVELI
KANNIYAKUMARI
LEGEND
FOREST DIVISIONS
NILGIRIS ELEPHANT RESERVE
NILAMBUR ELEPHANT RESERVE
SRIVILLIPUTHUR ELEPHANT RESERVE
ANAMALAI ELEPHANT RESERVE
KALAKAD MUNDANTHURAI TIGER RESERVE (NON OVERLAP)
TIGER RESERVE (OVERLAPPING)

TAMILNADU

**MAP-10**

## AVERAGE FALLOW LAND PER VILLAGE



# The Preparatory Survey on Tamil Nadu Biodiversity Conservation and Greening Project

# Final Report

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**Location Map**
**Thematic Maps**

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## Abbreviations

| | |
|---|---|
| ABS | Access and Benefit Sharing of Genetic Resources |
| AG | Auditor General |
| APCCF | Additional Principal Chief Conservator of Forests |
| AOFFPS | Area Oriented Fuel Wood and Fodder Project Scheme |
| AR-CDM | Afforestation/Reforestation Clean Development Mechanism |
| ASTRPS | Association fo ST and Rural Poor in Regeneration of Degraded Forests |
| ATR | Anamalai Tiger Reserve |
| AWG-LCA | Ad Hoc Working Group on Long-Term Cooperative Action |
| AWP | Annual Work Plan |
| BAP | Bali Action Plan |
| BMC | Biodiversity Management Committees |
| BPL | Below Poverty Line |
| BS | Bird Sanctuary |
| BZA | Buffer Zone Activities |
| CBD | Convention on Biological Diversity |
| CCF | Chief Conservators of Forest |
| CDM | Clean Development Mechanism |
| CF | Conservators of Forest |
| CR | Conservation Reserve |
| CRMC | Conservation Reserve Management Committee |
| COP | Conference of Parties |
| DFO | District Forest Officer |
| DF/R | Draft Final Report |
| DIT | Department of Information Technology |
| DPMU | District Project Management Unit |
| DPR | Detailed Project Report |
| DSM | Demand-side Management |
| EAG | Economic Activity Group |
| ELCOT | Electronics Corporation of Tamil Nadu |
| FDA | Forest Development Agency |
| FSI | Forest Survey of India |
| GFR | General Financial Rules |
| GDM | Green Development Mechanism |
| GEF | Global Environment Facility |
| GHG | Greenhouse Gas |
| GIM | Green India Mission |
| GO | Government Order |
| GOI | Government of India |
| GOJ | Government of Japan |
| GRB | General Rules of Business |
| HLEC | High Level Empowered Committee |
| HOFF | Head of Forest Force |
| IAEPS | Integrated Afforestation and Eco-development Project Scheme |
| IFGTB | Institute of Forest Genetics and Tree Breeding |
| IFS | Indian Forest Service |
| JBIC | Japan Bank for International Cooperation |
| JFM | Joint Forest management |
| JICA | Japan International Cooperation Agency |
| KMTR | Kalakad Mundanthurai Tiger Reserve |
| LOC | Letter of Credit |
| M&E | Monitoring and Evaluation |
| MDF | Moderately Dense Forests |
| MDPU | Multi Disciplinary Project Management Unit |
| MIS | Management Information System |
| MoEF | Ministry of Environment and Forest |

| | |
|---|---|
| MOU | Memorandum of Understanding |
| MP | Marine Park |
| MTR | Mudumalai Tiger Reserve |
| MVR | Monitoring, Verification and Reporting |
| NABARD | National Bank for Agriculture and Rural Development |
| NAPCC | National Action Plan on Climate Change |
| NBA | National Biodiversity Authority |
| NeGP | National e- Governance Action Plan |
| NFP | National Forest Policy |
| NGO | Non Government Organization |
| NP | National Park |
| NTFP | Non Timber Forest Products |
| NWAP | National Wildlife Action Plan |
| ODA | Official Development Assistance |
| OECF | Overseas Economic Cooperation Fund |
| OF | Opens Forests |
| PA | Protected Area |
| PCCF | Principal Chief Conservator of Forests |
| PES | Payment for Environmental Services |
| PFT | Project Facilitation Team |
| PMU | Project Management Unit |
| PSC | Project Steering Committee |
| PWDT | Public Works Department Tank |
| RED | Reducing Emissions from Deforestation |
| REDD | Reducing Emission from Deforestation and Forest Degradation |
| RET species | Rare, Endemic and Threatened species |
| RF | Reserved Forest |
| RL | Reserve Land |
| SBB | State Biodiversity Board |
| SCI | Supreme Court of India |
| SFR | State of Forest Report |
| SFRI | State Forest Research Institute |
| SGVSY | Samnavit Gram Vanikaran Samridhi Yojana |
| SIDA | Swedish International Development Cooperation Agency |
| SPMU | State Project Management Unit |
| TAP | Tamil Nadu Afforestation Project |
| TCPL | Tree Cultivation on Private Land |
| TNA | Training Needs Analysis |
| TNFA | Tamil nadu Forest Academy |
| TNFD | Tamil Nadu Forest Department |
| TNFS | Tamil Nadu Forest Service |
| TNFTC | Tamil Nadu Forestry Training College |
| TNSWAN | Tamil Nadu State Wide Area Network |
| TWAD | Tamil Nadu Water Supply and Drainage Board |
| UNDP | United Nation Development Program |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VC | Video Conferencing |
| VDF | Very Dense Forest |
| VFC | Village Forest Council |
| VPN | Virtual Private Network |
| VPRC | Village Poverty Reduction Committee |
| WLS | Wildlife Sanctuary |
| WPA | Wildlife (Protection) Act 1972 |
| WPR | Worker Population Ratio |
| WRO | Water Resource Organization |
| WUA | Water Users Association |

**The Preparatory Survey**
**on**
**Tamil Nadu Biodiversity Conservation and Greening Project**

**Final Report**

# PART I: EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

## Project Rationale

The Western Ghats, together with Sri Lanka, is one of the world's 34 biodiversity hotspots. The Government of India has recently (2010) nominated it for inclusion in the World Heritage List due to its importance. As a signatory to the Convention on Biological Diversity , India is obliged to identify and monitor the components of biological diversity that are important for its conservation and sustainable use. This obligation requires extensive field surveys to prepare the inventory of species and ecosystems of which they are a part. This also provides a benchmark, or record in time and space, against which future changes can be measured. Such surveys and repeat surveys provide the means of monitoring changes in biological diversity, assessing its conservation status and informing its management. The Project provides a major opportunity to improve information and access to knowledge on the diversity, distribution and conservation status of plant and animal species within Tamil Nadu's existing protected areas and reserve forests, particularly with respect to those comprising part of the Western Ghats.

Meanwhile the fast growing economy and degradation of forest resources have led to the increasing demand-supply gap of forest products and have caused pressure on natural forests. In order to effectively or sustainably achieve the biodiversity conservation in natural forest areas, it is essential to address the issues. It will contribute to mitigation of severe climate change phenomenon required by United Nations Framework Convention on Climate Change (UNFCCC).

## Project Objectives

Tamil Nadu Biodiversity Conservation and Greening Project (hereinafter called "the Project") aims to strengthen biodiversity conservation by improving ecosystem and the management capacity as well as undertaking tree planting outside the recorded forest areas, thereby contributing to environmental conservation and harmonized socio-economic development of Tamil Nadu

## Project Components

The project entails following six (3) components and consulting services:

| **Project Components and sub-components** |
|---|
| **1. Biodiversity Conservation**<br>1.1 Habitat restoration, enhancement and management<br>1.2 Resource protection<br>1.3 Mitigate human-wildlife conflict<br>1.4 Ecologically sustainable development |
| **2. Increasing the Natural Resource Base**<br>2.1 Tree cultivation on private land<br>2.2 Research on production forestry / agro-forestry / farm forestry |
| **3. Support Activities**<br>3.1 Capacity development<br>3.2 Monitoring and evaluation<br>3.3 Construction of buildings<br>3.4 Augmentation of office facilities & equipment<br>3.5 Strengthening mobility<br>3.6 Project management |
| **4. Consulting Services** |

## Proposed Features of the Project

### 1. Biodiversity Conservation

**1.1 Habitat restoration, enhancement & management**

1.1.1 Strengthen wetland planning and management
- ✧ **Target areas**: 11 bird sanctuaries, Point Calimere WLS (and Tirupudaimaruthur CR and Pulicat Lake BS for training of the staff)
- ✧ **Activities**: Training, wetland management planning, habitat enhancement (e.g., introduction of native wetland flora), survey & monitoring, and documentation & information sharing

1.1.2 Improve critical habitats (terrestrial and aquatic)
- ✧ **Target areas**: 15 sites: 5 PAs and 10 Divisions in Elephant Reserves
- ✧ **Activities**: Training, survey & monitoring, phased removal of invasive species

1.1.3 Conserve critically endangered/ endangered species of flora and fauna
- ✧ **Target areas**: 7 PAs, 10 Divisions in Elephant Reserves, 8 sites in east coast (for dugong and sea turtles), Nadugani and other sites to be identified
- ✧ **Activities:** Develop and implement species conservation plans, survey & monitoring, and documentation

1.1.4 Improve management of water, habitat and herbivores in Guindy National Park
- ✧ **Target areas**: Guindy National Park, Chennai
- ✧ **Activities:** Training, water resource management planning and implementation (including construction of waterholes and water supply facilities), and removal of invasive species

1.1.5 Improve management of water, habitat and herbivores in Vallanadu Black Buck Sanctuary
- ✧ **Target areas**: Vallanadu Blackbuck Sanctuary
- ✧ **Activities**: Construction of waterholes (check dams), clearance of woody scrub, supplement grass cover, and training

1.1.6 Improve management of water in PAs and RFs
- ✧ **Target areas**: 16 sites: 6 PAs and 10 Divisions within elephant reserves
- ✧ **Activities**: Develop water management strategy and action plan, construction of waterholes and check dams.

1.1.7 Monitor impacts of climate change on biodiversity
- ✧ **Target areas**: 6 PAs and 4 RF's: Point Calimere WLS, Pitchavaram, Kanyakumari WLS, Vallanadu Blackbuck Sanctuary, Grizzled Giant Squirrel WLS, Megamalai WLS and Mukurti NP, Pachamalai, Javadis, Harur
- ✧ **Activities**: Long-term monitoring and analysis of the impacts of climate change on biodiversity including baseline survey

**1.2 Resource protection**

1.2.1 Strengthen resource protection
- ✧ **Target areas**: 16 PAs: 6 sanctuaries and 10 Divisions within elephant reserves
- ✧ **Activities**: Strengthening field protection staff and consolidation of forest boundaries

**1.3 Mitigate human-wildlife conflict**

1.3.1 Train field staff and village volunteers in wildlife conflict management
- ✧ **Target areas**: 14 sites: 4 PAs and 10 Divisions within Elephant Reserves
- ✧ **Activities**: Training of field staff and village volunteers in wildlife conflict management

1.3.2 Identify and manage traditional migratory routes
- ✧ **Target areas**: 14 sites: 4 PAs and 10 Divisions within Elephant Reserves
- ✧ **Activities**: Review current status of traditional migratory routes and management requirement

1.3.3 Establish wildlife-proof barricades around villages
- ✧ **Target areas**: 13 sites: 3 PAs and 10 Divisions within Elephant Reserves
- ✧ **Activities**: Provide and maintain fencing, trenching and biofences, monitor incidences of human-wildlife conflict and effectiveness of wildlife-proof barricades, establish mobile veterinary unit, and translocate animals

**1.4 Ecologically sustainable development**

1.4.1 Socio-economic and forest dependency surveys of village communities
- ✧ **Target areas**: 63 villages
- ✧ **Activities**: Survey to monitor the impacts of the project

1.4.2 Community biodiversity registers
- ✧ **Target areas**: 88 villages abutting PAs and on the periphery of RFs and ecotourism sites
- ✧ **Activities**: compilation of community biodiversity registers (information on availability and knowledge of local biological resources)

1.4.3 Eco-development activities in villages abutting PAs
- ✧ **Target areas**: 30 villages situated on the fringe of PAs
- ✧ **Activities**: Participatory planning and implementation of eco-development (village based eco-enterprises), training and exposure visits of EDC members

1.4.4 Ecologically sustainable development in villages peripheral to RFs
- ✧ **Target areas**: 33 villages located around RFs that are part of Elephant Reserves
- ✧ **Activities**: Constitution of VCFs/SHGs, participatory planning and implementation of micro-plans (infrastructure, livelihood development, and ecological development)

1.4.5 Community-based ecotourism
- ✧ **Target areas**: 25 sites: 7 destinations are located around four wildlife sanctuaries, 18 other sites in 12 forest divisions
- ✧ **Activities**: Develop ecotourism strategy, constitute ectuorism SHG, develop business plans for ecotourism enterprises, and implement business plans

## 2. Increasing the Natural Resource Base

**2.1 Tree cultivation on private land (TCPL)**
- ✧ **Target areas**: fallow land in 32 districts in the state
- ✧ **Activities**: Village selection, formation of FIGs, preparation of micro-plans, tree planting, participatory M&E, and facilitating marketing of farm forestry products
- ✧ **Estimated planting area**: 110,000 – 130,000 ha

**2.2 Research on production forestry/ agro-forestry/ farm forestry**
- ✧ **Target areas**: at State Forest Research Institute (SFRI)
- ✧ **Activities:** Researches and studies

## 3. Supporting Activities

**3.1 Capacity Development**

3.1.1 Training needs analysis

3.1.2 Knowledge and skill Development
- ✧ Project orientation
- ✧ Refreshers orientation
- ✧ Managerial training
- ✧ Thematic training for project staff (domestic)
- ✧ Training on PC, GIS and MIS
- ✧ Exposure visits related to project oriented subjects
- ✧ Overseas training and study tours for project staff
- ✧ Need -based training
- ✧ Training to VFCs, EDCs and communitie

3.1.3 Workshop and conference/ seminars

3.1.4 Review meetings

3.1.5 Enhanced outreach and environmental education
- ✧ Website creation
- ✧ Publicity activities
- ✧ Awareness generation
- ✧ Publication

**3.2 Monitoring & Evaluation**
- ✧ Web-enabled MIS
- ✧ Computerized financial management and accounting system
- ✧ Periodic reviews and assessments
- ✧ Studies
- ✧ Baseline and socio-economic impact evaluation surveys
- ✧ Participatory M&E by community
- ✧ Social audits
- ✧ Video and photo documentation
- ✧ GIS-MIS integration

**3.3 Construction of buildings**
- ✧ PMU office building (1)
- ✧ Forest inspection bungalow (6)
- ✧ Circle offices (2)
- ✧ District offices (8)
- ✧ Range offices (58)
- ✧ Forest extension centres (2)
- ✧ Forest extension offices (26)
- ✧ Van shed for forest extension centres (12)
- ✧ Modern interpretation centres at Nanmangalam (1)
- ✧ Interpretation house in the existing extension centres (2)
- ✧ GIS cum biodiversity laboratory at training college (1)
- ✧ Antipoaching camp buildings (26)

**3.4 Augmentation of office facilities & equipment**

**3.5 Strengthening mobility**

**3.6 Project Management**

## 4. Consulting Services
- ✧ Foreign expert: 13 MM
- ✧ National experts: 150 MM
- ✧ Duration: 4 years +

## Outcome, Operation and Effect Indicators

**Overall Goal:** The project aims to conserve biodiversity and increase the natural resource base, thereby enhancing the State's ecological security and socio-economic well-being.

| Outcome Indicators | Current (2010) | Expected (2019) | Target Area |
|---|---|---|---|
| • % increase in family-income of target beneficiaries compared to non-beneficiaries from Eco-development ventures | 0% | >30% | 30 villages situated on the fringes of the following Protected Areas; 25 ecotourism sites; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • Increased grasslands area | x ha | >20% | Guindy National Park (2.8 $km^2$)and Vallanadu Blackbuck Sanctuary (16.4 $km^2$) |

| | | | |
|---|---|---|---|
| • Improved water retention capacities of water-bodies in natural areas | x days in June | >10% | 16 sites: 6 PAs and 10 RFs within Elephant Reserves |
| • Increase in cropping intensity | x% | >20% | Agriculture field adjoining forest areas |
| • Additional area under plough | x ha | >20% | Agriculture field adjoining forest areas |
| • Reduction in pressure on natural areas (measure change) | x% | >15% | 88 villages spread over the state of Tamil Nadu; 63 project villages covering sites abutting Protected Areas ; and 30 villages situated on the fringes of the following Protected Areas; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • Increase in family-income of target beneficiaries compared to non-beneficiaries from sale of tree products | 0% | >30% | 5,000 villages spread over 32 districts in the state |
| • Reduction in household expenses on fuel, fodder, etc. | 0% | >30% | 5,000 villages spread over 32 districts in the state; and 88 villages spread over the state of Tamil Nadu; 63 project villages covering sites abutting Protected Areas ; and 30 villages situated on the fringes of the following Protected Areas; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • % of household adopting alternate and efficient energy sources | 0% | >40% | ditto |
| **Operation Indicators** | **Current (2010)** | **Expected (2019)** | **Target Area** |
| **Component 1: *Biodiversity Conservation*** | | | |
| • Established Eco-development ventures | 0% | >90% | 30 villages situated on the fringes of the following Protected Areas; 25 ecotourism sites; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • Reduction in incidences of fire, poaching and encroachment | 0% | >90% | 16 protected areas for project interventions |
| • Reduction in incidences of wildlife destroying agricultural crops | 0% | >90% | 16 protected areas for project interventions |
| • Per cent of land cleared of invasive species | 0% | >90% | 14 sites: 4 PAs and 10 divisions in Elephants Reserves |
| • Proportion of turtle eggs hatched and hatchlings released to sea | | >0.70 | 8 districts in east coast (dugong and sea turtles) |
| • Bird species diversity and population sizes of migrant species at BSs | | increase | 11 Bird Sanctuaries |
| • Increase in blackbuck population in Vallanadu Sanctuary | >20% | >30% | Vallanadu Blackbuck Sanctuary (16.4 sq.km) |
| • Operational eco-tourism sites | 0% | >90% | 25 ecotourism sites; |
| • % of tribal population benefited by project | 0% | >30% | 33 tribal villages peripheral to RFs |
| **Component 2: *Increasing the Natural resource base*** | | | |
| • Increased tree cover outside recorded forest areas | 0% | >30% | 5,000 villages spread over 32 districts in the state |
| • Increased availability of fuel wood | 0% | >30% | ditto |
| • Survival percentage under different models over years by farmers category | 0% | >90% | ditto |
| • % of small and marginal farmers | 0% | >90% | ditto |

| | | | |
|---|---|---|---|
| covered under TCPL | | | |
| • % of area owned by small and marginal farmers covered under TCPL | 0% | >80% | ditto |
| • Number of tree planted by species and model | | >90% | ditto |
| • Number of SHGs/ FIG associated with tree plantation | | >90% | ditto |
| • Area planted by SHGs/ FIG associated under TCPL | | >90% | ditto |
| **Component 3: *Capacity Development*** *(including institutional and infrastructure capacity)* | | | |
| • Number of persons trained by skill and themes | 0% | >90% | PMU, project division and field unit staff; community, farmers, other stakeholders |
| • % of community institutions (EDC/ VFC) that could raise funds through conversion | 0% | >40% | VFC/ EDC implementing project |
| • % of Civil Works completed | 0% | 100% | Project areas |
| • Institutions established and strengthen with infrastructure | 0% | 100% | Project areas |

## Project Cost: Summary of Fund Requirement

| Component | Loan (Rs. million) | GOI (Rs. million) | Total (Rs. million) |
|---|---|---|---|
| **1. Biodiversity Conservation** | **1,029** | **25** | **1,054** |
| 1.1 Habitat restoration, enhancement and management | 416 | 7 | 423 |
| 1.2 Resource protection | 287 | 12 | 299 |
| 1.3 Mitigate human-wildlife conflict | 212 | 3 | 215 |
| 1.4 Ecologically sustainable development | 114 | 3 | 117 |
| **2. Increasing the Natural Resource Base** | **1,843** | **10** | **1,854** |
| 2.1 Tree Cultivation on Private Land | 1,774 | 10 | 1,784 |
| 2.2 Research on production forestry/agro-forestry/farm forestry | 70 | - | 70 |
| **3. Supporting Activities** | **945** | **1,389** | **2,334** |
| 3.1 Capacity Development | 137 | 0 | 137 |
| 3.2 Monitoring & Evaluation | 32 | 2 | 34 |
| 3.3 Construction of Buildings | 314 | 7 | 321 |
| 3.4 Augmentation of Office Facilities & Equipment | 114 | 11 | 125 |
| 3.5 Strengthening Mobility | 107 | 10 | 117 |
| 3.6 Project Management | 242 | 1,359 | 1,601 |
| **4. Sub-total (1+2+3)** | **3,818** | **1,424** | **5,241** |
| 5. Price Contingency | 497 | 291 | 788 |
| **6. Sub-total (4+5)** | **4,314** | **1,715** | **6,029** |
| 7. Physical contingency | 431 | 171 | 603 |
| **8. Sub-total (6+7)** | **4,746** | **1,886** | **6,632** |
| 9. Consulting Services | 108 | 11 | 119 |
| **10. Grand Total (8+9)** | **4,853** | **1,897** | **6.751** |

Source: JICA Preparatory Survey Team (2010)

## Result of Economic Evaluation

| Items | Result |
|---|---|
| Net present value (at discount rate of 10%) | Rs. 2,045 million |
| EIRR | 11.6% |

Source: JICA Preparatory Survey Team (2010)

**The Preparatory Survey**
**on**
**Tamil Nadu Biodiversity Conservation and Greening Project**

**Final Report**

# PART II: SURVEY REPORT

# CHAPTER 1 INTRODUCTION

## 1.1 Background

The Government of Japan (GOJ) has provided financial assistance to the Government of India (GOI) for implementation of Phase I (1997-2005) and Phase II (2005-2015) of Tamil Nadu Afforestation Project (TAP), which emphasized the restoration of degraded forests, alleviation of rural poverty, and forest extension and research. Both TAP I and II were implemented following the joint forest management (JFM) principle and successfully contributed to restoration of about 650,000 ha of degraded forests and community lands and improvement of the socio-economic status of rural people living in 2,167 villages.

Despite the success of TAP I and II, human pressure to forests are yet to be overcome completely in the state. In fact, unsustainable exploitation of forest resources is continuing and it leads to habitat degradation, loss and fragmentation. It has threatened the rich wild biodiversity and habitats of flagship species like the tiger, elephant, Nilgiri Tahr, and lion-tailed Macaque and other endangered species of plants and animals in the state. Meanwhile, the GOI has to deal with growing and urgent needs of mitigating climate change impacts in compliance with the United Nations Framework Convention on Climate Change (UNFCCC) and of biodiversity conservation under the Convention on Biological Diversity (CBD). Conservation of the rich biodiversity of the state is the topmost priority of the Tamil Nadu Forest Department (TNFD). Hence, TNFD has conceptualized and formulated the Tamil Nadu Sustainable Natural Resources Management Project[1] to meet the current issues governing the natural resources of the state.

In November 2009, the GOI officially requested GOJ to extend Japanese official development assistance (ODA) for the implementation of the Project. The detailed project report (DPR) prepared by TNFD was also submitted to Japan International Cooperation Agency (JICA). In response to the request, JICA has made several discussions with TNFD on the scope and components of the proposed Project. JICA finally reached an agreement with the TNFD in February 2010 on the conduct of supplemental survey to examine the project concept and components and improve the project design addressing the new emerging issues in the field of biodiversity conservation. In July 2010, a team for the preparatory survey (hereinafter referred to as “the Survey Team”) was organized. Thereafter, the Survey Team commenced the works.

## 1.2 Objectives of the Survey

The main objective of the preparatory survey is to expedite the formulation of the proposed project by examining its components as proposed in the DPR for the Project, including collection and analysis of relevant data/information.

## 1.3 Scope of the Survey

### 1.3.1 Survey Areas

The survey area is the entire State of Tamil Nadu.

### 1.3.2 Scope of the Survey

The scope of the survey covers the following items:

[1] The name of the project was changed to Tamil Nadu Biodiversity Conservation and Greening Project in September 2010.

**TOR 1: Necessity and Background of the Project**

1.1 Issues and Prospects of Tamil Nadu State and the Government of India

1.1.1 Detailed review of the five year plan, action plan, strategies, and other policies regarding the forestry sector, biodiversity conservation, poverty reduction strategy, etc. in Tamil Nadu.

1.1.2 Challenges and lessons of TAP I and II for their sustainability.

1.1.3 Review the past activities of other donors and NGOs in the field of forestry and biodiversity sectors in Tamil Nadu.

1.2 Review the Necessity of the Project

1.2.1 Examine the importance of supporting biodiversity conservation, socio-economic development, tree planting outside the recorded forest area, and supporting activities of Tamil Nadu compared with other states in India.

1.2.2 Examine the rationale of supporting biodiversity conservation, socio-economic development, tree planting outside the recorded forest area, and supporting activities within Tamil Nadu.

1.2.3 Summarize the necessity of the Project.

**TOR 2: Propose the Project Details**

2.1 Propose the project scope

2.1.1 Propose the scope of the biodiversity conservation

2.1.2 Propose the scope of tree planting outside the recorded forest area

2.1.3 Propose the scope of supporting activities

2.2 Estimation of the total project cost and eligible JICA financing portion (including annual fund requirement, budget appropriation)

2.3 Propose the implementation schedule of the Project.

2.4 Propose the procurement method and construction and/or afforestation technique

2.5 Propose the environment and social considerations (poverty, gender, scheduled tribe, etc.) for project effectiveness.

**TOR 3: Propose the Project Management Structure**

3.1 Review of the technical capacity of the executing agency and PMU

3.2 Review of the financial capacity of the executing agency and PMU (state budget allocation of the executing agency)

3.3 Propose appropriate operation and maintenance structure after the completion of the Project

**TOR 4: Examination of the Project Effectiveness**

4.1 Propose operation and effective indicators for the Project (base year indicators, target year indicators, data availability)

4.2 Review of the quantitative and qualitative impact of the Project

4.3 Calculation of the economic internal rate of return

4.4 Contribution to climate change (Examining possibility of estimation of the absorption of $CO_2$, and emission reduction of $CO_2$, if applicable)

## 1.4 Composition of the Survey Team

The Survey Team was composed of five international consultants and eight local consultants. The name and assignment schedule of each consultant are given below.

| Position | Name | 2010 | | |
|---|---|---|---|---|
| | | July | August | September |
| Team Leader / Forest Management | Mr. Akihiko Sasaki | | | |
| Biodiversity (1) | Dr. Michael John Beverley Green | | | |
| Biodiversity (2)/ Cost Estimation | Mr. Shinichiro Tanimoto | | | |
| GIS/Remote Sensing | Mr. Shalabh Bharadwaj | | | |
| Institutional/ Capacity Development | Ms. Hisako Kodama | | | |
| Biodiversity Conservation | Dr. R.J. Ranjit Daniels | | | |
| Farm Forestry/ Livelihood Development | Mr. Ajay Rai | | | |
| JFM/ Social Development/ Gender | Dr. Jeyshree Vencatesan | | | |
| REDD+ | Mr. Varghese Paul | | | |
| Forestry/ NTFP Development | Dr. R.C. Sharma | | | |
| M&E / Project Evaluation | Dr. Sanjay Verma | | | |
| Infrastructure/ Facility Development | Mr. Ramachandra Panda | | | |
| Institutional Development | Mr. Subrat Rana | | | |

Survey in India  Home Work in Japan

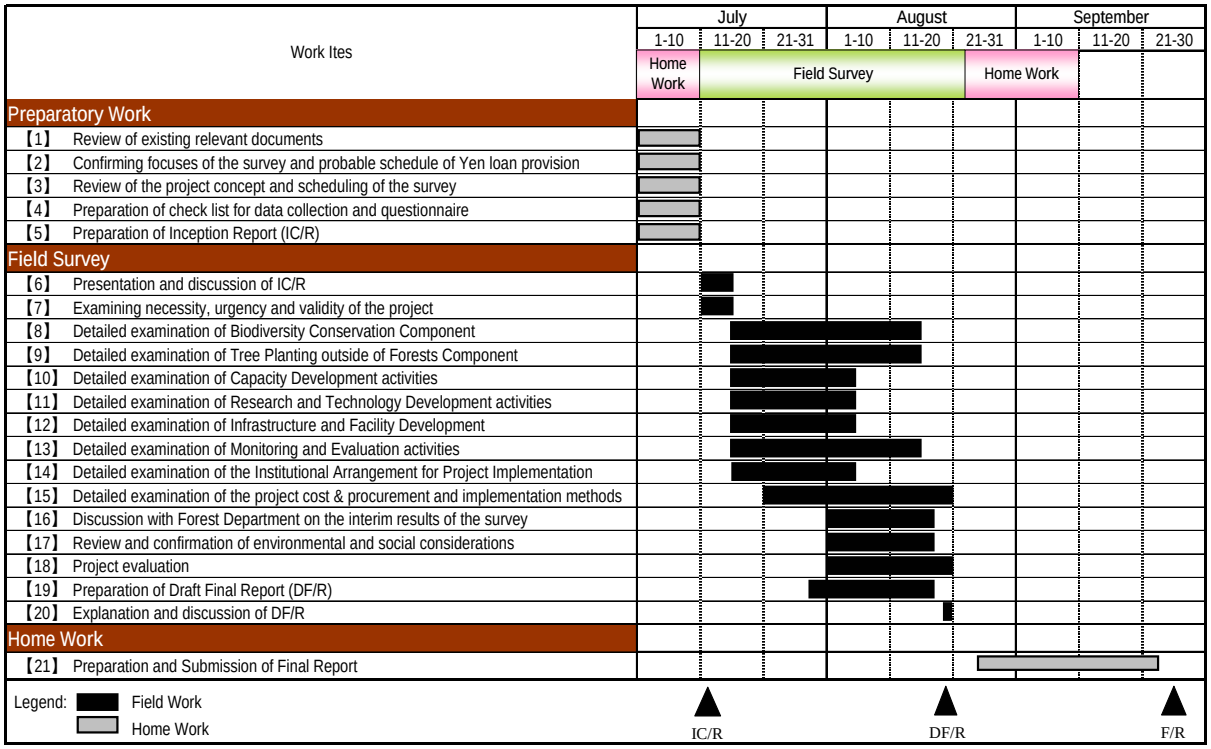
**Assignment Schedule of the Survey Team Members**

## 1.5 Counterpart Agency

The TNFD acts as the counterpart agency to the Survey Team as well as a coordinating body with other concerned for the smooth implementation of the preparatory survey.

## 1.6 Work Schedule of the Survey

The work schedule of the survey is presented below. The survey was carried out in India for over 1.5 months from July to August 2010. The draft final report will be finalized in September 2010 based on comments from TNFD, MoFE and JICA.




**Work Schedule of the Survey**

# CHAPTER 2 PRESENT CONDITIONS OF THE STATE OF TAMIL NADU

## 2.1 Location and Topography

Tamil Nadu is the southernmost Indian state located between $8^{o}05$'N-$13^{o}34$'N and $76^{o}14$'E-$80^{o}21$'E. It is bounded in the east by the Bay of Bengal, in the south by the Indian Ocean, in the west by Kerala, in the north by Andhra Pradesh, and in the northwest by Karnataka. The total area of the state is 130,058 $km^2$ (reported area for land utilization is 130,027 $km^2$ as per Forest Survey of India) which is equal to 4% of the country's geographical area.

Topographically, the state is generally flat except in the west and north where it shares the hills of the Western and Eastern Ghats with the adjoining states of Kerala, Karnataka and Andhra Pradesh (**MAP-1**). The altitude varies from sea level along the coast, i.e., 1,076 km long, to over 2,690 m above sea level (ASL) in the hills of Nilgiris. The intervening areas are low, with an average elevation of around 300 m ASL. Hills that exceed 1,000 m ASL are found locally in the Eastern Ghats and throughout the Western Ghats, whereas mountains that exceed 2,000 m ASL are found only in Palani Hills and Nilgiri Hills within the state. Due to the northern and western hilly terrain, the state has an easterly slope that drains much of the surface runoff into the Arabian Sea through the major river basins.

## 2.2 State Administration

The state has a human population of 62 million (as per the 2001 census) and is administered with Chennai as the capital. The Chief Minister is the head of the state. Under the Government of Tamil Nadu, there is an exclusive Environment and Forests Department headed by the Minister for Forests and the Minister for Environment. For administrative purposes, the state is divided into districts and at present, there are 32 districts and 17,244 revenue villages.

## 2.3 Socio-economic Conditions

### 2.3.1 Demography

#### (1) Demography

Tamil Nadu has grown rapidly during the nineties and moved ahead in all economic sectors. Tamil Nadu has also done well in terms of human development. The state has moved to the third position in terms of the human development index, by scoring 0.657 in 2001 as against the all-India average of 0.571.

The total population of Tamil Nadu is 62,405,679 as per the provisional results of the 2001 Census of India, constituting 6.05% of the total population of India. In terms of population, it holds the sixth position among the states and union territories in the country. While the all-India decadal growth rate of population was 21.34% during 1991-2001, Tamil Nadu achieved a growth rate of 11.19%. The sex ratio (i.e., the number of females per thousand males) in the state has improved from 974 in the previous census to 986 in the present census. Continuing with its commendable tradition of learning, the literacy rate in the state has shown remarkable improvement by reaching 73.47% when compared to 62.66% in the 1991 Census.

The population of Tamil Nadu was 55.9 million according to the 1991 Census, which rose to 62.4 million in 2001. Despite a decreased population growth rate, Tamil Nadu is not only one of the most populous states of India but also the sixth most densely populated state. Density of population in Tamil Nadu is 478 persons per $km^2$ whereas the national average is 324 persons per $km^2$.

### (2) Growth Rate

The population growth rate has declined during 1991-2001 as compared to 1981-1991 in practically all the major states. The southern states have shown a decline in growth rate from their already relatively lower levels. In Tamil Nadu, the growth rate between 1981 and 1991 was 15.39% whereas growth rate between 1991 and 2001 was only 11.19%. The decadal growth rate at the national level is 2.50% lower than the previous decade whereas in Tamil Nadu, it is 4.20% lower than the previous decade.

### (3) Rural-Urban Population

Tamil Nadu is also relatively more urbanised than the other major states of India. According to the 2001 Census, 43.9% of the population of Tamil Nadu lives in urban areas whereas the level of urbanisation at the national level is less than one third (27.8%). The level of urbanisation in Tamil Nadu (34.1%) was high even during the 1991 Census; in 2001, the state had the highest percentage of urban population in India.

**Urban Population of Tamil Nadu, 1991 and 2001**

| Place | 1991 | | | 2001 | | |
|---|---|---|---|---|---|---|
| | **Total Population** *(million)* | **Urban Population** *(million)* | **Urban Population** *(%)* | **Total Population** *(million)* | **Urban Population** *(million)* | **Urban Population** *(%)* |
| Tamil Nadu | 55.8 | 19 | 34.1 | 62.4 | 27 | 43.9 |
| All India | 846.3 | 218 | 25.7 | 1,027.0 | 258 | 27.8 |

Source: Census of India, 2001

The increase in level of urbanisation in Tamil Nadu over the period 1991-2001 is related to the emergence of a large number of statutory towns. In the 2001 census, all statutory towns and places that satisfy certain demographic and economic criteria have been treated as urban. All town panchayats have been included in the urban frame irrespective of their compliance to the demographic and economic criteria detailed in the guidelines.

The urban population of Tamil Nadu is about 27 millions who live in 832 urban centres. There are 21 centres with population of over 100,000 (Class I). While the Chennai metropolitan area has a population of 43 lakhs, urban agglomerations of Madurai, Coimbatore, Tiruchinapalli and Salem have populations over 1.0 million. There are 41 urban centres with a population of 50,000 to 100,000 (Class II), and 90 towns with population between 20,000 and 50,000 (Class III). The urban population is distributed in six municipal corporations, 102 municipalities, 9 municipal townships and 635 town panchayats. The rural population is distributed in 12,584 village panchayats.

## 2.3.2 Employment Situation in Tamil Nadu

The worker population ratio (WPR) in 1993-94 and 1999-2000 is given in the table below. WPR is expressed as the number of workers per 1,000 population according to usual status (taking both principal and subsidiary status). The WPR for Tamil Nadu and all-India (rural and urban) has declined in 1999- 2000 as compared to 1993-94.

However, the WPR in rural and urban areas is higher in Tamil Nadu compared to the national average during the time period of 1993-94 and 1999-2000. Compared to the other major states, the WPR is higher in Tamil Nadu especially in urban areas. The WPR engaged in agricultural sector has decreased in rural Tamil Nadu from 1993-94 (705) to 1999-2000 (679).

**Distribution of Usually Working Persons by Broad Industry Division** (per thousand)

| Sectors | Rural | | | | Urban | | | |
|---|---|---|---|---|---|---|---|---|
| | 1993-94 | | 1999-2000 | | 1993-94 | | 1999-2000 | |
| | TN | India | TN | India | TN | India | TN | India |
| Agriculture | 705 | 754 | 679 | 763 | 122 | 123 | 89 | 88 |
| Mining & Quarrying | 4 | 6 | 6 | 6 | 3 | 12 | 4 | 8 |
| Manufacturing | 126 | 70 | 139 | 74 | 299 | 236 | 282 | 227 |
| Electricity | 2 | 2 | 2 | 2 | 7 | 10 | 7 | 7 |
| Construction | 23 | 24 | 40 | 33 | 75 | 63 | 73 | 80 |
| Wholesale, Retail Trade, etc. | 48 | 43 | 56 | 51 | 136 | 194 | 253 | 269 |
| Transport Storage, etc. | 20 | 14 | 26 | 21 | 76 | 79 | 88 | 87 |
| Financial Insurance | 5 | 3 | 6 | 3 | 30 | 34 | 41 | 41 |
| Community Services | 62 | 64 | 47 | 49 | 202 | 248 | 163 | 198 |

Source: NSSO 50th Round and 55th Round (1999-2000)

It is evident that the WPR in the primary sector is lower than the national average. There is an increase of worker population in the service sector. In urban Tamil Nadu, 90% of the worker population is engaged in the secondary and tertiary sectors.

In rural Tamil Nadu, the percentage of workers engaged in casual labour (> 50%) is high compared to the national level (37.4%), while the percentage of self-employed persons (36.8%) is lower than the national average (55.8%). In urban Tamil Nadu, the percentage of regular employment (44.1%) is higher than the national average (40%) while percentage of self-employed is consequently lower.

**Comparison of Rural Employment Status in Tamil Nadu and at the National Level**

| Classification | Tamil Nadu 55th Round *Population/1,000 Persons* | | | India 55th Round *Population/1,000 Persons* | | |
|---|---|---|---|---|---|---|
| | Self-Employed | Regular Employed | Casual Labour | Self-Employed | Regular Employed | Casual Labour |
| Male | 358 | 153 | 489 | 550 | 88 | 362 |
| Female | 380 | 69 | 551 | 573 | 31 | 396 |
| Persons | 367 | 118 | 515 | 558 | 68 | 374 |

Source: NSSO 55th Round (1999-2000) Rural

**Comparison of Urban Employment Status in Tamil Nadu and at the National Level**

| Classification | Tamil Nadu 55th Round *Population/1,000 Persons* | | | India 55th Round *Population/1,000 Persons* | | |
|---|---|---|---|---|---|---|
| | Self Employed | Regular Employed | Casual Labour | Self Employed | Regular Employed | Casual Labour |
| Male | 330 | 454 | 216 | 415 | 417 | 168 |
| Female | 394 | 487 | 199 | 453 | 333 | 234 |
| Persons | 347 | 441 | 212 | 422 | 400 | 178 |

Source: NSSO 55th Round (1999-2000) Urban

### 2.3.3 Income

The per capita income of Tamil Nadu was Rs. 15,929 at current prices in 1996-97, as compared to an all-India per capita income of Rs. 11,554. This is a reversal of the situation in the 1980s when the state's per capita income was below the all-India average. Tamil Nadu occupies fifth place out of the 15 major states in terms of per capita income. District–wise distribution of per capita income is depicted in the table below.

**District-Level Income Categories**

| Per Capita Income Range *(in rupees/year)* | No. of Districts | Name of Districts |
|---|---|---|
| Above Rs. 20,000 | 2 | Kancheepuram and Chennai |
| Rs. 14,000 – 20,000 | 8 | Coimbatore, Madurai, Salem, Erode, Trichy, Thoothukudi, Thiruvallur and Virudhunagar |
| Rs. 10,000 – 14,000 | 13 | Nilgris, Vellore, Trinelveli, Nagapattinam, Namakkal, Theni, Dindigul, Karur, Perambalur, Dharmapuri, Pudukkottai, Ramanathapuram and Kanniyakumari. |
| Below Rs. 10,000 | 6 | Thanjavur, Cuddalore, Tiruvarur, Sivagangai, Thiruvanamalai and Villupuram |

Source: Tamil Nadu Human Development Report, 2003.

An analysis of the district-wise estimates of per capita income reveals wide divergence. Kancheepuram has the highest per capita income and Villupuram has the lowest. The per capita income (at current prices) in 1996-97 is Rs. 23,075 in Kancheepuram, almost three times that of Villupuram. Other districts with high per capita income are Chennai, Coimbatore, Madurai, Salem and Erode.

In general, the urbanised districts such as Chennai and Coimbatore have high per capita incomes. The manufacturing and tertiary sectors contribute a high percentage to total income while the primary sector's contribution in these districts is insignificant. Other districts such as Tiruchirappalli, Madurai and Virudhunagar have high levels of trading and business activities, leading to higher per capita income.

### 2.3.4 Poverty

While poverty levels remained relatively static in the 1970s and 1980s and well above the 50% level, as mentioned above, there has been a dramatic decrease in poverty levels since that time. Whereas in 1987–1988, the poverty level was 45.8%, it declined to 32.5% in 1993–1994 and further to 21.1% in 1999–2000. The estimated number of people living below the poverty line in Tamil Nadu in 1999–2000 was 13.05 million (8.05 million in rural areas and 5 million in urban areas). Whereas poverty rates declined from 32.4% to 20.6% in rural areas, the decline in urban areas was from 39.8% to 22.1%. Thus, the levels of poverty are almost equal in rural and urban areas.

**Trends in Poverty Levels in Tamil Nadu**

| Year | Population BPL (%) | | | No. of Persons BPL (million) | | |
|---|---|---|---|---|---|---|
| | Rural | Urban | Combined | Rural | Urban | Combined |
| 1973-1974 | 57.4 | 49.4 | 56.9 | 17.26 | 6.69 | 23.95 |
| 1977-1978 | 57.7 | 48.7 | 54.8 | 18.25 | 7.30 | 25.95 |
| 1983 | 54.0 | 47.0 | 51.2 | 18.25 | 7.85 | 26.10 |
| 1987-1988 | 45.8 | 38.6 | 43.4 | 16.18 | 6.93 | 23.11 |
| 1993-1994 | 32.5 | 39.8 | 35.0 | 12.17 | 8.04 | 20.21 |
| 1999-2000 | 20.6 | 22.1 | 21.1 | 8.05 | 5.00 | 13.05 |

Note: BPL – Below Poverty Line

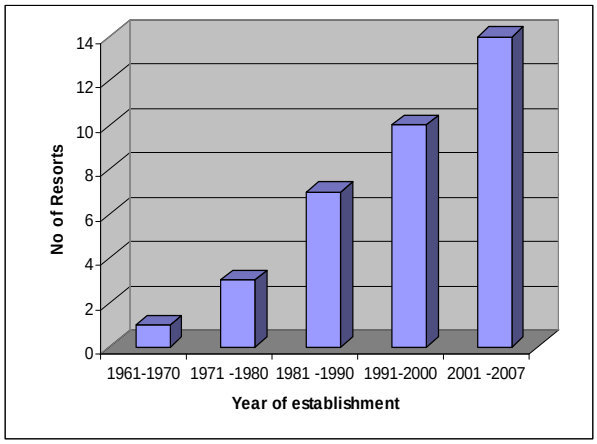
### 2.3.5 Tourism in Tamil Nadu

Some insights into the extent and growth of tourism in Tamil Nadu can be found in a study tourism in Mudumalai Wildlife Sanctuary[1]. This sanctuary constitutes part of the 5,520 km$^2$ Nilgiri Biosphere

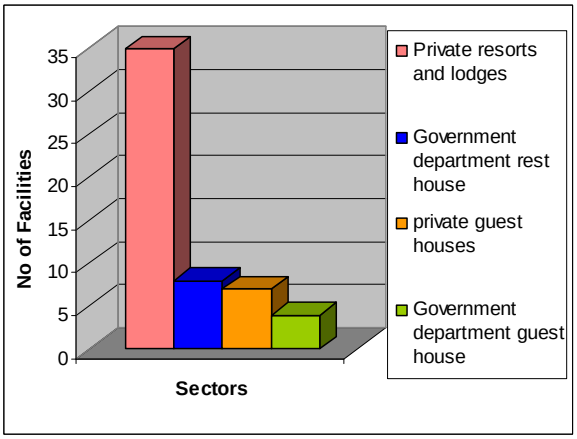
[1] Nithya. K (2007), Sustainable Tourism Plan for Mudumalai Wildlife Sanctuary, MSc. Thesis, Faculty Of Civil Engineering, Anna University, Chennai.

Reserve, of which 335 $km^2$ (6.1%) is zoned for tourism activities. Agricultural and other private patta lands, including some of which were forested, have been converted into resorts. Some 50 resorts, lodges, government rest houses and guest houses/home-stays have been established since 1967 within Masinagudi, Sholur and Ullathi panchyats, which cover an area of some 587 $km^2$ adjacent to the sanctuary. The total population within this area is 11,716 of which the majority (46.8%) are tribals, 15.0 % are scheduled castes and 38.2% are neither. Eighty one percent of the population lives outside the Sanctuary and Reserved Forests and 19% lives inside. Key findings from this study include the following:

- **Tourism is increasing, particularly with respect to destinations in natural areas.** The mean number of visitors to the Sanctuary increased from 72,583 in 1995-2000 to 102,339 per year in 2000-2006. Most visitors are domestic; indeed, the number of foreigners declined from nearly 10,000 visitors in 1996-1997 (9.8% visitors) to below 600 (0.5% visitors) in 2005-06 for reasons that are not explained. The rate of establishment of new resorts also continues to rise steadily, from 1-2 per decade to 10 in 1991-2000 and 14 in 2001-2007.




**Growth of resorts (left)**




**Accommodation facilities sector wise (right)**

- **Tourism is dominated by the private sector.** Most of the accommodation (50 facilities) is managed by private operators. Thus; 70% is private sector, 18% is government and 12% is run by local residents as home-stays and guest houses.

- **Local communities benefit only marginally from tourism and tribals even less.** Based on interviews of 244 local people, 81% do not benefit from any kind of employment through tourism and 72% of respondents opined that tourism has not brought any improvement in civic amenities. Thus, for example, of the 341 people employed in the private resorts, 96 are tribals, 115 are native to the locality and 130 are outsiders. Most of the tribals in the resorts are employed as cooks, guides, watchmen, room boys and coolies. None works in any managerial capacity. Furthermore, only 47 of the 150 jeeps operating in the area for tourism purposes are owned by outsiders, of which just two belong to tribals.

- **Tourism development has resulted in social and environmental impacts**. For example, 96% of interviewees considered that the price of essential commodities had increased as a result of tourism development; 67% felt that their traditional job and culture has been affected; and 40% had experienced a negative attitude form tourists. Environmental impacts include excessive use of water resources and sewage disposal by resorts, fragmentation of wildlife corridors and disruption of seasonal and diurnal movements of large animals due to inappropriate location of tourism facilities and infrastructure, noise and other forms of disturbance, and wildlife road kills.

Such studies show the tremendous potential for economic development afforded by tourism while also highlighting the many impacts from unsustainable forms tourism. Community-based approaches to ecotourism, by definition, are designed to avoid many of the pitfalls highlighted in this study and, therefore, must underpin the sustainable development of tourism promoted by this Project.

## 2.4 Natural Condition

### 2.4.1 Climate

Most part of Tamil Nadu is in the rain shadow region of the Western Ghats and hence, it is generally dry (**MAP-2**). Rainfall, except in the southern Western Ghats, is seasonal and confined to the southwest and northeast monsoons. The state receives an average annual rainfall of around 800 mm, of which nearly 60% falls during the northeast monsoon (October-December) and the rest during the southwest monsoon (June-August). The Western Ghats enjoy the southwest monsoon where locally, the rainfall exceeds 5,000 mm with Valparai in Coimbatore District being the wettest in the state. Summer rain is frequent in the southern districts, especially in Kanyakumari.

**Rainfall by Districts in mm (2008-09)**

| District | Southwest Monsoon (Jun-Sep 08) | | Northeast Monsoon (Oct-Dec 08) | | Winter Season (Jan-Feb 09) | | Hot Weather (Mar-May 09) | | Annual Total (Jun 08-May 09) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | Normal | Actual | Normal | Actual | Normal | Actual | Normal | Actual | Normal |
| Chennai | 285.7 | 443.5 | 875.6 | 753.1 | 13.1 | 37.3 | 14.7 | 64.2 | 1,189.1 | 1,298.1 |
| Coimbatore | 695.0 | 192.9 | 312.2 | 327.0 | 1.3 | 26.1 | 157.3 | 148.4 | 1,165.8 | 694.4 |
| Dharmapuri | 348.0 | 361.0 | 330.1 | 316.7 | 3.8 | 18.5 | 188.1 | 156.9 | 870.0 | 853.1 |
| Dindugal | 349.8 | 251.4 | 439.7 | 399.2 | 6.9 | 33.0 | 114.9 | 148.0 | 911.3 | 831.6 |
| Erode | 229.9 | 213.1 | 308.5 | 323.5 | 0.0 | 20.7 | 204.8 | 154.1 | 743.2 | 711.4 |
| Kancheepuram | 313.0 | 462.7 | 839.8 | 697.2 | 16.0 | 32.1 | 50.4 | 60.1 | 1,219.2 | 1,252.1 |
| Kanyakumari | 475.3 | 327.8 | 584.2 | 427.4 | 0.6 | 33.4 | 298.7 | 217.4 | 1,358.8 | 1,006.0 |
| Karur | 203.9 | 249.7 | 407.8 | 365.4 | 2.1 | 24.0 | 75.4 | 103.1 | 689.2 | 742.2 |
| Madurai | 310.8 | 305.4 | 388.2 | 373.0 | 8.1 | 29.8 | 173.0 | 131.8 | 880.1 | 840.0 |
| Nagapattinam | 175.8 | 274.1 | 1,222.4 | 886.4 | 58.3 | 81.5 | 288.1 | 99.7 | 1,744.6 | 1,341.7 |
| Namakkal | 380.8 | 317.0 | 321.3 | 291.0 | 0.0 | 18.1 | 155.9 | 150.4 | 858.0 | 776.5 |
| Nilgiris | 1,067.9 | 1,060.0 | 516.3 | 367.7 | 1.7 | 30.8 | 286.5 | 237.2 | 1,872.4 | 1,695.7 |
| Perambalur | 185.1 | 349.6 | 648.1 | 449.6 | 9.8 | 34.5 | 91.3 | 115.9 | 934.3 | 949.6 |
| Pudukottai | 292.0 | 350.7 | 545.0 | 418.0 | 13.7 | 38.2 | 80.9 | 114.6 | 931.6 | 921.5 |
| Ramanathapuram | 145.6 | 136.1 | 834.2 | 507.4 | 18.8 | 53.9 | 137.4 | 123.8 | 1,136.0 | 821.2 |
| Salem | 466.3 | 380.0 | 359.0 | 347.0 | 2.3 | 21.3 | 189.7 | 149.7 | 1,017.3 | 898.0 |
| Sivagangai | 331.8 | 289.6 | 456.0 | 415.5 | 1.4 | 35.8 | 123.1 | 135.1 | 912.3 | 876.0 |
| Theni | 345.0 | 178.4 | 325.2 | 384.0 | 3.7 | 48.4 | 157.2 | 222.7 | 831.1 | 833.5 |
| Tiruchirapalli | 259.1 | 270.3 | 575.6 | 356.1 | 7.6 | 25.0 | 51.6 | 110.1 | 893.9 | 761.5 |
| Tirunelveli | 145.2 | 92.6 | 564.1 | 429.8 | 8.2 | 72.6 | 123.9 | 141.9 | 841.4 | 736.9 |
| Tiruvarur | 218.5 | 301.8 | 1,122.6 | 665.4 | 31.9 | 57.9 | 202.7 | 104.8 | 1,575.7 | 1,129.9 |
| Toothukudi | 65.7 | 86.8 | 584.1 | 410.1 | 7.0 | 46.6 | 113.3 | 112.2 | 770.1 | 655.7 |
| Virudhunagar | 148.9 | 181.8 | 487.3 | 431.2 | 2.2 | 42.0 | 124.4 | 174.6 | 762.8 | 829.6 |

Source: Indian Meteorological Department, Chennai

There is considerable variation in rainfall across a short distance due to the rain shadow effect created by the Western Ghats. For example, the district of Coimbatore that is amongst the driest is also where Valparai, the wettest part of the state is located. Valparai is in the Western Ghats, just 70 km (as the crow flies) south of Coimbatore. Whereas the rain shadow effect has rendered much of the central parts of the state dry, rainfall tends to increase towards the east coast. The rather narrow coastal belt enjoys an annual rainfall that averages around 1,200 mm during normal years. Erratic behavior of monsoons, from time to time, leaves parts of the state dry.

Temperature is generally warm except in the hills where winter temperature can be as low as $0^{o}$C. Winter frosts are common in the hills of Ooty. Northern districts are usually the warmest,

experiencing summer heat that exceeds 40°C. Summer temperature of around 45°C is frequent in Chennai, Vellore and Tiruvallur districts.

According to the National Bureau of Soil Survey and Land Use (Indian Council of Agricultural Research), most part of Tamil Nadu (excluding the coastal districts) is agro-climatically classified as Southern Plateau and Hills Region. Within the region, there are seven distinct agro-climatic zones, viz.: northeastern zone, northwestern zone, western zone, Cauvery delta zone, southern zone, high rainfall zone and high altitude and hilly zone.

### 2.4.2 Soils and Land Use

#### (1) Soils

With the exception of the hills and coast, Tamil Nadu is classified as a hot semi-arid eco-region with red loamy soils, i.e., H1 D2 of the agro-eco-region demarcated by the National Bureau of Soils and Land Use. Under the same scheme of classification, the coastal belt falls within hot sub-humid to semi-arid eco-region with coastal alluvium-derived soils (S7 CD2-5), and the Western Ghats falls within the hot humid-per-humid eco-region with red, lateritic and alluvium derived soils (E2 B/A5). Within this broad scheme, there are 94 soil types.

#### (2) Land Use

Land use map of the state is shown in **MAP-3**.

Land, which cannot be brought under cultivation unless at a high cost whether such land is in isolated blocks or within cultivated holdings such as mountains, deserts, hills, etc., are classified as **barren and unculturable land**. An extent of 492,092 ha of land comes under this category, which represents 3.8% of the total geographical area of the state. Villupuram District alone accounted for 56,651 ha which is 11.5% of the state's barren and unculturable land and about 7.8% of its geographical area under this category. The area under this category is very meagre in Thiruvarur District with just 113 ha.

**District-wise Land Use Pattern (2007-08)**

| District | Total Geographic Area (ha) | Forest Area (ha) | Barren & uncultivable area | Land under non agricultural use | Cultivable Waste | Permanent pasure & other grazing land | Misc. tree crops & groves not included in net area sown | Current Fallow | Other Fallow | Net Area Sown |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 Chennai | 17,098 | 300 | 0 | 16,798 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 Kancheepuram | 443,210 | 23,856 | 10,948 | 146,505 | 10,726 | 18,286 | 12,920 | 34,861 | 56,524 | 128,584 |
| 3 Thiruvallur | 342,243 | 19,736 | 13,638 | 107,900 | 7,999 | 8,143 | 7,718 | 26,254 | 39,309 | 111,546 |
| 4 Cuddalore | 366,781 | 1,415 | 14,647 | 58,557 | 6,039 | 608 | 19,040 | 36,164 | 15,163 | 216,148 |
| 5 Villupuram | 722,203 | 71,697 | 56,651 | 135,977 | 9,943 | 4,170 | 6,204 | 84,825 | 17,470 | 335,266 |
| 6 Vellore | 592,018 | 150,722 | 21,028 | 85,857 | 6,031 | 3,998 | 2,976 | 56,582 | 67,572 | 197,252 |
| 7 Tiruvannamalai | 631,205 | 153,318 | 21,058 | 93,453 | 13,121 | 2,908 | 2,271 | 90,640 | 29,936 | 224,500 |
| 8 Salem | 520,530 | 125,682 | 38,694 | 59,142 | 5,088 | 4,200 | 3,184 | 55,434 | 24,806 | 204,100 |
| 9 Namakkal | 336,335 | 43,909 | 24,576 | 38,349 | 4,863 | 6,664 | 3,848 | 45,509 | 9,237 | 159,380 |
| 10 Dharmapuri | 449,777 | 164,177 | 15,804 | 51,412 | 3,833 | 6,209 | 2,914 | 43,055 | 3,986 | 158,387 |
| 11 Krishnagiri | 514,326 | 202,409 | 24,306 | 42,167 | 3,982 | 8,156 | 9,680 | 35,613 | 9,426 | 178,587 |
| 12 Coimbatore | 747,079 | 158,801 | 6,639 | 109,864 | 13,031 | 85 | 3,436 | 96,629 | 51,243 | 307,351 |
| *31 Tiruppur (new district)* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* |
| 13 Erode | 816,191 | 228,749 | 7,006 | 81,795 | 1,736 | 219 | 1,273 | 102,663 | 102,565 | 290,185 |
| 14 Tiruchirappalli | 440,383 | 36,773 | 12,745 | 84,965 | 7,434 | 659 | 1,961 | 27,400 | 94,166 | 174,280 |
| 15 Karur | 289,557 | 6,187 | 2,814 | 37,356 | 67,578 | 10,801 | 1,302 | 21,832 | 45,084 | 96,603 |
| 16 Perambalur | 369,137 | 17,025 | 11,313 | 59,702 | 8,964 | 1,443 | 22,050 | 19,674 | 18,284 | 210,682 |
| *32 Ariyalur (new district)* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* | *N.A.* |
| 17 Pudukkottai | 466,329 | 23,535 | 9,863 | 129,807 | 10,230 | 5,124 | 28,380 | 16,277 | 91,353 | 151,760 |
| 18 Thanjavur | 339,657 | 3,390 | 2,149 | 81,529 | 13,159 | 1,218 | 4,681 | 10,145 | 28,075 | 195,311 |
| 19 Thiruvarur | 209,709 | 2,452 | 113 | 37,088 | 2,063 | 786 | 2,119 | 6,616 | 7,572 | 150,900 |
| 20 Nagapattinam | 271,583 | 4,633 | 33,419 | 47,710 | 3,509 | 964 | 8,224 | 6,912 | 12,168 | 154,044 |
| 21 Madurai | 374,173 | 48,473 | 13,160 | 75,211 | 6,498 | 233 | 3,033 | 20,573 | 65,167 | 141,825 |
| 22 Theni | 324,230 | 103,718 | 43,320 | 24,058 | 2,864 | 315 | 1,585 | 3,310 | 32,655 | 112,405 |
| 23 Dindigul | 626,664 | 138,923 | 36,210 | 66,115 | 5,865 | 6,946 | 7,447 | 29,838 | 99,099 | 236,221 |
| 24 Ramanathapuram | 408,957 | 4,488 | 4,591 | 86,686 | 4,246 | 154 | 38,874 | 32,894 | 49,857 | 187,167 |
| 25 Virudhunagar | 424,323 | 26,466 | 4,525 | 70,510 | 9,572 | 804 | 6,635 | 15,242 | 160,618 | 129,951 |
| 26 Sivagangai | 418,900 | 16,439 | 4,710 | 122,011 | 21,021 | 1,367 | 5,509 | 12,875 | 122,824 | 112,144 |
| 27 Tirunelveli | 670,638 | 120,801 | 30,843 | 104,109 | 41,513 | 5,353 | 9,828 | 26,308 | 167,794 | 164,089 |
| 28 Thoothukudi | 470,724 | 11,012 | 19,878 | 76,330 | 53,958 | 5,132 | 39,446 | 14,358 | 74,902 | 175,708 |
| 29 Nilgiris | 254,485 | 142,577 | 3,375 | 9,976 | 2,023 | 5,078 | 3,779 | 8,240 | 1,865 | 77,572 |
| 30 Kanniyakumari | 167,200 | 54,155 | 4,006 | 28,256 | 0 | 104 | 708 | 0 | 0 | 79,971 |
| Total | 13,025,645 | 2,105,818 | 492,029 | 2,169,195 | 346,889 | 110,127 | 261,025 | 980,723 | 1,498,720 | 5,061,919 |
| (%) | 100.0% | 16.2% | 3.8% | 16.7% | 2.7% | 0.8% | 2.0% | 7.5% | 11.5% | 38.9% |

Source: Season and Crop Report Tamil Nadu: 2007-2008, Department of Economics and Statistics

Land put to use for purposes other than agriculture such as buildings, pathways, roads, social forests, bus stands, railway tracks, canals, rivers, local reservoirs, swamps, marshy and water-logged areas, lands under still water, etc. are brought under the category of **land under non-agricultural use**. Area under this classification is 2,169,195 ha accounting for 16.7% of the state's geographical area. The extent under this category has increased.

All lands available for cultivation whether only once or not taken up for cultivation, but not cultivated during the current year and continuously for the last five years or more in succession for one reason or another are classified as **culturable waste land**. Such lands may either be fallow or covered with shrubs and jungles which are not put to any use. The total area under culturable waste is 368,661 ha or 2.8% of the total geographical area of the state. The districts of Karur, Thoothukudi and Tirunelveli together accounted for 47.0% of the area under this category. The area under this category is nil in Kanyakumari and Chennai districts and very meagre in Erode District with just 556 ha.

All grazing lands, whether they are permanent pastures, or meadows, are considered as **permanent pastures and other grazing lands**. Village common and grazing lands within forested areas are included under this category. An extent of 110,127 ha or 0.8% of the geographical area of the state falls under this category, the extent of which is highest in Kancheepuram District with 18,286 ha (16.6%) followed by Karur District with 10,801 ha (9.8%).

All cultivable lands, which is not included under the net area sown, but is put to some agricultural use such as lands planted with casuarinas, eucalyptus, teak, bamboo bushes, babul, thatching grass and other groves for fuel, etc. which are not included under orchards and which bear yield only once in its

whole life span are classified under the category of **miscellaneous tree crops and groves**. The extent under this category is 261,025 ha, i.e., 2.0% of the geographical area of the state. Thoothukudi District with 39,446 ha ranks first contributing 15.1% to the total area of the state under this category followed by Ramanathapuram District with 38,874 ha (14.9%) and Pudukottai District with 28,380 ha (10.9%).

Lands that are kept fallow out of the net area sown during the previous year are classified as **current fallow** for the reporting year. The area under current fallow during 2007-2008 was 980,723 ha as against 758,840 ha during 2005-2006 with an increase of 221,883 ha, i.e., 29.2%. The extent under this category is highest in Erode District (102,663 ha) followed by Coimbatore (96,629 ha), Thiruvannamalai (90,640 ha), Villupuram (84,825 ha), Vellore (56,582 ha) and Salem (55,434 ha) districts. Together, these districts account for 49.6% of the total area of the state under this category.

Lands which were taken up for cultivation but have been temporarily put off for cultivation for a period of not less than one year but not more than five years due to poverty of the cultivators, inadequate supply of water, malarial climate, silting of canals and rivers, un-remunerative nature of farming, etc. are treated as **other fallow lands**. An extent of 1,498,720 ha, which is 11.5% of the total geographical area, was recorded under this category during 2007-2008 as against 1,518,008 ha during 2005-2006. There was a decrease of 19,288 ha (10.9%) under this category between 2005-2006 and 2007-2008. The area under this category was highest in Tirunelveli District with 167,794 ha. This district ranked first contributing 11.2% to the total area of the state under this category followed by Virudhunagar District with 160,618 ha, Sivagangai District with 122,824 ha and Erode District with 102,565 ha during 2007-2008.

Areas of major crops cultivated in the state are shown below:

**District-wise Area under Principal Crops (2007-2008)**

| District | Food Grains (ha) | | | | Cash Crops (ha) | | |
|---|---|---|---|---|---|---|---|
| | Total | Cereals | Paddy | Pulses | Sugarcane | Cotton | Groundnut |
| Chennai | - | - | - | - | - | - | - |
| Coimbatore | 128,423 | 102,634 | 6,479 | 25,789 | 7,174 | 1,997 | 14,944 |
| Dharmapuri | 82,251 | 66,203 | 18,801 | 16,048 | 17,294 | 4,888 | 13,910 |
| Dindugal | 120,965 | 97,015 | 17,276 | 23,950 | 6,372 | 1,256 | 14,744 |
| Erode | 80,765 | 65,955 | 38,360 | 14,810 | 41,906 | 1,983 | 31,416 |
| Kancheepuram | 92,408 | 91,563 | 91,356 | 845 | 4,847 | 12 | 21,863 |
| Kanyakumari | 21,511 | 20,349 | 20,349 | 1,162 | 0 | 10 | 39 |
| Karur | 46,561 | 40,424 | 12,433 | 6,137 | 6,042 | 114 | 6,212 |
| Madurai | 96,470 | 8,231 | 61,864 | 11,239 | 5,827 | 7,477 | 4,687 |
| Nagapattinam | 249,673 | 154,045 | 154,040 | 95,628 | 6,443 | 1,269 | 4,109 |
| Namakkal | 36,434 | 33,254 | 12,205 | 3,180 | 19,450 | 3,058 | 34,324 |
| Nilgiris | 1,113 | 1,113 | 1,110 | 0 | 10 | 5 | 0 |
| Perambalur | 107,901 | 105,986 | 38,121 | 1,915 | 15,803 | 15,267 | 22,003 |
| Pudukottai | 93,859 | 91,260 | 88,665 | 2,599 | 8,760 | 112 | 23,596 |
| Ramanathapuram | 132,669 | 127,962 | 123,771 | 4,707 | 334 | 2,165 | 6,111 |
| Salem | 69,365 | 58,144 | 21,711 | 11,221 | 11,610 | 15,128 | 24,559 |
| Sivagangai | 77,929 | 76,969 | 76,733 | 7,536 | 5,992 | 893 | 5,212 |
| Theni | 46,553 | 39,017 | 14,400 | 960 | 7,658 | 1,364 | 1,899 |
| Tiruchirapalli | 112,136 | 100,109 | 61,289 | 12,027 | 6,767 | 6,677 | 14,113 |
| Tirunelveli | 116,283 | 93,412 | 83,711 | 22,871 | 6,095 | 3,250 | 3,060 |
| Tiruvarur | 241,688 | 151,641 | 151,629 | 90,047 | 2,281 | 982 | 7,888 |
| Toothukudi | 11,2309 | 45,101 | 18,056 | 67,208 | 231 | 4,090 | 1,701 |
| Virudhunagar | 75,333 | 56,723 | 28,214 | 18,610 | 4,438 | 8,723 | 7,692 |
| | 4,866,709 | 2,487,987 | 1,789,170 | 609,552 | 354,022 | 99,335 | 535,211 |

Source: Department of Economics and Statistics, Chennai

### 2.4.3 Water Resources

Major sources of water other than rivers in the State are wells, reservoirs, tanks and canals. Erode has the largest number of open wells (121,358) followed by Salem (108,338). Erode, Salem, Coimbatore, Dharmapuri and Namakkal together account for 40-50% of the open wells found in Tamil Nadu. Nagapattinam and Tiruvarur have some of the longest canals; average length more than 60km in Nagapattinam and 45km in Tiruvarur. Sivagangai has the maximum number of tanks (4,966) followed by Dindugal (3,104). Coimbatore has the largest number of tube and other wells.

**Sources of water supply 2007-2008**

| District | Open wells | Wells used only for domestic purposes | Tube wells & other wells | Reservoirs | Tanks | Canals | |
|---|---|---|---|---|---|---|---|
| | | | | | | Number | Length (km) |
| Chennai | - | - | - | - | - | - | - |
| Coimbatore | 87,772 | 12,605 | 29,954 | 9 | 77 | 42 | 527 |
| Dharmapuri | 82,289 | 16,265 | 1,117 | 7 | 1,015 | 85 | 187 |
| Dindugal | 94,088 | 15,457 | 3,266 | 8 | 3,104 | 28 | 143 |
| Erode | 121,358 | 25,362 | 9,905 | 7 | 847 | 13 | 772 |
| Kancheepuram | 63,411 | 48,303 | 12,249 | 0 | 1,942 | 20 | 184 |
| Kanyakumari | 2,051 | 25,358 | 1,303 | 5 | 2,623 | 53 | 540 |
| Karur | 47,230 | 6623 | 2,055 | 0 | 286 | 23 | 226 |
| Madurai | 47,879 | 56,364 | 871 | 2 | 2,287 | 80 | 170 |
| Nagapattinam | 4,038 | 44,992 | 16,913 | 0 | 0 | 9 | 548 |
| Namakkal | 73,249 | 9,133 | 5,187 | 0 | 259 | 3 | 75 |
| Nilgiris | 775 | 668 | 0 | 0 | 0 | 1 | 2 |
| Perambalur | 44,267 | 10,891 | 12,033 | 2 | 816 | 4 | 47 |
| Pudukottai | 24,868 | 5527 | 13,601 | 0 | 5,451 | 28 | 78 |
| Ramanathapuram | 7,591 | 18,664 | 310 | 0 | 1,694 | 0 | 0 |
| Salem | 108,338 | 31, 218 | 9,552 | 3 | 546 | 78 | 233 |
| Sivagangai | 16,558 | 27,852 | 1,458 | 0 | 4,966 | 19 | 20 |
| Theni | 24,477 | 5,937 | 4,298 | 3 | 150 | 107 | 226 |
| Tiruchirapalli | 73,830 | 7,863 | 72,64 | 1 | 1,767 | 135 | 494 |
| Tirunelveli | 78,640 | 24,973 | 1,047 | 13 | 2,155 | 129 | 532 |
| Tiruvarur | 164 | 18,860 | 13,669 | 0 | 0 | 13 | 612 |
| Toothukudi | 24,770 | 12,896 | 786 | 0 | 651 | 4 | 78 |
| Virudhunagar | 35,659 | 10,162 | 5 | 6 | 997 | 0 | 0 |
| Total | 1,532,262 | | 200,306 | 78 | 41,260 | 2,237 | 9,736 |

Source: Department of Economics and Statistics, Chennai

All irrigation in Tiruvarur is through canals. Nagapattinam district more or less entirely relies on canals. Irrigation in Coimbatore is predominantly by way of open wells. Tiruvarur, Tiruchirapalli, Tirunelveli, Coimbatore, Dindugal, Erode, Kancheepuram, Nagapattinam and Pudukottai districts have more than 100,000ha under irrigation.

**Source-wise net area irrigated (in ha) by district 2007-2008**

| District | Canals | Tanks | Tube wells & other wells | Open wells | Other sources | Total |
|---|---|---|---|---|---|---|
| Chennai | - | - | - | - | - | - |
| Coimbatore | 47,832 | 1384 | 26,459 | 101,711 | 1439 | 178,825 |
| Dharmapuri | 972 | 3290 | 773 | 60,780 | 0 | 65,815 |
| Dindugal | 5610 | 6540 | 3686 | 85,842 | 960 | 102,638 |
| Erode | 87,961 | 263 | 16,489 | 66,373 | 2257 | 173,343 |
| Kancheepuram | 135 | 57,026 | 9096 | 56,041 | 0 | 122,298 |
| Kanyakumari | 10,148 | 15,906 | 157 | 375 | 151 | 26,737 |
| Karur | 15,820 | 55 | 4769 | 29,292 | 0 | 49,936 |
| Madurai | 26,854 | 25,226 | 584 | 31,012 | 5 | 83,681 |

| District | Canals | Tanks | Tube wells & other wells | Open wells | Other sources | Total |
|---|---|---|---|---|---|---|
| Nagapattinam | 122,729 | 0 | 0 | 0 | 646 | 123,375 |
| Namakkal | 6046 | 205 | 4911 | 48,948 | 4485 | 64,595 |
| Nilgiris | 15 | 0 | 0 | 534 | 140 | 689 |
| Perambalur | 9496 | 5952 | 17,865 | 29,608 | 83 | 63,004 |
| Pudukottai | 8658 | 65,714 | 22,812 | 7699 | 0 | 104,883 |
| Ramanathapuram | 0 | 53,110 | 2922 | 17,213 | 0 | 73,245 |
| Salem | 4013 | 1372 | 9278 | 84,363 | 1 | 99,027 |
| Sivagangai | 0 | 65,416 | 1933 | 9743 | 0 | 77,092 |
| Theni | 11,142 | 1260 | 7694 | 38,888 | 0 | 58,984 |
| Tiruchirapalli | 38,622 | 4696 | 7554 | 51,392 | 0 | 102,264 |
| Tirunelveli | 20,201 | 47,755 | 878 | 48,274 | 185 | 117,293 |
| Tiruvarur | 145,238 | 0 | 0 | 0 | 0 | 145,238 |
| Toothukudi | 11,824 | 10,127 | 1108 | 18,592 | 0 | 41,651 |
| Virudhunagar | 0 | 24,024 | 11 | 34,229 | 0 | 58,264 |

Source: Department of Economics and Statistics, Chennai

## 2.5 Biodiversity of the State

### 2.5.1 Fauna and Flora

Tamil Nadu has a heterogeneous mosaic of vegetation that has resulted from the diverse topography, climate and human influence. The 23,338 $km^2$ of natural forests represent 9 of the 16 major forest types in India. The single most dominant forest type is the tropical dry deciduous forest that covers an area of approximately 1.2 million ha (i.e., 12,230 $km^2$ or 54% of the natural forests in the state).

The 23,338 $km^2$ of forests amount to 17.94% of the state, of which 2,926 $km^2$ (12.5%) is considered as dense while another 10,196 $km^2$ (43.7%) is treated as 'open' with a crown density of less than 40%. An additional 3.82% of the state's forest is contributed by 'tree cover'.

**Major Forest Types and Sub-types along with Their Relative Extent in the State of Tamil Nadu**

| Forest Type & Code Numbers | Sub-type | | Edaphic and Seral Type | | Area Covered |
|---|---|---|---|---|---|
| Tropical wet evergreen forests (**1A**) | 1A/C3 | Southern hilltop evergreen forests | 1E1 | Cane brakes, | 60,000 ha (2.67%) |
| | 1A/C4 | West coast tropical evergreen forests | 1E2 | Wet bamboo brakes, | |
| | | | 12S1 | Pioneer Euphorbiaceous scrub | |
| Tropical semi-evergreen (**2A**) | 2A/C2 | West coast semi-evergreen forests | 2E3 | Moist bamboo brakes, | 23,000 ha (1.01%) |
| | 2A/C3 | Tirunelveli semi-evergreen forests | 2E4 | Lateritic semi-evergreen forests, | |
| | 2A/2S1 | West coast secondary evergreen Dipterocarp forests | 2/2S1 | Secondary moist bamboo brakes | |
| Tropical moist deciduous (**3B**) | 3B/C1 | Moist teak bearing forest | | | 260,000 ha (11.10%) |
| | 3B/C1/1a | Very moist teak forest | | | |
| | 3B/C1/1b | Moist teak forest | | | |
| | 3B/C2 | Southern moist mixed deciduous forests | | | |
| | 3B/2S1 | Southern secondary moist mixed deciduous forests | | | |
| Littoral & swamp forests (**4A, 4B, 4C, 4E**) | 4A/L1 | Littoral forest | | | 23,000 ha (1.01%) |
| | 4B/TS1 | Mangrove scrub | | | |
| | 4B/TS2 | Mangrove forest | | | |
| | 4C/FS2 | Sub-montane hill valley swamp | | | |

| Forest Type & Code Numbers | Sub-type | | Edaphic and Seral Type | Area Covered |
|---|---|---|---|---|
| | | forest | | |
| | 4E/RS1 | Riparian fringing forest | | |
| Tropical dry deciduous (**5A, 5D**) | 5A/C1<br>5A/C1a<br>5A/C1b<br>5A/C2<br>5A/C3<br><br>5DS1<br>5DS2<br>5DS3<br>5DS4 | Dry teak-bearing forests<br>Very dry teak forest<br>Dry teak forest<br>Dry red sanders-bearing forest<br>Southern dry mixed deciduous forests<br>Dry deciduous scrub<br>Dry savannah forest<br>Euphorbia scrub<br>Dry grassland | 5E4 Hardwickia forest,<br>5E7 Laterite thorn forest,<br>5E9 Dry bamboo brake,<br>5/1S1 Dry tropical riverine forest,<br>5/2S1 Secondary dry deciduous forest | 1,203,000 ha (54.30%) |
| Tropical thorn forest (**6A**) | 6A/C1<br>6A/C2<br>6A/DS1<br>6A/DS2 | Southern thorn forest<br>Carnatic umbrella thorn forest<br>Southern thorn scrub<br>Southern euphorbia scrub | | 500,000 ha (22.20%) |
| Tropical dry evergreen forest (**7**) | 7C1<br>7 DS1 | Tropical dry evergreen forest<br>Tropical dry evergreen scrub | | 26,000 ha (1.16%) |
| Sub-tropical broad-leaved hill forest (**8**) | 8A/C1<br>8A/E1<br>8A/C1/DS1 | Nilgiri sub-tropical hill forest<br>Reed brakes (Ochlandra)<br>South Indian tropical hill savannah woodland | | 114,000 ha (5.04%) |
| Montane wet temperate forests (**11A**) | 11A/C1<br>11A/C1/DS1<br>11A/C1/DS2 | Southern mountain wet temperate forests<br>Southern mountain wet scrub<br>Southern mountain wet grassland | | 34,000 ha (1.5%) |

Source: Annamalai (2004); codes are as per Champion and Seth.

Flora (including algae, bryophytes and fungi) are fairly well-documented. Available information has suggested that there is a significant diversity in each of these taxa. For instance, along the Cauvery River (when surveyed over its entire course), not less than 1,081 species of algae are known. Elsewhere along the Mandapam Coast, 104 species of marine algae have been reported.

Nearly 400 species of lichens representing 93 genera are known from Tamil Nadu. A single landscape as that of Palni Hills is known to have yielded 368 species of bryophytes during the early surveys of the 20$^{th}$ century. Elsewhere in the Tirunelveli Hills, 160 species of ferns and allies have been collected. Forty-three species of ferns found in Tamil Nadu have been considered as rare and endangered.

Four species of gymnosperms are native to Tamil Nadu. However, nearly 60 species have been introduced in the state. Tamil Nadu has the highest number of angiosperm species in the country; 32% of all native angiosperms known in India are found in Tamil Nadu. Nilgiris has 2,611 species of angiosperms representing 942 genera and 163 families. Tirunelveli District in the south has 2,105 species of angiosperms representing 872 genera and 137 families. Even an urban area like Coimbatore has great diversity of plants. Around 869 taxa (species and varieties) of angiosperms were known from the urban borders of Coimbatore in 1968.

The five most dominant families of angiosperms are Leguminosae (507 species), Poaceae (436 species), Asteraceae (240 species), Rubiaceae (209 species) and Euphorbiaceae (198 species). About 192 species of orchids are known in the state where the rare *Paphiopedilum Druryi* of Tirunelveli Hills is considered one of the rarest.

Tamil Nadu also has a great diversity of medicinal plants and wild relatives of crop plants. Around

1,500 species of angiosperms in the state are known to have medicinal properties. Around 68 species of wild angiosperms are edible and approximately 260 species representing 55 genera are considered to be wild relatives of crop plants.

**Summary of Diversity of Flora and Fauna in the State***

| Taxa | India | Tamil Nadu | | | |
|---|---|---|---|---|---|
| | No of Species | No of Genera@ | No of Species | No of Endemic Species$ | No of Threatened Species* |
| Algae | - | 432 | 1119 | - | - |
| Bryophytes | - | 182 | 560 | 187 | - |
| Fungus | - | 370 | 1077 | - | - |
| Lichen | - | 93 | 400 | - | - |
| Ferns & allies | - | - | 279 | - | - |
| Gymnosperm | 64 | 3 | 4 | - | - |
| Angiosperm | 17,672 | 1668 | 5239 | 533 (270) | 230 |
| Butterflies | - | 100 | 316 | 35 | - |
| Freshwater fish | - | 70 | 165 | 43 (15) | 126 |
| Amphibians | 197 | 21 | 76 | 41 | 56 |
| Reptiles (all) | 408 | 78 | 178 | 71 (11) | 77 |
| Snakes | - | 37 | 78 | 46 | - |
| Birds | 1224 | 220 | 454 | 17 | 32 |
| Mammals | 350 | 87 | 187 | 24 | 40 |

*Animals based on Conservation Assessment and Management Plan (CAMP) Report;
No of species in India based on Government of TN, Department of Environment, ENVIS data
@ Approximate numbers considering the variability in taxonomic treatment between authors; $ Endemic animals also include those confined to southern India/Western Ghats that occur in TN; those exclusive to TN are shown in brackets

Considerable amount of information is available on the distribution and diversity of animal species in Tamil Nadu. Information on species richness exists even for little known organisms like Ascidians (Prochordate animals). About 42 species have been reported from in and around the Gulf of Mannar. However, there is generally more information on the vertebrate animals than on invertebrates, with the exception of butterflies.

More than 1,000 species of vertebrate animals are known from the State of Tamil Nadu. Of these, 196 species (20%) are endemic to southern India. Endemism is highest in reptiles, particularly in snakes. There are more than 40 endemic species each of freshwater fishes and amphibians that are known from Tamil Nadu. Eleven species of reptiles and 15 species of freshwater fishes are endemic to the state.

Endangered animals (Schedule I of the Wildlife Protection Act, 1972) known from the state include the butterfly, common pierrot (*Castalius rosimon*), Indian peafowl, mugger (marsh crocodile), flap-shell turtle (*Lissemys punctatus*), elephant, tiger, blackbuck, Nilgiri tahr, lion-tailed macaque, etc. Tamil Nadu has the largest population of endangered endemic animals such as Nilgiri tahr and lion-tailed macaque. It has also the largest population of mugger, elephant and tiger in south India.

**Annexure 2.1** and **2.2** provide the list of angiosperms endemic to Tamil Nadu and endangered animals.

### 2.5.2 Protected Areas (PAs)

Tamil Nadu ranks 14th in the country for its land under protected areas (PA). The PAs of Tamil Nadu extend over 4,578 km$^2$ comprising 3.5% of the geographical area and 20.0% of the recorded forest area. The state has also declared one tiger reserve, three elephant reserves and three biosphere reserves. The Point Calimere Wildlife Sanctuary is the only Ramsar site in the state.

**Summary of PAs and Reserve Forests in Tamil Nadu**

| | Category | India | | Tamil Nadu | |
|---|---|---|---|---|---|
| | | No | Total area (ha) | No | Total area (ha) |
| **National** | National Park | 97 | 3,819,947.00 | 5 | 82,763.00 |
| | Sanctuary (Wildlife) | 510 | 11,841,911.00 | 10 | 357,962.88 |
| | Sanctuary (Bird) | | | 12 | 17,074.59 |
| | Conservation Reserve | 7 | 32,150.80 | 1 | 2.84 |
| | Reserve Forest | - | - | - | 2,333,800.00 |
| **International** | World Heritage Site | - | - | - | - |
| | Biosphere Reserve # | 15 | 7,467,400.00 | 3 | 1,453,760.00 |
| | Ramsar Site | 25 | 677,131.00 | 1 | 1,726.00 |

Source: Sreedharan (undated); TNFD (unpublished information);
#: Gulf of Mannar with 1,050,000 ha, NBR (TN) with 253,760 ha and Agasthyamalai with 150,000 ha (area shared with Kerala not excluded)

**MAP-4** shows the location of PAs. The important biodiversity of national parks, sanctuaries (wildlife and bird) are listed in the table below. Interestingly, some of these PAs, in part or full, have been nominated in the year 2009 to be recognized as World Heritage sites.

**Important Biodiversity of PAs**

| Name of PA | Important Biodiversity (Flora and Fauna) |
|---|---|
| Guindy NP | Blackbuck, pangolin, pale-bellied hedgehog, civets, jungle cat, endemic herbs and grasses |
| Mudumalai NP & WLS | Elephant, tiger, leopard, wild dog, gaur, sambar, peafowl |
| Mukurti NP*# | Nilgiri tahr, Nilgiri wood pigeon, Nilgiri pipit, Nilgiri laughing thrush, numerous endemic cold-adapted plants and animals; diversity of native balsams (*Impatiens* spp) |
| Indira Gandhi NP & WLS*# | Elephant, tiger, Nilgiri tahr, lion-tailed macaque, Kelaart's long-clawed shrew, Nilgiri langur, great pied hornbill, Ceylon frogmouth, several species of endemic fish, amphibians and reptiles, endemic plants (e.g., *Cullenia excelsa*) |
| Gulf of Mannar Marine NP | Coral, prochordates, sea horse, sea cucumber, dugong, sea turtles, numerous species of reef invertebrates and fish |
| Sathyamangalam WLS | Tiger, elephant, wild dog, leopard, blackbuck, white-backed vulture |
| Meghamalai WLS | Tiger, elephant, tropical rainforest plants and animals, lion-tailed macaque, Nilgiri langur |
| Grizzled Giant Squirrel WLS*# | Elephant, Nilgiri tahr, lion-tailed macaque, grizzled giant squirrel; the now extinct red-faced malkoha was once reported from the PA |
| KalaKad WLS | Tiger, elephant, Nilgiri langur, lion-tailed macaque, tropical rainforest species of plants and animals, endemic amphibians, reptiles and fish |
| Mundanthurai WLS | Tiger, elephant, leopard, small carnivores |
| Vallanadu Black Buck WLS | Blackbuck, peafowl, stone curlew, species restricted to dry scrub |
| Kanyakumari WLS | Elephant, Nilgiri tahr, Nilgiri langur, travancore tortoise, kangaroo lizard (*Otocryptis beddomei*), endemic fishes (e.g., *Puntius rohani* sp nov); reed brakes are unique |
| Point Calimere WLS# | Blackbuck, sand grouse, migratory birds including rare spoon-billed sandpiper, flamingo, mangrove forests |

| Name of PA | Important Biodiversity (Flora and Fauna) |
|---|---|
| Pulicat Lake BS | Flamingo, painted stork, migratory ducks, waders, terns and gulls, Spoonbill, numerous species of crabs, mollusk |
| Karikili BS# | Grey pelican, storks, glossy ibis, migratory ducks |
| Vedanthangal BS# | Grey pelican, storks, glossy Ibis, migratory ducks |
| Vellode BS | Resident and migratory birds |
| Karaivetti BS# | Resident and migratory birds; 16 species of ducks; bar-headed goose, osprey |
| Vaduvoor BS# | Resident and migratory birds |
| Udayamarthandam BS | Darter, Indian Reef heron, spoonbill, other resident and migratory birds |
| Vettangudi BS# | Resident and migratory birds |
| Kanjirakulam BS# | Resident and migratory birds |
| Chithrangudi BS# | Resident and migratory birds |
| Melaselvanur-Kilaselvanur BS | Resident and migratory birds |
| Koonthakulam-Kadankulam BS# | Grey pelican, jackal, resident and migratory birds; bar-headed goose, black ibis |

*Nominated for recognition as World Heritage site;

#Designated as important bird areas (Birdlife International)

District-wise distribution of PAs and conservation areas of international importance are given below:

**District-wise Distribution of PAs and Conservation Areas of International Importance**

| District | Protected Areas (PAs) | | | | Int'l CA | | GOI Projects | |
|---|---|---|---|---|---|---|---|---|
| | National Park | Sanctuary (Wildlife) | Sanctuary (Bird) | Conservation Reserve | Biosphere Reserve | Ramsar Site | Tiger Reserve | Elephant Reserve |
| Chennai | 1 | - | - | - | - | - | - | - |
| Coimbatore | 1 | 1 | - | - | - | - | 1 | 2 |
| Dharmapuri | - | - | - | - | - | - | - | 1 |
| Dindugal | - | - | - | - | - | - | - | 1 |
| Erode | - | 1 | 1 | - | - | - | - | 1 |
| Kancheepuram | - | - | 2 | - | - | - | - | - |
| Kanyakumari | - | 1 | - | - | 1 | - | - | - |
| Madurai | - | - | - | - | - | - | - | - |
| Nagapattinam | - | 1 | - | - | - | 1 | - | - |
| Namakkal | - | - | - | - | - | - | - | - |
| Nilgiris | 2 | 1 | - | - | 1 | - | Proposed | 2 |
| Perambalur | - | - | 1 | - | - | - | - | - |
| Ramanathapuram | 1 | - | 3 | - | 1 | - | - | - |
| Sivagangai | - | - | 1 | - | - | - | - | - |
| Theni | - | 1 | - | - | - | - | - | 2 |
| Tirunelveli | - | 2 | 1 | 1 | 1 | - | 1 | - |
| Tiruvarur | - | - | 2 | - | - | - | - | - |
| Toothukudi | - | 1 | - | - | - | - | - | - |
| Virudhunagar | - | 1 | - | - | - | - | - | 1 |

Source: JICA Preparatory Survey Team

### 2.5.3 Protection System of PAs

Before the Wildlife (Protection) Act (WPA) of 1972 came into force in India, forests and wildlife were protected under different laws and through government notifications. After 1972, all forms of protection in and out of PAs are governed by the WPA. Under the WPA, the following terms are formally used and defined as follows:

**Terminology Used in the Wildlife (Protection) Act, 1972**

| Term | Definition |
|---|---|
| Closed Area | The area which is declared under Sub-section (1) of Section 37 to be closed to hunting |
| National Park | An area declared, whether under Section 35 or Section 38, or deemed, under Sub-section (3) of Section 66, to be declared as National Park |
| Reserve Forest | The forest declared to be reserved by the state government under Section 20 of the Indian Forest Act, 1927 |
| Sanctuary | An area declared whether under Section 26A or Section 38, or deemed, under Sub-section (3) of Section 66, to be declared as a wildlife sanctuary |
| Specified Animal | Any animal in Schedule I or Schedule II, Part II (of WPA) |
| Specified Plant | Any plant in Schedule VI (of WPA) |
| Vermin | Any animal in Schedule V (of WPA) |
| Wild Animal | Any animal found wild in nature and includes any animal specified in Schedule I, Schedule II, Schedule III, Schedule IV or Schedule V (of WPA), wherever found |
| Wildlife | Any animal, bees, butterflies, crustacean, fish and moths; and aquatic or land vegetation which form part of any habitat |

The WPA in its Chapter III prohibits the hunting of wild animals. It also prohibits the collection of specified plants in Chapter IIIA. Thereby, all wild species of plants and animals get some form of legal protection whether they are within notified PAs or not. Further in Chapter IV, the WPA has dealt with the declaration of sanctuaries, national parks and closed areas. Provisions of the WPA are mainly focused on the prevention of fire, entry/use of weapons and injurious substances into sanctuaries. However, they are only meant to regulate grazing in the interest of wildlife. It is prescribed in the WPA that the chief wildlife warden of the state take such measures as necessary to immunize against communicable diseases livestock maintained within 5 km radius of any sanctuary.

National parks are managed more strictly in that grazing of livestock is prohibited and any movement of livestock is permitted through the PA when used as a vehicle for transport. No alteration of the boundaries of a national park can be made except on a resolution passed by the legislature of the state. Any reference in this regard by the PA manager to the State Legislature is construed as a reference to the parliament.

Section 36 of the WPA has made provisions for declaring any area owned by the government, particularly the areas adjacent to national parks and sanctuaries and those areas which link one protected area with another, as a conservation reserve for protecting landscapes, seascapes, flora and fauna and their habitat. The management of conservation reserves is participatory in that the state government constitutes a conservation reserve management committee (CRMC) to advise the chief wildlife warden on conservation and management of the reserve. The CRMC will have representatives from the village panchayat within whose jurisdiction the reserve falls. There is also provision for including three representatives from NGOs in the CRMC.

The Indian Man and Biosphere Reserve Program of the Ministry of Environment and Forests (MoEF) provides support and guidance for the management of biosphere reserves. However, there is no binding law that governs the management and therefore, biosphere reserves are managed by the state in accordance with the provisions of the WPA. Similarly, ramsar sites are also not governed by any exclusive national law and policy other than the WPA.

**Protected Areas of Tamil Nadu and their Status**

| Name of PA | Status | Act under which it is Notified | Date of Notification | Area (ha) |
|---|---|---|---|---|
| Mudumalai WLS | RF | 193 Development Department | 27.1.1940 | 21,776.00 |
| Indira Gandhi WLS | RF | Wildlife (Protection) Act 18(1) | 14.10.1976 | 84,149.00 |
| Mundanthurai WLS | RF | Wild Birds and Animals Protection Act | 2.8.1962 | 35,228.38 |

| Name of PA | Status | Act under which it is Notified | Date of Notification | Area (ha) |
|---|---|---|---|---|
| | RL | 1912 | | 22,979.00 |
| Kalakad WLS | RF | Wildlife (Protection) Act 18(1) | 6.3.1976 | 22,358.00 |
| Grizzled Giant Squirrel WLS | RF | Wildlife (Protection) Act 18(1) | 26.12.1988 | 48,520.00 |
| Point Calimere WLS | RF | Sec. 62 of Madras Forests Act 1882 | 13.6.1967 | 1726.00 |
| Vallandu Blackbuck Sanctuary | RF | Wildlife (Protection) Act 18(1) | 28.9.1987 | 1641.00 |
| Kanyakumari WLS | RF | Wildlife (Protection) Act 26A 1(b) | 20.11.2007 | 40,239.55 |
| Sathyamangalam WLS | RF | Wildlife (Protection) Act 26A 1(b) | 3.11.2008 | 52,434.94 |
| Megamalai WLS | RF | Wildlife (Protection) Act 26A 1(b) | 26.6.2009 | 26,910.81 |
| Vedanthangal BS | PWDT | Wildlife (Protection) Act 26A(1) | 3.7.1998 | 30.00 |
| Karikili BS | PWDT | Wildlife (Protection) Act 18(1) | 23.5.1989 | 61.21 |
| Pulicat Lake BS | Lake | Wildlife (Protection) Act 18(1) | 22.9.1980 | 15,367.00 |
| Vettangudi BS | PWDT | Wildlife (Protection) Act 18(1) | 3.6.1977 | 38.40 |
| Kanjirakulam BS | PWDT | Wildlife (Protection) Act 18(1) | 21.9.1999 | 104.00 |
| Chitrangudi BS | PWDT | Wildlife (Protection) Act 18(1) | 21.9.1999 | 47.63 |
| Udayamarthandam BS | PWDT | Wildlife (Protection) Act 26A(1) | 31.12.1998 | 45.28 |
| Vaduvoor BS | PWDT | Wildlife (Protection) Act 26A(1) | 22.7.1999 | 128.10 |
| Koonthakulam-Kadankulam BS | PWDT | Wildlife (Protection) Act 18(1) | 30.11.1994 | 129.00 |
| Kariavetti BS | PWDT | Wildlife (Protection) Act 18(1) | 5.4.1999 | 453.71 |
| Vellode BS | PWDT | Wildlife (Protection) Act 26 A(1) | 29.2.2000 | 77.18 |
| Melaselvanur-Kilaselvanur BS | PWDT | Wildlife (Protection) Act 18(1) | 10.3.1998 | 593.08 |
| Mudumalai NP | RF | Wildlife (Protection) Act 35(4) | 16.6.2005 | 10,323.00 |
| Indira Gandhi NP | RF | Wildlife (Protection) Act 35(1) | 23.1.1989 | 11,710.00 |
| Mukurti NP | RF | Wildlife (Protection) Act 35(4) | 12.12.2001 | 7846.00 |
| Guindy NP | RF | Wildlife (Protection) Act 35(4) | 4.9.1978 | 282.00 |
| Gulf of Mannar MP | RL & Sea Area | Wildlife (Protection) Act 35(1) | 10.9.1986 | 52,602.00 |
| Thirupudaimaruthur Birds CR | Temple Area | Wildlife (Protection) Act 36A(1) & 36B(1) | 14.2.2005 | 2.84 |

Source: TNFD (unpublished); **WLS** – Wildlife Sanctuary; BS – Bird Sanctuary; **NP** – National Park; **CR** – Conservation Reserve; **PWDT** – Public Works Department Tank; **RF** – Reserve Forest; **RL** – Reserve land; **MP** – Marine Park

### 2.5.4 Human-Wildlife Conflict

Human-animal conflict is of varying intensity depending on the kind of animals involved. In the Kalakad-Mundanthurai Tiger Reserve (KMTR), wild boars, elephants and sloth bears invade agricultural crops. Common langurs occasionally damage human property in the fringes. Leopards and sloth bears stray into villages. In general, the magnitude of the problem is higher in villages abutting PAs where there is a greater density of elephants. While the Tamil Nadu Forest Department (TNFD) has adopted various mitigation measures to deal with the problem (e.g., solar-powered electric fencing, trenches, driving animals back, capturing and relocation of stray wild animals), there has been a generally increasing trend in the number of casualties starting from 2006. Consequently, the amount paid as compensation has increased from Rs. 8.594 million in 2006 to Rs. 11.387 million in 2010.

**Summary of Conflicts and Compensation Paid During 2006-2010**

| Year | Number of Cases & Compensation Paid (100,000 rupees) | Type of casualty | | | | | |
|---|---|---|---|---|---|---|---|
| | | Human Death | Human Injury | Livestock Damages | Crop Damages | Property Damages | Total |
| 2006-07 | Number of cases | **30** | **33** | **2** | **1,267** | **10** | **1,342** |
| | *Compensation paid* | *30.00* | *3.13* | *0.04* | *52.42* | *0.35* | *85.94* |
| 2007-08 | Number of cases | **25** | **29** | **15** | **742** | **12** | **823** |
| | *Compensation paid* | *25.00* | *4.37* | *0.30* | *41.66* | *0.60* | *71.93* |
| 2008-09 | Number of cases | **35** | **27** | **27** | **1,328** | **22** | **1,439** |
| | *Compensation paid* | *35.20* | *3.13* | *0.56* | *75.37* | *0.71* | *114.97* |
| 2009-10 | Number of cases | **30** | **28** | **22** | **1,195** | **16** | **1,827** |
| | *Compensation paid* | *30.00* | *3.17* | *0.46* | *79.61* | *0.63* | *113.87* |

| Year | Number of Cases & Compensation Paid (100,000 rupees) | Type of casualty | | | | | |
|---|---|---|---|---|---|---|---|
| | | Human Death | Human Injury | Livestock Damages | Crop Damages | Property Damages | Total |
| **Total casualties** | | **126** | **119** | **68** | **4,950** | **48** | **5,311** |

Source: Tamil Nadu Forest Department

The Eleventh Five-Year Plan has proposed to erect 360 km of solar-powered electric fences at a cost of Rs. 160,000/km. Investments during previous years on solar-powered electric fencing have been varied. In 2006-2007, 262.5 km were fenced at a cost of Rs. 42.4 million, while 315.75 km were fenced at a cost of Rs. 80.82 million during the year 2007-2008. In 2008-2009, an additional 331.25 km were fenced at a cost of Rs. 52.90 million and in 2009-2010, 258 km were fenced at a cost of Rs. 41.535 million. Satyamangalam (170 km) and Coimbatore (129.5 km) are the two forest divisions that have attracted the longest fencing. These are followed by Tirunelveli (99 km), Hosur (94 km), Pollachi (87 km) and Kanyakumari (85 km). **Table 2.1** summarizes solar fencing distance and costs from 2006 to 2010.

### 2.5.5 Issues of Biodiversity Conservation in the State

As part of the country-wide exercise in developing the National Biodiversity Strategy and Action Plan in 2000-2004, the TNFD led the task of preparing the Tamil Nadu Biodiversity Strategy and Action Plan. The key conservation issues identified under the 'Forest Biodiversity Strategy and Action Plan' (2004) are as follows:

1) Implementation of forest policy
2) Implementation of National Forestry and Wildlife Action Plan
3) Increasing PAs for in situ conservation
4) Restoration of degraded forests
5) Preservation of all existing grasslands
6) Maintaining the existing positive trend in forest cover
7) Consolidation of JFM
8) Expanding eco-development
9) Promoting agro-forestry
10) Promoting social forestry
11) Adopting watershed management as the core strategy
12) Awareness creation and sensitization
13) Strengthening symbiotic relationship between tribal communities and forests
14) Acquiring private forest enclaves in Protected Areas
15) Minimizing the pressures from other enclaves
16) Minimizing the diversion of forest lands
17) Prevention of fire and managing fire
18) Reducing head-loading (of forest products)
19) Reducing grazing
20) Minimizing trade pressure on sandal wood
21) Preventing destructive methods of NTFP collection
22) Reduction in trade of wild medicinal plants
23) Preventing destructive methods of wild plant collection
24) Preventing further encroachment
25) Speeding up settlement process
26) Reviewing mining policy
27) Reducing exotic plantation
28) Preventing poaching
29) Minimizing the accidental death of wild animals including electrocution
30) Rescuing and releasing wild animals
31) Minimizing human-animal conflicts
32) Preventing pollution
33) Preventing the spread of Invasive Alien Species
34) Reducing pilgrim and tourist pressures
35) Preventing habitat fragmentation
36) Evolving specific species conservation plans
37) Integrating biodiversity conservation in forestry planning
38) Training and capacity building
39) Promoting research on survey of biodiversity
40) Evolving monitoring strategies for red-listed and other important species
41) Evolving recovery strategies for red-listed species

## 2.6 Forestry Sector of the State

### 2.6.1 Forest Area Classification

The recorded forest area in the state is 2,287,700 hectares, which constitutes 17.6% of its geographical area The two hill formations, namely, Western Ghats and Eastern Ghats, account for over 90% of the forest area of the state. The east coast and west coast with over 1,076 km of coast line is dotted with unique ecosystems like mangroves, estuaries and wetlands. The state forests are major catchments for most of the principal river systems, contributing to 85% of the catchments for all the 32 river systems, 11 major reservoirs and 61 major irrigation structures in the state.

The Forest Survey of India (FSI) as part of the MoEF, has been entrusted with the task of preparing the country's forest cover map at a regular interval of two years and coming out with the State of Forest Report (SFR). India SFR 2009, which is the 11$^{th}$ in the series launched by FSI in 2009, presents regular features like forest cover, tree cover, and mangrove cover along with some new features. The legal classification of the recorded forest area in Tamil Nadu, as per SFR 2009, is as follows:

| | |
|---|---|
| Reserved Forests | 19,388 km$^2$ |
| Protected Forests | 2,183 km$^2$ |
| Sub-total | 21,571 km$^2$ |
| Unclassified Forests | 1,306 km$^2$ |
| Total | 22,877 km$^2$ |

Major forests in Tamil Nadu are tropical dry deciduous forests (55%) and tropical dry thorn forests (22%). There are anthropogenic pressures in the form of fuel wood and fodder extraction and diversion of forests for various developmental uses. Low moisture level also adds to fire hazards. All such factors are leading to the degradation and shrinkage of the resource base. The state forest department estimated that 700,000 ha of forests were in a precariously degraded condition when it launched Phase I of TAP and about 3,072 forest fringe villages comprising primarily of forest dependent communities were adversely affected by degradation. As per report of the SFD, about 650,000 ha of degraded forests have been tackled under TAP I and TAP II and other state funds. This has resulted in the improvement of socioeconomic conditions of over 2,100 programme villages.

The distribution of reserved forests and lands in the state is depicted in **MAP-5**.

### 2.6.2 Forest Cover

As against legally recorded forests, forest cover includes all lands having trees with canopy density of 10% and above and with area of 1 ha or more. The minimum mapped area is 1 ha of forest cover, which corresponds to a cartographic limit (a polygon of the size 2 mm by 2 mm) on a map at 1:50,000 scale. Forest cover is shown in three density classes, viz., very dense forest (VDF), moderately dense forest (MDF), and open forest (OF). Scrub forest areas have also been delineated. Area under VDF, MDF and OF also includes mangrove cover of the corresponding density class. The classification scheme of forest cover mapping is as follows:

| | |
|---|---|
| Very Dense Forest | All lands with tree cover of canopy density of 70% and above |
| Moderately Dense Forest | All lands with tree cover of canopy density between 40% and 70% |
| Open Forest | All lands with tree cover of canopy density between 10% and 40% |
| Non-forest | Any area not included in the above classes. |

As per SFR 2009, the forest cover in the state, based on interpretation of the satellite data taken from Jan 2006 to May 2007, is 23,448 $km^2$, which is 17.94% of the state's geographical area. In terms of forest canopy density classes, the state has 2,926 $km^2$ VDF, 10,216 $km^2$ MDF and 10,196 $km^2$ OF.

The distribution of forest cover of the state is shown in **MAP-6**.

SFR 2009 has compared the current forest cover (satellite data of Jan 2006 – May 2007) with the previous assessment (satellite data of Dec 2004 – Feb 2005) which shows a gain of 24 $km^2$ of forest cover. The change matrix given in the table below reveals that there has been an increase of 1 $km^2$ in VDF and 27 $km^2$ in MDF but a decrease of 4 $km^2$ in OF.

**Forest Cover Change Matrix (area in $km^2$)**

| 2005 Assessment (Data of Dec 2004 - Feb 2005) | 2007 (Data of Jan 2006 - May 2007) | | | | | Total of 2005 |
|---|---|---|---|---|---|---|
| | VDF | MDF | OF | Scrub | NF | |
| Very Dense Forest | 2,889 | 23 | 3 | 0 | 0 | **2,925** |
| Moderately Dense Forest | 25 | 9,693 | 58 | 4 | 409 | **10,189** |
| Open Forest | 1 | 68 | 9,616 | 12 | 503 | **10,200** |
| Scrub | 0 | 4 | 11 | 1,131 | 16 | **1,162** |
| Non-Forest | 1 | 428 | 508 | 59 | 104,586 | **105,582** |
| **Total of 2007** | **2,926** | **10,216** | **10,196** | **1,206** | **105,514** | **130,058** |
| Net Change | 1 | 27 | -4 | 44 | -68 | |

District-wise forest cover in different canopy density classes and scrub along with the changes compared to 2005 assessment is given in the table below:

**District-wise Forest Cover in 2007 (Area in $km^2$)**

| District | Geographical Area (G.A.) | VDF | MDF | OF | Total | % of G.A. | Change* | Scrub |
|---|---|---|---|---|---|---|---|---|
| Ariyalur | 1,947 | 0 | 66 | 251 | 317 | 16,3 | 2 | 1 |
| Chennai | 144 | 0 | 5 | 4 | 9 | 6.3 | 0 | 0 |
| Coimbatore | 7,469 | 379 | 951 | 540 | 1,870 | 25.0 | -5 | 15 |
| Dharmapuri | 9,622 | 239 | 1,080 | 1,708 | 3,027 | 31.0 | 0 | 201 |
| Cuddalore | 3,706 | 0 | 219 | 225 | 444 | 12.0 | -2 | 10 |
| Dindigul | 5,580 | 352 | 537 | 540 | 1,429 | 25.6 | 0 | 64 |
| Erode | 8,209 | 439 | 1,409 | 367 | 2,215 | 27.0 | 1 | 37 |
| Kanchipuram | 4,474 | 0 | 113 | 259 | 372 | 8.3 | 3 | 24 |
| Kanniyakumari | 1,684 | 43 | 224 | 212 | 479 | 28.4 | 0 | 34 |
| Karur | 2,901 | 0 | 28 | 60 | 88 | 3.0 | 0 | 6 |
| Madurai | 4,277 | 23 | 291 | 254 | 568 | 13.3 | 4 | 134 |
| Nagapattinam | 2,140 | 0 | 26 | 32 | 58 | 2.7 | 5 | 0 |
| Namakkal | 3,413 | 55 | 189 | 300 | 544 | 15.9 | -1 | 22 |
| Perambalur | 1,748 | 19 | 36 | 86 | 141 | 8.1 | -1 | 8 |
| Pudukkottai | 4,651 | 0 | 78 | 174 | 252 | 5.4 | 16 | 8 |
| Ramanathapuram | 4,232 | 0 | 76 | 197 | 273 | 6.5 | -6 | 4 |
| Salem | 5,235 | 139 | 422 | 657 | 1,218 | 23.3 | 0 | 79 |
| Sivaganga | 4,086 | 0 | 86 | 226 | 312 | 7.6 | -1 | 17 |
| Thanjavur | 3,415 | 0 | 131 | 52 | 183 | 5.4 | 4 | 0 |
| The Nilagiris | 2,549 | 240 | 998 | 810 | 2,048 | 80.4 | -1 | 0 |
| Theni | 2,764 | 202 | 508 | 298 | 1,008 | 36.5 | -3 | 64 |
| Thiuvallur | 3,413 | 0 | 59 | 154 | 213 | 6.2 | 0 | 79 |
| Thiruvarur | 3,413 | 0 | 23 | 6 | 29 | 1.1 | 1 | 0 |
| Tiruchirapalli | 4,511 | 74 | 146 | 190 | 410 | 9.1 | -1 | 50 |

| District | Geographical Area (G.A.) | VDF | MDF | OF | Total | % of G.A. | Change* | Scrub |
|---|---|---|---|---|---|---|---|---|
| Tirunelveli | 6,810 | 282 | 780 | 177 | 1,239 | 18.2 | 4 | 47 |
| Tiruvannamalai | 6,191 | 169 | 523 | 695 | 1,387 | 22.4 | 0 | 57 |
| Toothkudi | 4,621 | 0 | 28 | 139 | 167 | 3.6 | 1 | 23 |
| Vellore | 6,077 | 172 | 628 | 938 | 1,738 | 28.6 | -3 | 185 |
| Viluppuram | 7,190 | 70 | 370 | 571 | 1,011 | 14.1 | 5 | 20 |
| Viudhunagar | 4,283 | 29 | 186 | 74 | 289 | 6.8.0 | 2 | 17 |
| **Total** | **130,058** | **2,926** | **10,216** | **10,196** | **23,338** | **18** | **24** | **1,206** |

*Change compared to 2005 assessment (revised).

### 2.6.3 Tree Cover

Tree cover of the state has been estimated using sample data of TOF inventory collected over a period of six years, i.e., 2002-2008. The estimated tree cover in the state is 4,968 $km^2$, which is 3.82% of the geographical area of the state. Eleven districts (Coimbatore, Dindigul, Erode, Kancheepuram, Kanniyakumari, Madurai, Namakkal, The Nilgiris, Theni, Thiruvarur and Virudhunagar) of the state have been inventoried. The forest and tree cover of the state is presented in the table below:

| Category | Area ($km^2$) | % of Geographical Area |
|---|---|---|
| Tree Cover | 4,968 | 3.82 |
| Forest Cover | 23,338 | 17.94 |
| **Forest & Tree Cover** | **28,306** | **21.76** |

### 2.6.4 Forest Type

Champion and Seth have defined forest type as a unit of vegetation which possesses broad characteristics in physiognomy and structure sufficiently pronounced to permit its differentiation from other such units. Major forest types of the state are southern tropical wet evergreen, tropical semi-evergreen, tropical moist deciduous, littoral and swamp, tropical dry deciduous, tropical dry thorn, sub-tropical broad-leaved hill and montane wet temperate forests. The major type groups are subdivided into sub-types on a geographic basis since a recognisable type group varies somewhat with locality. This is due to differences in floristic and minor variations in climate and site occurring within the range associated with each group type as a whole. Depending on unique features, the forest types have further been divided into sub-types, details of which are given in the table below.

**Forest Types in Tamil Nadu**

| Forest Types | Sub-Types | Area in $km^2$ | No. of Species | Diversity Index |
|---|---|---|---|---|
| Southern Tropical Wet Evergreen | 5 | 557.50 | 38.63 | 3.47 |
| Southern Tropical Semi Evergreen | 6 | 372.40 | 31.71 | 3.10 |
| Southern Tropical Moist Deciduous | 3 | 2,166.80 | 17.63 | 2.45 |
| Littoral and Swamp | 4 | 208.00 | 9.42 | 2.04 |
| Southern Tropical Dry Deciduous | 12 | 10,766.50 | 15.31 | 2.11 |
| Southern Tropical Dry Thorn | 4 | 6,256.90 | 14.36 | 2.29 |
| Southern Tropical Dry Evergreen | 2 | 845.60 | 16.66 | 2.25 |
| Subtropical Broad leaved Hill | 3 | 979.60 | 21.46 | 2.85 |
| Montane Wet Temperate | 3 | 398.70 | 33.33 | 2.88 |

### 2.6.5 Forestry Management System

Forests of Tamil Nadu have a long history of scientific forestry management systems which evolved

on the basis of silvicultural requirements and the forest policies of the government. At present, the basis of management systems flows from the National Forest Policy (NFP) 1988 which mandates that no forest should be permitted to be worked out without the government having approved the management plan, which should be in a prescribed format and in keeping with the NFP. In order to meet the growing needs for essential goods and services which the forests provide, it is necessary to enhance forest cover and the productivity of the forests through the application of scientific and technical inputs. Production forestry programmes, while aiming at enhancing the forest cover in the country and meeting national needs, should also be oriented to narrowing, by the turn of the century, the increasing gap between demand and supply of fuel wood. Forest management should take special care of the needs of wildlife conservation, and forest management plans should include prescriptions for this purpose.

In order to achieve this, the NFP 1988 provided the following as essentials of forest management:

i) Existing forests and forest lands should be fully protected and their productivity improved.

ii) Adequate strengthening and extension of the network of national parks, sanctuaries, biosphere reserves and other protected areas for the conservation of total biological diversity.

iii) Provision of sufficient fodder, fuel wood and pasture, especially in areas adjoining forest, and intensification of afforestation programme with special emphasis on augmenting fuel wood production to meet the requirement of the rural people.

iv) Minor forest produce protection, improvement and enhanced production for providing sustenance to tribal population and other communities residing in and around the forests.

The state has accordingly crafted the following objectives to ensure sustainability of the natural resources:

1. Ensuring environmental and ecological stability of the state
2. Biodiversity, wildlife and genetic resource conservation
3. Rehabilitation and restoration of degraded forests
4. Coastal ecosystem conservation and management
5. Forest protection for resource management and augmentation
6. Enhancing tree cover outside forests for livelihood security
7. Water augmentation through forest conservation and catchment area management
8. Tribal development to ensure economic prosperity and ecological stability
9. Technology support, research and development for scientific forest
10. Forest extensions for tree cover augmentation, outreach and conservation education for wildlife management support
11. Forestry for rural energy security
12. Eco-tourism for supporting conservation
13. Human resource development for forest management
14. Climate change mitigation

In order to translate these objectives, the working plans provide for the specific working circles which become the operational matrix for forest management. For example, in the Working Plan for Nilgiris South Forest Division (2009-2010 to 2018-2019) by K.Paneer Selvam, IFS has stipulated the following working circles:

- Wildlife Management Working Circle (Overlapping)
- Biodiversity cum Eco-restoration Working Circle
- Watershed Management Working Circle

- Tree Cultivation in Patta Lands Working Circle
- Eco-tourism/Eco-education Management Working Circle
- Forest Protection Working Circle
- Tribal Development Working Circle
- Non-timber Forest Produce cum Medicinal Plants Working Circle

The status of working plan preparation in Tamil Nadu and approval by the MoEF is very good, as evident from the position indicated below:

| | | |
|---|---|---|
| i) | Working plans approved by MoEF, GOI | 22 |
| ii) | Working plans sent to MoEF, GOI | 2 |
| iii) | Working plans under scrutiny/rectification | 3 |
| iv) | Working plans under preparation | 6 |

As already stated, no forests are to be worked out without the approved working plan. The Supreme Court of India (SCI) has also mandated this provision.

### 2.6.6 Farm Forestry Programmes in Tamil Nadu

Farm forestry has been a part of all the forestry development programmes undertaken over the last thirty years. Until now, the programme has been mainly characterised by provision of supply of free (or at subsidised rate) planting material and some financial incentives based on survival of seedlings. The programme, however, has suffered due to the *absence of a comprehensive strategy* focusing on promoting tree cultivation on private land. This has resulted in low survival of farm forestry plantations as well as sluggish uptake of the programme by farmers, particularly the small and marginal category of farmers.

Over the last three years, TNFD has introduced a new programme called Tree Cultivation on Private Land (TCPL) to encourage farmers to adopt tree planting on their fallow land. The main feature of the programme is planting of trees on farm land by the forest department with its own funds and providing financial support to the farmers in the form of 'survival incentive' for maintenance and care of the plantations. It is reported that the programme has generated significant interest among farmers with encouraging results[2], although the result of a sample survey being conducted by the forest department on TCPL is still pending.

As is the case in many other states, Farm Forestry in private lands was initiated on a major scale in Tamil Nadu only after SIDA-aided Social Forestry Programme in 1981. Before the advent of SIDA-aided social forestry programme, Tamil Nadu had been adopting the practice of tree growing activities in community land and during 20 years (1960-61 to 1980-81) an area of about 1.5 lakh ha had been planted. However, the process of tree planting in areas outside forest picked up momentum after 1976-77 after adoption of the recommendations of National Agriculture Commission in 1970's.

**Details of Seedling Distribution under Major Programmes in Tamilnadu**

| Project Name | Period | Implementing Agency | No. of seedlings distributed (million) | Comments |
|---|---|---|---|---|
| TN Social Forestry Project – Phase 1 (SIDA) | 1981-88 | Forest Deptt. (FD) | 44 | Free seedlings and financial incentive |
| | | FD | 121 | Seedling supplied at cost |
| TN Scoial Forestry Project – Phase 2 (SIDA) | 1988-96 | Agriculture Department | 36 | 18,000 ha planted; assuming 2,000 seedlings per ha. |

[2] A total of 34,542 ha were planted under TCPL from 2007/2008 to 2009/2010. (Source: Presentation material of TNFD)

| | | | | |
|---|---|---|---|---|
| TAP – 1 | 1997-2004 | FD | 25 | Financial incentive for local tree cultivation |
| Tree Cultivation on Private Land | 2007-continuing | FD | 30 | Funded by state government; 100% subsidy for seedling & planting cost; survival incentive |

**Plantations Raised Outside Forest on Community and Panchayat Land**

| Duration | Programme | Area of plantation (ha.) |
|---|---|---|
| 1961-81 | Various | 1,50,000 |
| 1981-88 | TNSFP – Phase 1 | 2,40,000 |
| 1988-96 | TNSFP – Phase 2 | 3,59,000 |
| 1992-97 | TNADP | 40,000 |
| | **TOTAL** | **789,000** |

Over last 50 years, at least 0.8 million ha (6% of the total geographical area) have been covered by plantations in areas outside forest and at least 250 million seedlings have been distributed (considering **only** four major programmes over last 30 years) covering a notional area of about 0.5 million ha or about 4% of total geographical area. If these plantations could have been sustainably managed, then the tree cover outside forest – considering a modest 60% survival -- should have been at least 6% of the total geographical area.

A comprehensive strategy for farm forestry programme could involve various elements.

**Element of Comprehensive Strategy for Farm Forestry Programme**

| Element of farm forestry strategy | Situation in Tamil Nadu |
|---|---|
| Enabling policies for harvesting and sale of trees grown on private land | Quite positive. Only a few farm forestry species still restricted |
| Technical support for planting and management | TCPL introduced plantation by FD on farmland |
| Agro-climate context specific and farmer category specific planting models | Not much evidence |
| Effective extension system | 30 extension centres with good infrastructure; poor in human resources |
| Enabling farmer's access to quality planting material of desired species | Mainly through decentralised nurseries; no provision for clonal or older seedlings for farm forestry |
| Enabling farmer's access to finance | Limited number of farmers access bank finance for farm forestry; Earlier limited to poor; TCPL provides seedling and planting cost for all farmers |
| Incentives for survival | Common strategy present in most of the programmes |
| Support mechanism for marketing of wood & non-wood products, especially for small and marginal farmers | Farmer-industry meets; contract farming with buy-back arrangements in some areas but FD not directly involved |
| Robust monitoring of programme | Lacking |

**Enabling policies**: Some of the rules and regulations that are designed to help conserve the forest end up discouraging farmers to undertake forestry on private land. Examples of such rules include the restriction on harvesting and transport of trees, restrictions placed on trade of forest products etc. During the last year, the state government has undertaken two important measures to liberalize the policy related to farm forestry, firstly it has expanded the list of tree species which do not require any permit for harvesting and transport to cover 36 more species and secondly, it has lifted the restrictions placed on the export of pulpwood to other states. There are still some restricted species such as teak and red sanders, which are also being planted by farmers in increasing numbers on private land. Apart from harvesting and transport rules, government policies related to import of pulp and timber and

supply of raw material to industries from government plantations also depress the market for farm forestry products.

**Provision of quality planting material**: For increasing seedling survival, ensuring better productivity and facilitating quicker returns, quality materials should be used. This also requires investment in research to develop and standardize new ways of developing quality planting material for a different tree species preferred by farmers. The quality assurance mechanism for seedlings for farm forestry needs to take into account the fact that the seedling requirement is served through a relatively large number of temporary nurseries (4-6 months) dispersed over a large area and located close to the villages. Such nurseries are also unable to cater to the need for tall (older) seedlings by farmers – especially for multi-purpose trees, fruit trees and bamboo. Protocols to ensure quality of seedlings in cluster nurseries and creating capabilities for permanent and hi-tech nurseries to provide tall and clonal seedlings are essential ingredients to the farm forestry programme strategy. Under state-funded TCPL, only 4-6 month old seedlings are provided through decentralised nurseries.

**Access to finance**: Creating a plantation requires large initial financial investment. This huge investment acts as a deterrent especially for small and marginal farmers. Over the last 15 to 20 years different opportunities have been created for farmers in this regard, including provision of bank finance for farm forestry (with refinancing by NABARD) and AR-CDM. Available data indicates that the access to institutional finance or AR-CDM remains very limited due to the high transaction cost – higher for small and marginal farmers. The subsidy in terms of supporting the farmer for seedling and planting cost is justified primarily for small and marginal category of farmers, who have mostly been excluded from traditional farm forestry initiatives involving free or subsidized distribution of seedlings.

**Technical support for creating and managing plantations**

Experience and studies on farm forestry indicate that poor techniques employed in planting and management are responsible for low survival and low productivity from farm forestry – apart from poor quality of seedlings. Direct planting by forest department on fallow land of farmers takes care of the planting issues to a large extent. An effective extension system should ensure that the farmers understand the silvicultural aspects of the management of their plantation maximize their profit.

**Marketing support**

Successful marketing is key to adoption of farm forestry as a key element of the farming strategy. Given the long rotation of trees, In a situation of low supply and high demand, Past experience has shown that market for Eucalytus, Acacia and Poplar have crashed at different times during last thirty years, leading to disenchantment of farmers with farm forestry. Strategies such as farmer-indutry linkages; buy-back arrangements etc. have been tried with good results. In A.P., Eucalyptus, Casuarina and Subabul have been declared as agricultural produce and can be traded through Agricultural Marketing Committees. In Tamil Nadu, Bamboo and terminalia chebula are declared as agricultural produce.

The studies on the nature of wood markets tend to show that they are more exploitative than allocative. High timber / pole prices prompt many farmers to change their existing land use shows that at least initially the markets do perform an allocative function. High pole price signal demand, which is transmitted through the mechanism of markets to the farmers, who then allocate their resources in wood production. Farmers are able to obtain profits in the initial years because of a huge gap between supply and demand. But as the gap narrows, other issues relating to market imperfections became more relevant. Farmers' enterprise, according to these studies, has been thwarted by market constraints caused by exploitative trade practices.

### 2.6.7 Interviews to Farmers Participating in TCPL

The survey team visited three districts – Kancheepuram, Villupuram & Cuddalore – to discuss TCPL related issues with farmers. The team interacted with a total of around 30 farmers including 11 women. They were mostly small and marginal farmers. The understanding gained from them related to re-planting was as follows:

1) Tree plantation is being preferred by farmers because of uncertainty and high cost of arranging labour, especially in the case of large and medium farmers. The small and marginal farmers prefer to plant on bunds and in smaller numbers. However, those which have found alternate employment opportunities may be willing to go in for block plantation.
2) Tree planting is seen by villagers as one-time investment requiring lower labour inputs compared to agricultural cultivation.
3) The farmers find cultivation of commercial agricultural crops (sugar cane, etc.) riskier due to fluctuating market price, increasing input cost and declining returns compared to tree plantation.
4) There are other employment opportunities available in neighbouring towns and cities, which is being availed by small and marginal category of farmers. Therefore male farmers migrate for work to different places. Depending upon the availability of labour within the family and the income derived from migration, the family may continue to discontinue cultivation.
5) Declining size of agricultural land acts as disincentive to continue agricultural cropping (declining economy of scale). Relatively large initial investment required for tree planting (in large numbers) acts as a deterrent mainly for small, marginal and poor farmers.
6) Convenience is another factor in influcing farmers' decision for replanting. Rough calculations by farmers indicated that even though the financial return from paddy cultivation and Casuarina planting could be same, they still prefer Casuarina due to low hassle in raising and sale of produce.
7) Planting of Casuarina with horticultural crops is already a well established system in the three districts. Farmers have been involved in planting, harvesting, sale and replanting of Casuarina by themselves. At least four farmers interviewed had been engaged in Casuarina planting for many years.
8) Tree planting, especially of timber species (Teak) has been attempted by farmers in the past. One well-off farmer had planted 100 seedlings – buying them at the rate of Rs. 15 per seedling -- about five years ago. However, after five years there was less than 10% survival. In general, the farm forestry has suffered due to poor quality of seedlings, poor planting technique and lack of understanding on proper management of plantations.
9) Women prefer a more diverse menu of tree species including MPTs and fruit trees. Large farmers and male prefer species such as Teak and Casuarina.
10) The farmers could replant without further financial support from TNFD if they able to sell their plantations profitably. If the TNFD continues to provide financial support, they would not mind availing such support.

The decision by a farmer to plant or re-plant tree is a complex function of various factors including cost, convenience, returns, market conditions, risks involved in marketing, availability of sufficient labour within the family, availability of other employment opportunities etc. For short rotation crops such as Casuarina, the sustainability is already proved based on existing experience and practices adopted by farmers especially in north-eastern coastal districts. For a long rotation crop such a question is difficult to answer with some degree of certainty. However, the trends linked to

diversification of economy, declining per capita land availability, increasing demand and price of timber / pulpwood due to increasing urbanization and industrialization, indicate that there would be higher propensity on the part of farmers to put their land under tree cultivation – especially in regions which are irrigated, and commercial farming is practiced.

### 2.6.8 Demand and Supply for Forest Products

The Wood Balance Study for Tamil Nadu (2009) assessed the total demand for wood in Tamil Nadu for the year 2008 at 28.5 million cu.m of which fuelwood constituted 82% of the total demand. Households and industries demand for wood accounts for 77% and 16% respectively of the total demand for wood.

The industrial demand for timber, poles and pulpwood is primarily met from imports, captive plantations, plantations taken up by forest department and TAFCORN, and farm forestry plantation taken-up by farmers. In recent years, the big pulp and paper mills – Sheshasayee and TNPL – have stopped importing pulp and can meet their entire pulp / pulpwood requirement domestically. There is no production of timber and poles from natural forest to meet the industrial demand. The timber supply is mainly through trees outside forests, followed by farm forestry and other sources including transfers from other states. Main supply source of fuelwood is attributed as 'other sources' indicating that the supply chain of fuel wood is fairly complex. Trees outside forest (TOF) are estimated to contribute 41% of the total fuelwood supply.

**Overall demand for Wood in Tamil Nadu, 2008 (million cu.m.)**

| Sector | Wood Demand | | Total |
|---|---|---|---|
| | Fuelwood | Timber | |
| Household | 19.73 (84.5) | 2.288 (44.6) | 22.02 (77.3) |
| Industry | 2.08 (8.9) | 2.553 (49.7) | 4.63 (16.3) |
| Services | 1.54 (6.6) | 0.292 (5.7) | 1.83 (6.4) |
| **Total** | **23.35 (100)** | **5.133 (100)** | **28.48 (100)** |

Source: Wood Balance Study – Tamil Nadu, Madras School of Economics, Chennai

**Overall supply of Wood in Tamil Nadu, 2008 (million cu.m.)**

| Supply Source | Fuel Wood | Timber | Total |
|---|---|---|---|
| Forests | 0.42 (1.8) | 0.07 (1.3) | 0.49 (1.7) |
| TOF | 9.55 (40.9) | 2.37 (46.2) | 11.92 (41.8) |
| Farm forestry | 0.89 (3.8) | 1.13 (21.9) | 2.02 (7.1) |
| Imports | 0 | 0.97 (19.0) | 0.97 (3.4) |
| Other Sources | 12.49 (53.5) | 0.59 (11.5) | 13.08 (45.9) |
| **Total** | **23.35 (100)** | **5.133 (100)** | **28.48 (100)** |

Source: Wood Balance Study – Tamil Nadu, Madras School of Economics, Chennai

The total demand for fuel wood under various scenarios is expect to vary between 15.17 to 23.22 million cu.m. by year 2013 according to the study. Household sector which contributes 84.5% of the total fuel-wood demand continues to dominate with contribution ranging between 70% and 80%. The total demand for timber under various conditions is expected to vary between 5.4 to 6.5 million cu.m. by year 2013 and between 5.7 and 7.7 million cu.m. by year 2018.

**Outturn of Forest Produce in Tamil Nadu: 2000-2006**

| Products | Unit | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|---|---|
| Timber | MT | 194.258 | 1497.602 | 3906.884 | 6033.92 | 7421.24 | 7748.877 | 6410.749 |
| Teak Poles | No | 0 | 2174 | 5042 | 32 | 1769.87 | 9488 | 0 |
| Pulp wood | MT | 6560 | 3595.787 | 1782.87 | 15797 | 100020.1 | 93393.59 | 29593.13 |
| Fuelwood | MT | 45176 | 11925.225 | 16845.08 | 31011.27 | 17057.46 | 20548.53 | 63104.5 |

| Products | Unit | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|---|---|
| Sandalwood (heartwood) | MT | 1477 | 920 | 1225 | 210.5 | 344.078 | 332.336 | 616.025 |
| Sandalwood (sapwood) | MT | 51 | 325 | 726.325 | 311 | 91.9 | 94.3 | 96.99 |
| Wattle Bark | MT | 463 | 247.012 | 664.878 | 2500 | 4847.143 | 3439.15 | 445.732 |
| Babul | MT | | 107434.6 | 98172.59 | 93591.13 | 89113.12 | 48148.97 | 80029.44 |

Source: Statistical Handbooks of Tamilnadu; MT – Metric Tonne

## 2.7 Projects/Programs Related to Biodiversity Conservation and Forestry

The orthodox system of managing forests that saw humans as biotic interference has had its limits. As the role of people in nurturing forests and biodiversity has gained wider attention and acceptance, there has been a series of attempts to involve people in forestry and conservation. Various projects and programs undertaken by the state to involve people have benefited biodiversity directly or indirectly. One of the earliest programmes that have seen success is the Joint Forest Management (JFM).

JFM became an alternative to the orthodox exclusive forest and biodiversity conservation programmes beginning in 1990. In Tamil Nadu, JFM evolved from 'interface forestry'. Interface forestry was introduced as an innovative component of the Phase II of the Swedish International. Development Authority (SIDA)-aided Social Forestry Project in 1988. The project aimed at managing micro-watersheds including the forests that abutted villages. Since the focus of interface forestry was on forest and agricultural ecosystems, a wider spectrum of biodiversity has been benefitted by the project. Studies on the impact of interface forestry on biodiversity have suggested that bird species richness increased locally (Dr. S. Balaji, IFS/CCF personal communication).

Interface forestry was formally concluded in 1996. Starting 1997, the Japanese OECF-aided Micro-watershed-based Comprehensive Forestry Project (TAP-I: Tamil Nadu Afforestation Project Phase I) took over. The main objectives of the project were to: 1) upgrade degraded forests with the active participation of local people, 2) augment water resources, 3) develop human resources in the participating villages, 4) meet the forest-based needs of the local people, and 5) promote agro-forestry in people's farmlands.

The principles of JFM have been adopted in planning and implementing more projects in the state such as TAP, Area-Oriented Fuel Wood and Fodder Project (centrally-sponsored), Western Ghats Development Project, Eastern Ghats Development Project and Non-Timber Forest Produce Project (centrally-sponsored). Some of the major interventions adopted during the projects (1997-2002) are tribal life support, sand dune stabilization, conservation of species, wetlands conservation (mangroves) and conservation of dry evergreen forests.

Although specific information on how the various projects have influenced biodiversity in the state is lacking, there has been a continuous attempt by the TNFD to improve the tree cover and reduce human pressures on natural forests. The Eleventh Five-Year Plan for Forestry and Wildlife, 2007-2012 has summarized the earlier interventions as follows:

**Summary of Expenditure and Targets Achieved in the Five-Year Plans***

| Plan | Plan Period | Expenditure (million Rs) | Target Achieved | Significant Policy Landmarks |
|---|---|---|---|---|
| I | 1951-56 | 3.043 | Not specified | - |
| II | 1956-61 | 14.7 | 78,070 ha plantation raised including cashew and fuel wood | Farm Forestry, the precursor of Social Forestry, introduced on 934 ha |
| III | 1961-66 | 37.214 | 75,574 ha of plantations raised; rubber was raised for | - |

| Plan | Plan Period | Expenditure (million Rs) | Target Achieved | Significant Policy Landmarks |
|---|---|---|---|---|
| | | | the first time in Kanyakumari District | |
| Annual | 1966-69 | 27.999 | 38,700 ha of plantations raised | - |
| IV | 1969-74 | 57.471 | 68,226 ha of pulpwood planted | The concept of Biosphere Reserves was adopted; the Wildlife (Protection) Act, 1972 comes into force |
| V | 1974-78 | 119.833 | 108,526 ha planted under Farm Forestry, Commercial Forestry, fuel wood plantations. Discontinuation of clear-felling of forests | Centrally-sponsored schemes and National Commission on Agriculture covered the State |
| Annual | 1978-80 | 51.613 | 41,000 ha of plantations raised | - |
| VI | 1980-85 | 570.0 | 213,000 ha of Social Forestry | 42nd Constitutional Amendment placed forests on the Concurrent List; Promulgation of Forest (Conservation) Act 1980 came into force |
| VII | 1985-90 | 1118.9 | 180,000 ha plantations raised | Eco-development of Eastern and Western Ghats |
| Annual | 1990-92 | 850.4 | 85,000 ha plantations | - |
| VIII | 1992-97 | - | 7,478 ha added to the PA network (NP1 & WLS 4); 25,137 ha watershed afforestation | Conservation Forestry, Restoration and Protection Forestry, Production Forestry, Community Forestry, Private Forestry, Frontier Forestry |
| IX | 1997-2002 | - | TAP I; Western Ghats Development Program; Hill Area Development Program; 410,000 ha of forest upgraded through JFM; Gulf of Mannar Biosphere Reserve Trust formed to get financial assistance from GEF | Nilgiri Biosphere Reserve and Gulf of Mannar Biosphere Reserve on Global Biosphere Reserve Network of UNESCO |
| X | 2002-03 to 2006-07 | 7173.261 plus 688.144 under NAP | 228,713 ha plus 48,123 ha under NAP; specific focus on conservation of biodiversity outside PAs | Emergency Tsunami Reconstruction Project (ETRP) |

*PCCF/TNFD (undated) Eleventh Five Year Plan 2007-2012

Another project that had considerable positive impact on biodiversity is the eco-development project launched in 1994 at the KMTR, which was funded by the World Bank. Of the various socio-economic benefits that the project bestowed on the local people, the one that has probably contributed the most to conservation of biodiversity is the gross reduction in livestock grazing within the PA. Reportedly, livestock grazing has been reduced by 50% since the project was launched. Further, the project has been successful in creating greater awareness among the target villagers on the need to conserve forests and biodiversity within the reserve. Subsequently, there was a marginal reduction in the number of forest and wildlife offences in 1998 as compared to that in 1996. Due to the decrease in interference by the local people, the sightings of wildlife, including that of the tiger even in fringe forests, have become common. The regeneration in fringe forests has started in some of the most degraded forest beats of the reserve.

The initial line of experience and direction of project implementation of KMTR towards planning,

developing and innovating eco-development approaches for conservation has been the forerunner in providing a framework for similar eco-development efforts now undertaken in five tiger reserves and two national parks in the country, under the India Eco-development Project (1997-2002) assisted by the World Bank and Global Environment Facility. Many representatives from other PAs and eco-development sites have visited KMTR to learn and share the experiences gained so far.

Project Tiger and Project Elephant discussed in Sections 3.2.4 and 3.2.5, respectively, have also contributed significantly to the conservation of biodiversity in the state. While biodiversity conservation achieved by the implementation of these projects and programs are, to a large extent incidental, the TNFD, in its most recent five-year plan, has specifically spelt out a strategy and action plan for conservation of biodiversity both inside and outside PAs in the state (see Section 3.3.1).

TAP Phase I covered 4,317 $km^2$ of the 7,000 $km^2$ of degraded forests in the state (1997-2004). The major interventions of the TAP I are JFM, tribal life support, incentive for local tree cultivation, greening of community lands, water augmentation in micro-watersheds, sand dune stabilization, shelter-belt plantations, teak canal bank plantation, wetlands conservation and dry evergreen forest conservation.

An additional 1,325 $km^2$ of degraded forests have been targeted in the TAP Phase II which is being implemented starting 2005 (2005-2013). The mission of TAP Phase II is as follows: The 'problem of precarious degradation of forests is to be sorted out by Phase II with additional coverage by the National Afforestation Program (NAP) that started in 2002, covering villages that are not covered by TAP II'.

The TAPs (Phase I, 1997-2004 and Phase II, 2005-06 onwards) have treated 2,167 watersheds covering an area of 0.66 million ha. Micro-watersheds of 250 ha have been selected and planted with local tree species during the project period.

The main focus of TAP II are: 1) Afforestation, 2) Buffer zone activities, 3) Provision of basic infrastructure support for field work, and 4) Supporting activities for forest management. The project components and activities are shown below:

**1. Afforestation**
- 1.1 Integrated Watershed Development Program: covering 650 villages in 23 districts and 250 ha/village at a tree planting density of 100/ha.
- 1.2 Integrated Tribal Development Program: covering 30 villages in year 1 and 40 each in years 2, 3, and 4 such that 150 villages are covered and 100 ha of forests will be treated in each village. The list of trees planted is provided in the Appendix.
- 1.3 Urban Forestry: excluded from TAP II

**2. Buffer Zone Activities (BZA)**
- 2.1 Community development works: 33% of funds earmarked for BZA
- 2.2 Income generation activities: 67% of funds earmarked for BZA
- 2.3 Others

**3. Provision of basic infrastructure support for field work**

**4. Supporting activities for forest management**
- 4.1 Human resource development
  - 4.1.1 Domestic training
  - 4.1.2 Overseas training
- 4.2 Monitoring and Evaluation (Employ consultants)
  - 4.2.1 Socio-economic studies
  - 4.2.2 Water table status studies
  - 4.2.3 Vegetation changes studies
  - 4.2.4 Sociological studies (BZA)
  - 4.2.5 Training of trainers

4.2.6 Marketing of IGA
4.3 Extension: 15 centers in Phase I and 11 more in Phase II
4.4 Research: broad focus – improvement of degraded forest landscapes and improvement in forest cover
4.5 Enhancement of GIS

**Geographical Spread of TAP I and II**

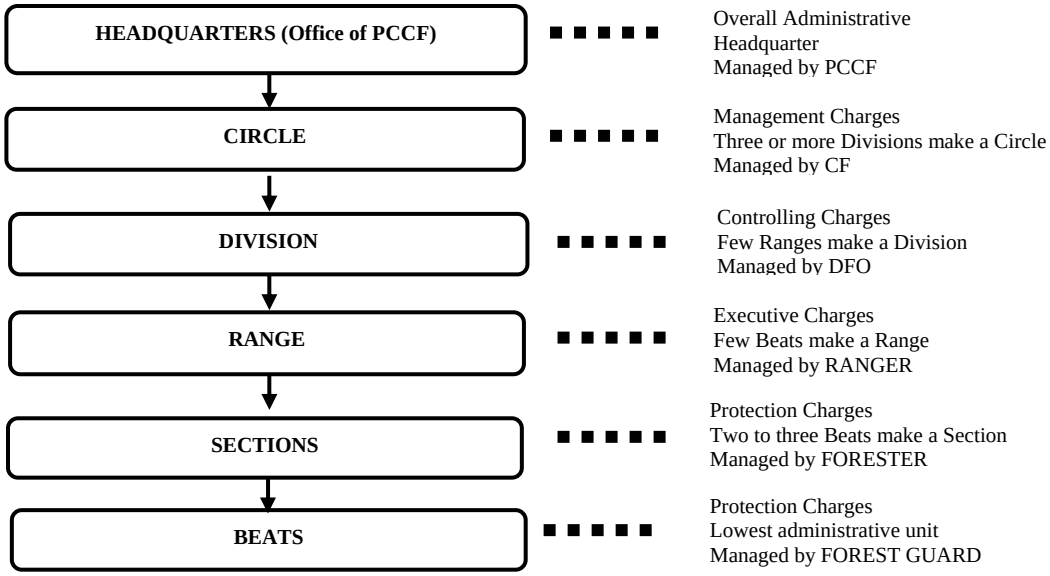
| District | TAP I | | TAP II | | |
|---|---|---|---|---|---|
| | Expanding human capacity to conserve biodiversity – interpretation centers | Introduction of GIS | Integrated Watershed Development (<40% forest density) | Integrated Watershed Development (40-60% forest density) | Integrated Tribal Development |
| Chennai | + | + | - | - | - |
| Tiruvallur | - | - | + | - | - |
| Kancheepuram | - | - | + | - | - |
| Vellore | + | + | + | + | + |
| Tiruvannamalai | - | + | + | + | + |
| Villupuram | - | + | + | - | - |
| Dharmapuri | + | - | + | + | + |
| Salem | + | + | + | + | + |
| Cuddalore | + | + | + | - | - |
| Perambalur | - | - | + | + | - |
| Namakkal | - | - | + | + | + |
| Erode | + | + | + | + | + |
| Nilgiris | - | - | - | - | - |
| Coimbatore | - | + | - | + | - |
| Karur | - | - | - | - | - |
| Tiruchy | + | - | + | - | - |
| Tanjore | - | + | - | - | - |
| Thiruvarur | - | - | - | - | - |
| Nagapattinam | + | - | - | - | - |
| Pudukottai | + | + | - | - | - |
| Dindugal | + | + | + | + | + |
| Theni | - | + | + | - | + |
| Madurai | + | + | + | + | - |
| Sivagangai | - | - | + | - | - |
| Virudhnagar | + | + | + | - | - |
| Toothukudi | + | + | + | - | - |
| Ramnad | + | - | + | - | - |
| Tirunelveli | - | - | + | + | + |
| Kanyakumari | + | - | - | + | + |

## 2.8 Administration for Biodiversity and Forestry Sectors

### 2.8.1 Institutional Setup

The major objective of the TNFD is to conserve, protect and manage the forests and wildlife existing within the political boundaries of the state in accordance with scientific principles of silviculture and management for aesthetic, ecological and environmental values. The functioning of the department is guided by the Tamil Nadu Forest Policy. The state forest policy has been formulated keeping the specific geographical, climatic, edaphic, ecological, environmental and demographic characteristics of the state within the broader framework of the national forest policy.

The administrative set-up of the forest department is shown below:




**Administrative Set-up of the Forest Department**

The following table summarizes the number of offices within TNFD. The functional unit has no particular territorial jurisdiction for operations; it generally carries out the function which may cover either all or part of territorial areas. Functional divisions include: 1) 9 Social Forestry; 2) 5 Interface Forestry; 3) 3 Moisture & Soil Conservation; 4) 2 Crush Plantation; 5) 1 Urban Forestry; 6) 1 Forest Engineering; 7) 1 Afforestation; 8) 1 Rural Firewood; and 9) 1 Bamboo Estate. The Interface Forestry Division was created during the Social Forestry Project Phase II funded by SIDA. The forest protection squads are directly monitored by two CCFs at headquarters, thus squads do not fall in the above flowchart.

**Number of Administrative Set-up of TNFD (Tentative)**

| | Forestry | | Wildlife | | Special Unit | | Total |
|---|---|---|---|---|---|---|---|
| | Territorial | Functional | Territorial | Functional | Territorial | Functional | |
| Regions | 6<br>Chennai<br>Madurai<br>Trichy<br>Salem<br>Tirunelveli<br>Coimbatore | | 4<br>Arignar Anna Zoological Park<br>Kalakkad Mundanthurai Tiger Reserve<br>Mudumalai Tiger Reserve<br>Anamalai Tiger Reserve | | 8<br>Tamil Nadu Forest Academy<br>Working Plan Trichy<br>Working Plan Salem<br>Working Plan Vellore<br>Working Plan Coimbatore<br>Research<br>Forest Extension<br>Forest Utilization | | 18 |

| | Forestry | | Wildlife | | Special Unit | | Total |
|---|---|---|---|---|---|---|---|
| | Territorial | Functional | Territorial | Functional | Territorial | Functional | |
| Circles | 12<br>Chennai Coimbatore<br>Dharmapuri Dindigul<br>Erode Madurai<br>Salem Tirunelveli<br>Trichy Vellore<br>Villupuram Virudunagar | | - | | 2<br>Forest Protection Squad (North)<br>Forest Protection Squad (South) | | 14 |
| Divisions | 36 | 23 | 4 | 2 | | 55 | 120 |
| Forest Protection Squad | - | - | - | - | - | 13 | 13 |
| Ranges | 181 | 201 | 21 | 24 | - | 89 | 516 |
| Beats | 1,169 | - | 95 | - | 2 | - | 1,266 |

Source: TN Forest Department 2010

The name of the divisions as well as the distribution of the division-wise number of ranges and beats are shown in **Annexure 2.3.**

The TNFD is headed by the Principal CCF (Head of Forest Force: HOFF) and PCCF (Chief Wildlife Warden). They are supported by ten APCCFs of Wildlife, Administration, Forest Conservation Act, Planning and Budgetary, Afforestation, Protection & Vigilance, Research, Social Forestry, Working Plan, and Director of Tamil Nadu Forest Academy. In addition, there are 23 CCFs and 18 CFs[3]. who support the PCCFs and APCCFs. The structure of TNFD is shown in **Annexure 2.4.**

### 2.8.2 Human Resources

TNFD is staffed with the cadres of the following services:

1) Indian Forest Service (IFS): IFS officers join the department with ACF rank and can rise to the rank of PCCF depending on seniority.
2) Tamil Nadu Forest Service (TNFS): TNFS officers also join with the ACF rank, and can get promoted to DCF. Meritorious officers can be upgraded to the IFS, with the concurrence of the central government.
3) Tamil Nadu Forest Subordinate Service: Officers with the rank of range officers and below belong to the subordinate services. They are recruited at the levels they occupy and can be promoted. The cadre-wise positions are shown below.

The CCF (HOFF) and PCCF (Chief Wildlife Warden) will report to the government directly on all statutory matters concerning wildlife and keep the CCF (HOFF) informed. The CCF (HOFF) will report to the government on all other matters. Post-wise responsibilities are shown in **Annexure 2.5**.

The following table summarizes the existing manpower (sanctioned and actual) of TNFD at different cadres and ranks.

**Staffing of Tamil Nadu Forest Department (as of July 2010)**

| Cadre | Sanctioned Post | Actual Post | Cadre | Sanctioned Post | Actual Post |
|---|---|---|---|---|---|
| FOREST OFFICERS | | | | | |
| Indian Forest Service (IFS)[4] | | | Tamil Nadu Forest Subordinate Service | | |
| PCCF | 2 | 2 | Ranger | 590 | 462 |
| APCCF | 10 | 10 | Forester | 1,356 | 1,074 |
| CCF | 23 | 23 | Forest Guard | 2,421 | 1,887 |
| CF | 16 | 15 | Watcher | 1,353 | 1,348 |
| Sub Total | 51 | 51 | Mali | 153 | 152 |

[3] In addition to the Sanctioned 23 CCFs and 16 CFs, temporary post of CCF (TAP), CF (TAP1) and TAP2 were created for implementation of Tamil Nadu Afforestation Project

[4] Exclude deputation to other department or central government.

| Cadre | Sanctioned Post | Actual Post | Cadre | Sanctioned Post | Actual Post |
|---|---|---|---|---|---|
| Tamil Nadu Forest Service (TNFS) | | | Mahouts and Cavady | 78 | 36 |
| DCF | 68 | 53* | Sub-total | 5,951 | 4,959 |
| ACF | 75 | 62 | Tamil Nadu Ministerial Service and others | | |
| Sub Total | 143 | 115 | Supporting Staff | 3,009 | 2,369 |
| | | | TOTAL | 9,154 | 7,493 |

Source: Tamil Nadu Forest Department. * The figure with star is as of July 2009.

As shown in the table, there is a significant number of vacancies that remain unfilled in different staff categories in the department.

Although the department has a direct recruitment policy[5] for TNFS officers and frontline staffs (Tamil Nadu Forestry Subordinate Services), direct recruitment is not made regularly. The department bears the burden of having more than 2,000 plot watchers and social forestry workers to be promoted to watcher. This has restricted the department to make direct recruitment.[6] Large numbers of uniformed and ministerial staff are likely to retire within five years. The Government of Tamil Nadu has given permission to fill up about 500 vacancies. The TNFD has now restarted recruiting rangers. Recruitment of foresters and guards is also planned to start from 2010.

### 2.8.3 Human Resource Development

#### (1) Coordination and Execution of the Training

The Chief Conservator of Forests (HRD) is responsible for overall capacity building of the department's personnel. Planning of training outline and coordination for training under special projects is the responsibility of the person in-charge of the concerned project. State-owned Tamil Nadu Forest Academy (TNFA) and Tamil Nadu Forestry College (TNFTC) are the nodal agencies entrusted with the implementation of training. There is no specific cell or unit to handle overall training aspects in the state. Mainly four types of training are to be conducted in TNFA and TNFTC, namely: 1) induction training for new recruits, 2) refresher training for promoted rangers/foresters, 3) thematic needs, and 4) project-oriented training for the specific project. The CCF (HRD) disseminates the training information to division offices and requests the DFO to nominate potential candidates for the training. The DFO is entrusted to nominate the candidates within his/her jurisdiction. Nominations are made based on seniority in the post and training received in the past.

#### (2) Tamil Nadu Forest Academy (TNFA)

The TNFA conducts induction, promotion-linked and refresher training for direct recruit and promoted rangers and foresters[7]. At present, six-month training courses for promoted rangers and foresters are being conducted in TNFA regularly. It also conducts project-oriented and thematic training up to the rank of conservator of forest to rangers and forester under specific programmes. The head of the academy is the director with the post of APCCF. He is supported by two additional directors with the rank of CCFs (one of the posts is vacant at present), two assistant lecturers with the rank of ACFs, and four assistant lecturers with the rank of rangers (one of the posts is vacant at present). Regular training is taught by these in-house lecturers. The academy takes guest lecturers and experts for thematic training because the number and subjects taught by in-house lecturers are limited. The TNFA has advantage of good access to and network with other institutes related to forest sector, namely:

[5] 45% of rangers, 40% of foresters, and 60% of forest guards are to be filled by direct recruitment.

[6] They were originally employed temporarily for Social Forestry Project. However, the government has issued the order that state-wide seniority list of social forestry workers and plot watchers who are employed under daily consolidated wages may be prepared and those who are able to read and write in Tamil be appointed as forest watchers and malis in the existing and future vacancies according to their seniority by relaxing recruitment and age rules.

[7] Training for foresters was originally imparted by Tamil Nadu Forestry Training College. TNFA took over the training to fill the unutilized period.

1) Ghandigram Rural Institute, Dharmapuri
2) Central Academy for State Forest Service[8], Coimbatore,
3) Institute of Forest Genetics and Tree Breeding (IFGTB)[9], Coimbatore,
4) Forest College and research institute (FC & RI)[10], Mettupalayam (near Coimbatore),
5) Tamil Nadu Agricultural University, Coimbatore, and
6) Tamil Nadu Forestry Training College, Vaigai Dam (near Madurai).

The details of resource persons for TNFA are given in **Annexure 2.6.**

In addition to the subjects on regular forestry and plantation techniques, TNFA puts emphasis on training for participatory approaches for JFM. With the support of guest lecturers, the academy conducted training on participatory approach to NGOs, VFC members, and TNFD staff at different levels during TAP Phase I and II.

The academy, awarded "one week refresher training course for IFS officers" by the MoEF since 2004, has now grown from a regional to a national level training institute and has been providing training to various levels of officers and field staffs of the forest department as well as other states.

The air-conditioned auditorium of TNFA can accommodate about 100 persons. Classrooms for 50-60 persons are equipped with audio-visual facilities. Besides, conference room, computer-lab for computer training, library and hostel to accommodate about 180 trainees are available inside the campus. About 30 rooms of the existing hostel were renovated recently as executive suites to accommodate officers attending training.

### (3) Tamil Nadu Forestry Training College (TNFTC)

The TNFTC imparts the induction training as well as promotion-linked training to the direct recruit and the promoted forest guards under the Tamil Nadu Forest Subordinate Service. Until 2000, the college imparted induction training to foresters and forest guards but after that, the foresters are being trained in TNFA. Currently, a six-month promotion-linked training for forest guards and one month training[11] for forest watchers are imparted at TNFTC. Besides the regular training, it also conducts several short duration thematic training courses to the forest guards and forest watchers under the special programme. The training is imparted on forest protection activities such as weapon training, fire fighting skill and allied area. The college is headed by an additional director and dean with the rank of CCF, supported by seven faculty members (called as instructors) with the forest ranger rank. The college has two classrooms of 65 seating capacity with audio-visual equipment, library, laboratory, computer centre, hostel facility, etc. The hostel can accommodate 126 trainees at a time.

### (4) Infrastructure and Budget of TNFA and TNFTC

The improvements in the infrastructure and facilities of TNFA and TNFTC have been undertaken with the financial assistance from the state government, forest corporations, and from special projects such as the Western Ghats Development Project, TAP I and II, and AHRDP.[12] **Annexure 2.7** provides a list of infrastructure and facilities at the TNFA and TNFTC

[8] The college is one of the institutions under the Directorate of Forest Education, MoEF, which imparts professional training to newly-recruited range officers and in-service training to the state forest service officers with ACF and DCF ranks from neighboring states.
[9] IFGTB is a national institute formed in April 1988 under the Indian Council of Forestry Research and Education (ICFRE), and it is an autonomous council under the MoEF.
[10] FC&RI is the college for the B.Sc., M.Sc., and Ph.D. in Forestry under the Tamil Nadu Agricultural University.
[11] Induction or promotion-linked training for forest watcher is not mandatory.
[12] World Bank-funded Agricultural Human Resources Project.

Both training institutes are allocated funds from the forest department. The financial proposal for the next financial year, prepared by TNFA/TNFTC in August, is generally approved and sanctioned by the state government (GOTN) only at around the middle of the next financial year. Due to this procedure, most of the training courses are conducted in the latter half of the year, and the training facilities in the early half of the year is not utilised to the full extent. The TNFD is now under the process of converting the TNFA to autonomous society in order to meet training requirements of not only the forest department personnel but also the entire forestry sector in the state consisting of NGOs, tree farmers, wood-based industries, and to improve financial viability by making steady revenue from these trainings.

**Sanctioned Budget and Funding for TNFTC and TNFA (in thousand Rs.)**

| Sources | TNFTC | | | TNFA | | |
|---|---|---|---|---|---|---|
| | 2008-09 | 2009-10 | 2010-11 | 2008-09 | 2009-10 | 2010-11 |
| TNFD | 10,320 | 9,702 | 10,074 | 16,424 | 12,298 | 13,100 |
| Other department | - | - | - | - | - | - |
| Government of India | - | - | - | - | - | - |
| Other source | - | - | - | - | - | - |
| Total | 10,320 | 9,702 | 10,074 | 16,424 | 12,298 | 13,100 |

Source: TNFA and TNFTC

## (5) Induction Training and Promotion-linked/Refresher Training

Training for ACF is conducted at the Central Academy for State Forest Service for a two-year period, consisting of modules on various forestry subjects and field exercises. TNFD adds fresh ADF to the payroll only to fill the vacancy when there is no candidate for promotion. Induction training courses for TNFD staff in the subordinate cadre are conducted by TNFA and TNFTC. Since no regular staff has been recruited for quite a long time[13], there are only training courses for promoted staff. Both TNFA and TNFTC are conducting only promotion-linked/refresher training for rangers, foresters, and forest guards at present.

**Induction Training**

| | Eligibility for Direct Recruitment | Induction Training |
|---|---|---|
| ACF | Bachelor's Degree in Science | Two years training at Central Academy for State Forest Service |
| Ranger | Bachelor's Degree in Science | 18 months training at TNFA |
| Forester | Bachelor's Degree in any Subject | 6 months training at TNFTC |
| Forest Guard | Passed the 12$^{th}$ grade | 6 months training at TNFTC |
| Forest Watcher and Mali | Passed the 10$^{th}$ grade | |
| Plot Watcher, Social Forestry Worker | | |

**Promotion-linked/Refresher Training**

| | Eligibility for promotion | Promotion-linked training |
|---|---|---|
| APCCF | 25 years in service as IFS | Mandatory mid-career advancement training |
| CCF | 18 years in service as IFS | Mandatory mid-career advancement training |
| CF | 13 years in service as IFS | Mandatory mid-career advancement training |
| DCF | 4 years in service as ACF | Mandatory mid-career advancement training |
| ACF | 8 years in service as Ranger | Mandatory 6 weeks training after the promotion |
| Ranger | 8 years in service as Forester | 6 Mandatory months training at TNFA |

[13] The last induction training batch for foresters at TNFTC was conducted in 1998-2000. TNFD is now planning to recruit new rangers, foresters, and forest guards.

| | Eligibility for promotion | Promotion-linked training |
|---|---|---|
| Forester | 8 years in service as Forester | Mandatory 6 months training at TNFTC |
| Forest Guard | 8 years in service as Forester | Mandatory 6 months training at TNFTC |
| Forest Watcher and Mali | Read and write in Tamil and seniority in the state list | Non- mandatory 1 month in-service training at TNFTC |
| Plot Watcher, Social Forestry Worker | | |

**Training Details for Refresher Training**

| | Refresher | | | | Refresher | |
|---|---|---|---|---|---|---|
| Target | - Rangers (promoted from Foresters)<br>- Foresters (promoted from Forest Guard) | | | | Forest Guards | |
| Venue | Tamil Nadu Forest Academy, Coimbatore | | | | Tamil Nadu Forestry Training College, Vaigai Dam | |
| Duration | Six months | | | | Six months | |
| Frequency | Once in the rank of Forester /Ranger | | | | Once in the rank of Forest Guard | |
| No. of trainings and participants | Post-wise no. of training | | Post-wise person trained | | Post-wise no. of training | Post-wise person trained |
| Trainings in the past 5 years (2005-06 to 2009-10) | Ranger | Forester | Ranger | Forester | Forest Guard | Forest Guard |
| | 6 | 9 | 313 | 344 | 6 | 617 |
| Major topics covered | Silviculture, Field Botany, Forest Utilization, Soil and Moisture Conservation, Forest Mensuration, Office Procedure and Accounts, Forest Protection and Law, Social Forestry and JFM, Wildlife Management, Computer, Forest Engineering, Forest Survey | | | | Silviculture, Field Botany, Forest Utilization, Soil and Moisture Conservation, Forest Mensuration, Office Procedure and Accounts, Forest Protection and Law, Social Forestry and JFM, Wildlife Management, Computer, Forest Engineering, Forest Survey | |
| Cost per training | Approximately Rs. 2500 per trainee only for outsourcing resource personnel and other contingent expenditure. | | | | Approximately Rs. 2000 per trainee only for outsourcing resource personnel and other contingent expenditure. | |

Source: TNFA and TNFTC

## (6) In-service (Thematic) Training

In-service training are provided for various levels of TNFD staff to update their knowledge and skills at the levels appropriate to meet their executive functions. The training courses are conducted based on operational needs in the field and financial availability. The table below shows some of the training courses for TNDF staff undertaken at the TNFA and TNFTC.

**Training Details for In-service Training**

| | Name of Training | Target | Duration | Main Subjects |
|---|---|---|---|---|
| 1 | Elephant Management Technique Training | ACF, Ranger, Forester, Forest Guard | 5 days | Introduction to elephants, Habitat requirements, Estimation of elephant population, Man-elephant conflict, Legal protection to elephants, Monitoring health, Common diseases, Management of camp elephants, etc. |
| 2 | Wildlife Census Training | Ranger, Forester | 1 - 5 days | Census operation, Census operation special technique, Data analysis, Interpretation and reporting, Census exercise, Tiger census – Predator and prey relationship, Planning in census operation, Presentation of results and group |

| | Name of Training | Target | Duration | Main Subjects |
|---|---|---|---|---|
| 3 | Compulsory training programme for IFS officers | CF, DFO, DCF | 5 days | Institution-building and sustainability of JFM, Women's participation and microcredit, Role of SHG/NGOs, Micro-planning, Alternate employment and poverty alleviation, GIS in JFM, Impact monitoring and evaluation of JFM, Legal issues in JFM, etc. |
| 4 | Training on Right to Information Act 2005 for Public Information Officers | Superintendent | 1 day | Right to Information (RTI) Act 2005 – an overview, Panel discussion – RTI Act and Forest Department |
| 5 | Intelligence gathering conducted by the Police Department | Ranger, Forester Forest Guard, Forest Watcher, Anti-poaching Watcher | 5 days | Meaning of intelligence, Methods of collecting intelligence, etc. |
| 6 | Forest Fire and Management | Ranger, Ministerial Staff | 5 days | Forest fire causes, Fire prevention, Fire fighting, Fire damage, Assessment of fire damage, Reporting fire incidents, Using GIS techniques in fire protection |
| 7 | Law Training | Ranger, Forester | 5 days | Latest amendments, Documentation of forest offences, Booking cases, Criminal procedure, Conducting court cases |
| 8 | Weapon Training | Ranger, Forester | 5 days | Different types of weapon, Handling weapons, Weapon maintenance, Legal powers to use weapons |
| 9 | Computer training | Forester | 10 days | Basics of using computers |
| 10 | Fluency to read and write | Forest Guards | 3 months | |

Source: TNFA and TNFTC

### (7) Project-oriented Training

During the TAP Phase I and II, a number of trainings were given to the TNFD officials and field staff, NGOs, VFC members, and SHG members. Details of training for TAP Phase I and Phase II conducted in TNFA and TNFTC are given in the **Annexure 2.8** and **2.9,** respectively.

### (8) Training at Circle Level

Need-based short duration training programmes are conducted at circle level by the concerned circle office under the TAP with the budget allocated by the department for the purpose. The target group for these training programmes includes rangers, foresters, watchers, as well as NGOs, VFS, and SHGs. The training utilizes services of the department officials who had undergone the trainers' training at TNFA and guest trainers. Although there is no training establishment set up at the circle level, it still catered to a large number and wide spectrum of stakeholders.

### (9) Training Needs Analysis

During TAP Phase II, training needs analysis (TNA) was undertaken by a consultancy firm in 2008. The study analyzed 610 samples from seven circles that included forest personnel ranging from CCFs to forest guards and forest watchers, as well as field level stakeholders such as NGOs, VFC, SHG involved in the project. Besides, faculty and head of the TNFA and TNFTC were also included in the sample for the study. The TNA study report indicates various performance gap and training needs for the above stakeholders in terms of JFM implementation, e.g., participatory approaches and institutional building. The study also suggested the necessity of strengthening certain areas, faculty development, exposure to training, competence to handle training in the new areas, and competence in the design of training.

# CHAPTER 3 POLICIES, STRATEGIES, AND DEVELOPMENT PLANS RELATED TO BIODIVERSITY CONSERVATION AND FOREST MANAGEMENT

## 3.1 International Conventions Related to Biodiversity Conservation and Forest Management

### 3.1.1 Convention on Biological Diversity (CBD)

#### (1) Historical Background

Biological diversity (biodiversity) is the foundation upon which human civilizations have been built. Its conservation is the prerequisite for sustainable development and, as such, constitutes one of the greatest challenges of the modern era. The importance of this challenge was universally acknowledged at the Earth Summit, held in Rio de Janeiro in 1992, and through the development of the Convention on Biological Diversity (CBD), an international legally binding treaty came into force that now has 187 parties.

The CBD has 42 articles: 'Article 1: Objectives' involves the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including through appropriate access to genetic resources and appropriate transfer of relevant technologies, taking into account all rights over these resources and technologies, as well as through appropriate funding.

Other articles of direct relevance to the proposed project are 'Article 6: General measures for conservation and sustainable use'; 'Article 8: In-situ conservation', which recommends the following: (a) establishing a system of protected areas or areas where special measures need to be taken to conserve biological diversity, (c) regulate and manage biological resources important for conservation of biological diversity whether within or outside protected areas with a view to ensuring their conservation and sustainable use, (e) promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas, (f) rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies, and (j) subject to national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of benefits arising from the utilization of such knowledge, innovations and practices; 'Article 9: Ex-situ conservation'; 'Article 10: Sustainable use of components of biological diversity', 'Article 11: Incentive measures'; and 'Article 12: Research and training'.

During its Conference of Parties (COP) V (May 2000), CBD has placed emphasis on the consideration of options for conservation and sustainable use of biological diversity in dry land, Mediterranean, arid, semi-arid, grassland and savannah ecosystems (Decision V/23) and biological diversity and tourism (Decision V/25).

#### (2) India's Actions on CBD

India was amongst the first signatories of CBD and became a party in 1994. In the same year, the Government of India's Ministry of Environment and Forests (MoEF) published a document entitled 'Conservation of Biological Diversity in India: An Approach'. This document was meant to disseminate useful information on the subject of biological diversity and share the Indian experience

on conservation and sustainable management of biological diversity with the international community.

Subsequently, the MoEF conducted wide-ranging consultations with sectoral ministries and departments of the Government of India, state governments, NGOs, experts and technical institutions, and other stakeholders to delineate policies and programs for further action. The objectives were to consolidate, adapt and augment existing strategies for conservation and sustainable use and initiate new programs based on a sound coordinated policy for future actions. The result of these consultations has been a framework named the National Policy and Action Strategy on Biological Diversity. This draft framework was published by the MoEF in 1997.

Following the publication of the Draft National Policy and Action Strategy on Biological Diversity, India submitted the first National Report on Implementation of Article 6 of the Convention on Biological Diversity in 1998, as a mandatory prerequisite for availing funds from the Global Environment Facility (GEF). Soon after this, in the year 2000, MoEF with support from the United Nations Development Programme (UNDP) and GEF launched the country-wide project to draft the National Biodiversity Strategy and Action Plan (NBSAP). The county-wide exercise resulted in 29 state and union territory plans, 10 eco-regional plans, 14 sub-state/local plans, 12 thematic (cross-cutting) plans, and 32 sub-thematic reviews. The Tamil Nadu NBSAP was prepared by the Forest Department.

Although the MoEF did not adopt the NBSAP, the technical and policy core groups that coordinated the project concluded by stating that "in conclusion, it would hopefully not be an exaggeration to say that this has indeed been a unique process, one that in its scale and coverage has never before been tried in India in the context of natural resources and development. Both in its successes and failures, therefore, it has critical lessons for future planning processes in all sectors".

### (3) Green Development Mechanism (GDM) - Proposed Financial Mechanism under CBD

Green development mechanism (GDM) is the working title of a proposed financial mechanism to create enabling conditions for increased private sector support for implementation of CBD. It seeks to mobilize private sector finance through a market-based mechanism to mitigate biodiversity loss, much as CDM has done to mitigate climate change. The GDM aims to mobilize private sector finance by linking biodiversity supply with biodiversity demand through a market mechanism.

The current thinking about GDM is that it will facilitate the supply of biodiversity – protected area hectares, i.e., certified protected areas – in the form of GDM-accredited areas available for businesses, consumers and others to 'buy'. The sale would not be the land per se, but rather the biodiversity management of the land including its conservation and sustainable use of its resources. Like carbon markets, standards and certification schemes are envisaged. Unlike carbon market, however, biodiversity would not be traded as a commodity, e.g. tonnes of reduced emissions, but rather as units of land, i.e., so many hectares protected with certified biodiversity management plan.

The way GDM is proposed, it aims to support and complement, not substitute for, the current funding commitments from developed counties set out under Articles 20 and 21 of the CBD. The official communications by CBD further clarifies that the GDM proposal does not seek additional official development assistance (ODA), but it will build on the existing officially supported instruments. The governments, however, may be invited to support the GDM by funding enabling capacities to establish the mechanism in a pilot phase.

Although CBD has issued a clarification on the issue, the relationship between GDM and the international regime on access and benefit sharing (ABS) of genetic resources is not very clear at the moment. However, it should be noted that the discussions on GDM is at a very incipient stage, and although it is listed as one of the agenda items for discussion during COP 10 at Nagoya, Japan, it would take at least a couple of years for the mechanism to be finalised. Needless to say, its implementation would in turn depend on future COP decisions on the issue.

### (4) Tenth meeting of the Conference of the Parties to the CBD (COP 10)

COP 10 is the 10th conference among 193 countries ratified to the convention on biological diversity, international organizations, and observers such as NGOs. It will be held in October 2010 at Nagoya, Japan, while 1st conference was held in 1994 at Nassau, Bahamas.

In the past conferences (COPs), "Cartagena Protocol" that sets the treatment of living modified organisms, and "2010 Biodiversity Targets" in which Parties committed themselves to a more effective and coherent implementation of the three objectives of the Convention, to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth, have been adopted. In COP 10, verification of achievement of 2010 Biodiversity Targets, post 2010 Biodiversity Targets, Access and Benefit Sharing (ABS) to genetic resources, marine and coastal biodiversity, and climate change and biodiversity will be mainly discussed.

Japan has taken several actions towards COP 10. The Basic Act on Biodiversity went into effect in 2008, National Biodiversity Strategy 2010 was endorsed by the Cabinet, and new National Biodiversity Strategy is to be formulated in light of the result of COP10. Short-term targets (2020) and Mid/long-term target (2050) have been drafted and to be included in the Strategy. Several organizations have held seminars and symposiums, and discussions have been developed with respect to the post 2010 target, ABS, protected areas, climate change and biodiversity, public engagement, sustainable use of biodiversity, financial mechanism and enhancing the scientific basis.

In the mean time, India has also taken actions as it will be the host country of COP 11 in 2012. National Biodiversity Authority 16th meeting was held in March 2010 in Channai, and ABS, post 2010 target, biodiverisy and sustainable development, awareness generation of Biodiversity Act 2002 and Rules 2004 were discussed.

Japan government has established the Satoyama Initiative to achieve the post 2010 target that protecting biodiversity entails not only preserving pristine environments, such as wilderness, but also conserving human-influenced natural environments, such as farmlands and secondary forest, that people have developed and maintained sustainably over a long time. There are landscapes in Western Ghats region of India which are similar to Satoyamalandscapes in Japan, traditional land use and resource management practices in these rural communities of valley and plateaus. Forests, agriculture lands, garden vegetable plots and rice paddies are found in the small-scale river basin and exhibit characteristics of Satoyamalandscapes. These landscapes in Western Ghats are sustainable social-economic production systems and biodiversity is conserved and the forests function as sinks. It is recommended for Japan government to introduce Satoyama Initiative as a result of COP 10 and support biodiversity conservation and sustainable development through this project.

## 3.1.2 United Nations Framework Convention on Climate Change (UNFCCC)

### (1) A Brief History of Climate Negotiations

Climate change is generally recognized as one of the greatest challenges of this century. To address climate change, the United Nations Framework Convention on Climate Change (UNFCCC) was established at the Earth Summit in Rio de Janeiro in 1992. India ratified the convention in 1993. The protocol came into existence in 1994. The ultimate objective of the convention is to stabilise greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system. The convention operates on the principle of "common but differentiated responsibilities" with greater responsibility for reducing greenhouse gas emissions in the near term on the part of developed/industrialised countries which are listed in Annex 1 (known as Annex 1 countries) of the convention. The convention had set a voluntary non-binding target for Annex 1 countries to stabilize their emissions of greenhouse gases (GHGs) at 1990 levels by the year 2000.

The Kyoto Protocol of the Convention, adopted in 1997 and came into force on 16 February 2005, has set binding targets for 37 industrialised countries (known as Annex 1 countries or Annex B countries of the protocol) and the European community for reducing GHG emissions. These targets amount to an average of 5% against 1990 levels over the first commitment period of 2008-2012. The detailed rules for the implementation of the protocol were adopted at the COP 7 in Marrakesh in 2001, and are called the "Marrakesh Accords."

Kyoto Protocol is an international agreement linked to the UNFCCC. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European community for reducing GHG emissions. These targets amount to an average of 5% against 1990 levels over the five-year period of 2008-2012. In addition to domestic actions, Annex 1 countries have the option of using three flexible market-based mechanisms for meeting their targets. Out of the three flexible mechanisms, the clean development mechanism (CDM) is the one relevant for developing countries. The CDM allows Annex 1 countries to earn emission credits (certified emission reductions or CERs) through investment in sustainable development projects that reduce emissions in developing countries.

The UNFCCC and Kyoto Protocol are also designed to assist countries in adapting to the inevitable effects of climate change and facilitate the development of techniques that can help increase resilience to climate change impacts. An Adaptation Fund was established to finance concrete adaptation projects and programmes in developing countries that are parties to the Kyoto Protocol. The fund is to be financed through proceeds from CDM project activities and funds from other sources.

The first commitment period of the Kyoto Protocol ends in 2012 and the Bali Action Plan (BAP) was agreed in COP 13 in Bali, which specifically called for the implementation of the UNFCCC through long-term cooperative actions beyond 2012. The BAP is built upon four key elements, namely: **mitigation, adaptation, technology, and financing**. BAP also recognises the role of Reducing Emissions from Deforestation and Forest Degradation Plus **(REDD Plus**) in mitigating climate change. The BAP further identified a roadmap for putting in place a legally binding international agreement in 2009 at the 15th Conference of Parties. However, meetings in Copenhagen in December 2009 failed to come up with an international binding agreement. The key elements of the accord are:

- Pledge to fight climate change by preventing the temperature rise by more than 2°C
- Help countries adapt to the damaging impacts of climate change such as droughts, storms or rising sea levels, especially least developed countries, small island developing states and Africa
- Developed nations will submit emissions goals for UN review. Developing nations' actions will be under domestic review if funded by their budgets but "subject to international measurement, reporting and verification" when funded by foreign aid
- Recognize REDD Plus as an important and cost-effective mitigation measure
- Pursue various approaches on cost-effectiveness for mitigation actions
- Developed nations promise new and additional funds "approaching $30 billion for 2010-12" to help developing countries. In the longer term, "developed countries commit to a goal of mobilising jointly $100 billion a year by 2020".
- Establish Copenhagen Green Climate Fund & Technology Mechanism
- Set end-2010 deadline for legal text on the global climate change issues
- The accord will be reviewed in 2015, including whether the temperature goal should be toughened to 1.5°C

### (2) Adaptation

Adaptation is identified as one of the five key building blocks (shared vision, mitigation, adaptation, finance and technology) of a future climate change deal. After the negotiation process in Copenhagen, countries have made progress in defining a comprehensive framework for strengthened action on adaptation, capable of addressing the needs of developing countries for scaled-up financial support, technology and capacity-building. The framework will enable developing countries to implement adaptation strategies. There is a growing convergence on the following elements of such a framework: vulnerability assessments; national adaptation plans; enabling policy environments; arrangements for sharing knowledge (e.g., through regional centres and the Conventions Nairobi Work Programme); and tools for risk reduction and sharing such as insurance. The final elements and form of the framework remain to be agreed through the negotiations.

Parties (countries) have emphasized that both adaptation and mitigation need to be accorded the same level of importance. Adaptation does not replace mitigation of GHG emissions. On the contrary, both adaptation and mitigation need to be pursued in parallel during the same period of time, thus complementing each other, and these need to be implemented through sufficient financing and appropriate technology.

### (3) Forests under UNFCCC

Forests have a vital role to play in the fight against global warming, being the largest terrestrial store of carbon and the third largest source of carbon emissions after coal and oil. Deforestation is estimated to be responsible for 17% of current GHG emissions (Nabuurs, Masera, Andrasako, *et al*., 2007). In addition, forests have significant economic and ecological value as providers of ecosystem services, being homes to much of the world's biodiversity and supporting the livelihoods of over one billion of the world's poorest people.

Although their importance in addressing climate change is clear, forests have had a complex history in the international climate negotiations. The UNFCCC calls on all nations to protect and enhance the reservoirs of carbon, including forests. While afforestation, reforestation and deforestation were discussed and considered at Kyoto, the Marrakesh Accords made only *afforestation and reforestation* projects in developing countries eligible for CDM and excluded *deforestation* from CDM. There were various reasons for this, including concerns that:

1) Carbon stored in forests might not be permanent because it could be released in the future due to human activities such as logging or natural disturbances such as drought;

2) Protecting a forest in one place might simply result in deforestation in another area *(leakage)*;

3) Deforestation "avoided" by the project might not have happened anyway *(additionality)*; and

4) Data and methodologies weren't available and/or sufficiently accurate.

However, at the COP 11 in Montreal in December 2005, the issue of compensating developing countries for reduced deforestation (Reducing Emissions from Deforestation or RED) with carbon finance was back on the agenda. The scope was gradually broadened to include forest degradation, and thus, RED became Reduced Emissions from Deforestation and forest Degradation (REDD).

India advocated a comprehensive approach to REDD, which was eventually termed as REDD Plus approach *(see Box 1 for India's position on REDD Plus*). This broadened scope has been reflected in the Bali Action Plan and Copenhagen Accord. In the latest negotiating text of AWG-LCA of UNFCCC (FCCC/AWLCA/2010/8), the scope of REDD Plus includes:

- Reducing emissions from deforestation
- Reducing emissions from forest degradation
- Conservation of forest carbon stocks
- Sustainable management of forests
- Enhancement of forest carbon stocks

It has also been decided that REDD Plus would be implemented in phases, as presented below. The choice of the starting phase depends on the specific national circumstances and capabilities.

Phase 1: Assessment, planning, stakeholder consultations and institutional capacity building to develop a national REDD plan;

Phase 2: Development, initial implementation and monitoring of policies and measures in accordance with the national REDD plan, further capacity building and results-based demonstration activities; and

Phase 3: Evolving into results-based actions that would be fully measured, reported and verified.

The modalities and methodologies for operationalising REDD Plus have not been finalised yet and are under discussion. In a recent development, however, a REDD+ partnership (a global partnership of developed and developing countries established under the Oslo Climate and Forest Conference in May 2010) has been set up as an action track to supplement the UNFCCC negotiation track. India is party to this partnership. This partnership allows developing and developed country partners to act together now to reduce deforestation, building on the political momentum from Copenhagen, while continuing the negotiations on a global regime.

Box 1: India's Position on REDD

India advocates a comprehensive approach to REDD which has been termed as REDD Plus. The approach argues not only for reducing deforestation and forest degradation, but also for conservation, sustainable management of forests and increase in forest cover (ICFRE, 2007). The basic principle of this approach is that one unit of carbon saved is equal to one unit of carbon added. In its submission to UNFCCC in August 2009, India had elaborated REDD as Reducing Emission from Deforestation in Developing Countries, Sustainable Forest Management and Afforestation and Reforestation (A&R).

India advocated a mechanism outside the purview of CDM with national level accounting for REDD. The Indian approach to REDD Plus has changed from a strict fund-based approach to a mix of fund-based and market-based approaches; a central funding should compensate for maintenance of forest carbon stocks keyed to a reference point whereas money for compensating change in carbon stock (decrease in deforestation and forest degradation or increase in forest cover) could be generated by selling carbon credits in international markets (MoEF, 2009).

### (4) Government of India's stance on REDD plus after Copenhagen

Government of India's stance has remained the same after Copenhagen as evident from the statement and presentation made by India during the Oslo Climate and Forest Conference in May, 2010. Key issues raised by India during the Conference are summarized below:

- The integrity of the REDD plus concept as identified in the Bali Action Plan should be maintained, and the Oslo Partnership must put REDD and other "Plus" activities on the same footing, as envisaged in Bali Action Plan.
- Reduction of deforestation and conservation and enhancement of forest carbon stocks should be treated at par.
- Fairness requires that a unit of carbon saved should be treated the same as unit of carbon added

India has expressed concern regarding lack of finance for the plus activities and sought REDD plus funds for its Green India Mission.

## 3.2 Policies, Strategies, and Development Plans at National Level

### 3.2.1 Biodiversity Act

After an extensive and intensive consultation process involving the stakeholders, the Government of India passed the Biological Diversity Act in 2002. The main objectives of the act are:

- To regulate access to biological resources of the country with the purpose of securing equitable share in the benefits arising out of the use of biological resources and associated traditional knowledge relating to biological resources
- To conserve and sustainably use biodiversity and biological resources
- To respect and protect traditional knowledge of local communities relating to biodiversity
- To secure sharing of benefits with local people as conservers of bio-resources and holders of knowledge and information relating to the use of bio-resources
- To conserve and develop areas of importance by declaring them as biological diversity heritage sites and to protect and rehabilitate threatened species
- To involve institutions of state governments in the broad scheme of the implementation of the Biological Diversity Act through the constitution of state biodiversity boards (SBBs) and biodiversity management committees (BMCs)

The act mandates the regulation of access to biological diversity, the establishment of the National Biodiversity Authority (NBA), SBB, BMC and local biodiversity fund.

### 3.2.2 Wildlife (Protection) Act

The Wildlife (Protection) Act, 1972 (WPA) came into force on 9 September 1972. It is 'an Act to provide for the protection of wild animals, birds and plants for matters connected therewith or ancillary or incidental thereto, with a view to ensuring the ecological and environmental security of the country'.

The act drafted and adopted as the Wild Birds and Animals Protection Act of 1912 had become completely outmoded. It was felt that the existing state laws were not only outdated but provided punishments that are not commensurate with the offence and the financial benefits which accrue from poaching and trade in wildlife produce. Further, such laws mainly relate to control hunting and do not emphasize other factors which are also primary reasons for the decline of India's wildlife, namely taxidermy and trade in wildlife and products derived there from. Under the act, these are the following rules:

- The Wildlife (Transactions and Taxidermy) Rules, 1973

- The Wildlife (Stock Declaration) Central Rules, 1973
- The Wildlife (Protection) Licensing (Additional Matters for Consideration) Rules, 1983
- The Wildlife (Protection) Rules, 1995
- The Wildlife (Specified Plants – Conditions for Possession by Licensee) Rules, 1995
- The National Zoo Policy, 1998
- The Declaration of Wildlife Stock Rules, 2003

The WPA lays down guidelines for declaring protected areas (PAs). It also places species of plants and animals under various schedules. The schedule in which a given species is placed is based on the assessment of its conservation status in the country (see Section 2.5.3).

### 3.2.3 National Wildlife Action Plan (2006-2016)

The first National Wildlife Action Plan (NWAP) was adopted in 1983 based on the decision taken in the 15th meeting of the Indian Board for Wildlife that was held in 1982. The recent NWAP (2002-2016) is more of a vision for long-term conservation of wildlife in India. In its preamble, it states that "habitat loss caused by developmental projects such as dams, mines, etc. compounds the problems of wildlife conservation". The most recent NWAP has also reiterated the need to minimize man-animal conflicts. In stating this, NWAP has made it explicit that 'while increasing man-animal conflict is an outcome of shrinkage, fragmentation and deterioration of habitats, it has caused destruction of wildlife and generated animosity against wild animals and protected areas. This is a crucial management issue, which needs to be addressed through innovative approaches'.

For the sake of effective conservation of endangered species and their habitats, the NWAP has recommended that 'all identified areas around Protected Areas and wildlife corridors shall be declared as ecologically fragile under the Environment (Protection) Act, 1986'. This action as envisaged by MoEF was to be completed by the year 2004. Further, while discussing strategies for the restoration of degraded habitats outside the PAs, NWAP has proposed that degraded habitats around each PA and potential corridor be identified where protection and restoration will yield best results. In such areas, the key factors responsible for degradation are to be identified and recovery plans are to be made for restoration.

### 3.2.4 Project Tiger

The Government of India launched the Project Tiger programme in 1973 to arrest the loss of the tiger and its natural habitat throughout the country. As of now, there are 29 tiger reserves in India. The following information is extracted from the ***Compendium of Guidelines and Circulars issued by Director (Project Tiger) New Delhi*** under the auspices of Project Tiger Directorate in MoEF:

- Project Tiger implementation by states is governed by the Government of India Guidelines and the Indian Board for Wildlife's Task Force Report on Project Tiger; the three cardinal principles of Project Tiger are:
    a) Elimination of all kinds of exploitation and disturbance from the core area, while rationalizing such activities in the buffer (or multiple use) area,
    b) Limiting the habitat management to repairing damages inflicted on it by biotic pressures so as to resurrect the habitat in its natural form, and
    c) Researching facts about habitats and wild fauna, while monitoring the changes in flora/fauna owing to Project Tiger initiatives.
- As per the guidelines, the buffer zone has two functions:

a) To provide habitat supplement to the spill-over population of wild animals from the core area, conserved with the active cooperation of stakeholder communities, and

b) To provide site-specific, need-based participatory eco-development inputs to local stakeholders for reducing their resource dependency on the core zone and for eliciting their support towards conservation initiatives in the area.

- No intensive form of land use like mining, quarrying and the like should be fostered in the buffer zone, and due care should be exercised while granting no objection certificates (NOCs) to such activities in private or revenue areas, if any, included in the multiple use area.
- Development projects should be obligated to have a local orientation so that they become part of local area development without upsetting the resource needs and common property resources; appropriate compensations or alternatives to be built in project cost, and preferential employment of local people, if necessary, after arranging education and training for them.

### 3.2.5 Project Elephant

In 1991-92, the Government of India formally launched the Project Elephant. Eleven elephant reserves were designated and of these, Reserve 7 – Nilgiris-Eastern Ghats is the largest in India covering the south Indian states of Tamil Nadu, Kerala, Karnataka and Andhra Pradesh. It has a total spread of 12,583 $km^2$ and an estimated 5,000 elephants. The forest divisions of Tamil Nadu included in the reserve are: Mudumalai WLS, Gudalur (part), Nilgiris North, Satyamangalam, Erode, Dharmapuri and Hosur.

The elephant reserves that cover parts of the Tamil Nadu State are Reserves 8, 9 and 10. Reserve 8 (Nilambur-Silent Valley-Coimbatore) covers a total area of 2,385 $km^2$ and includes parts of Mukurti NP, Nilgiris South and Coimbatore forest divisions. Reserve 9 (Aniamalai-Parambikulam) covers 5,723 $km^2$ and includes Indira Gandhi WLS and Kodaikanal, Dindugal and Theni forest divisions. Reserve 10 (Periyar) covers 3,364 $km^2$ and includes parts of Theni forest division and Grizzled Giant Squirrel WLS.

The Project Elephant plan document of the Government of India has classified the issues relating to 'Conservation of Elephant' into two distinct categories:

1) Activities like hunting and capture which affect the number of elephants directly; and

2) Human activities and development programs leading either to loss of elephant habitat or its qualitative degradation.

Human and development activities that have specifically interfered with the movement and survival of elephant populations that have been identified under Project Elephant are:

- Plantation of exotic trees for forestry (and afforestation)
- Mining of extensive forest lands
- Dams and reservoirs that have fragmented prime habitats
- Channels and power transmission corridors that have prevented migration
- Roads and human settlements
- Habitat degradation due to invasive plants, grazing and fire
- A shortage of the preferred food plant

In its strategy and action plan, Project Elephant begins by discussing the issue of corridors,

management of elephant ranges and corridors between adjoining habitats. The management plan states that "There can be no hard and fast rule about the design of corridors. The main thing is to ensure that elephants will use them and will not spill over into the adjacent human settlements. The viability of corridors naturally depends on the distances separating the two populations. If the distances are relatively small, then the corridor need not be very broad. A corridor of 1 km width could be sufficient to see the elephants through. The width will have to be much more if the distances between the two habitats are significantly more. The corridor need not be a very good habitat. It can be degraded vegetation or a monoculture that provides cover for the migrating elephants".

### 3.2.6 National Forestry Policy

The National Forest Policy (NFP) has evolved for over 100 years since it was first adopted in 1894. The way it has evolved into a more people-friendly policy is summarized below:

**Summary of Evolution of the National Forest Policy***

| Class of Forests | Ownership | Rights of People | Objective of Management | National Forest Policy | | |
|---|---|---|---|---|---|---|
| | | | | 1894 | 1952 | 1988 |
| 1st Class or Preservation Forest | Government | None | Preservation of climate | + | | |
| 2nd Class or Commercial Purpose Forest | Government | Very limited | Supply of valuable timber for commercial purpose | + | | |
| 3rd Class or Minor Forest | Government | Small timber & fuel | Supply at nominal cost | + | | |
| 4th Class Forest or Pasture | Government/ Community | Grazing | Grazing (for a cost/fee) | + | | |
| Protection Forest | Government | None | Preservation of climate | | + | |
| National Forest | Government | None | To meet demands of defense, communication & industry | | + | |
| Village Forest | Government/ Community | Small timber & fuel; grazing | To meet the needs of local communities | | + | |
| Private Forest & Tree Land | Individual | Full right to owner | Owner not permitted to meet short-term interests/gains | | + | |
| State Forest | Government | Limited rights within carrying capacity | For environmental stability through preservation and restoration of ecological balance; area worked as per Working Plan | | | + |
| Forest Land/Land with tree cover | Government | Entire benefits to local people | Forests not to be diverted to non-forest use; forest land maintained as national asset for the benefit of entire community | | | + |
| Village and Community Land | Government/ Community | Ownership rights on trees given to SC/ST people | To provide usufruct rights to people of the weaker section of society | | | + |

Source: Anonymous, 2010

The National Forest Policy, 1988 aims at maintenance of ecological balance and environmental

stability that is vital to the sustenance of all life forms (biodiversity), i.e., human, floral and faunal, and calls for making direct economic benefits from forests subordinate to this principal objective. The policy seeks to achieve this aim by bringing at least one third of the total land area and at least two thirds of the total hill area of the country, under forest or tree cover.

With regard to management of state forests, the NFP, 1988 made the following important provisions:

i) No forest should be permitted to be worked out without the government having approved the management plan, which should be in a prescribed format and in keeping with the NFP. The central government should issue necessary guidelines to the state governments in this regard and monitor compliance.

ii) In order to meet the growing needs for essential goods and services which the forests provide, it is necessary to enhance forest cover and productivity of the forests through the application of scientific and technical inputs. Production forestry programmes, while aiming at enhancing the forest cover in the country and meeting national needs, should also be oriented to narrowing, by the turn of the century, the increasing gap between demand and supply of fuel wood.

iii) Forest management should take special care of the needs of wildlife conservation, and forest management plans should include prescriptions for this purpose. It is specially essential to provide for "corridors" linking the protected areas in order to maintain genetic continuity between artificially separated sub-sections of migrant wildlife.

In view of increasing recognition of the importance of forests for environmental health, energy and employment, the NFP, 1988 suggested laying of due emphasis on research with adequate strengthening of its base and new priorities for action. Some broad priority areas of research and development that need special attention identified by this policy were as follows:

i) Increasing the productivity of wood and other forest produce per unit of area per unit time by the application of modern scientific and technological methods.

ii) Revegetation of barren/marginal/waste/mined lands and watershed areas.

iii) Effective conservation and management of existing forest resources (mainly natural forest ecosystems).

iv) Research related to social forestry for rural/tribal development.

v) Development of substitutes to replace wood and wood products.

vi) Research related to wildlife and management of national parks and sanctuaries.

### 3.2.7 National Afforestation Program

The MoEF was operating the following four centrally-sponsored afforestation schemes during the 9$^{th}$ Plan:

(a) Integrated Afforestation and Eco-development Project Scheme (IAEPS),
(b) Area-Oriented Fuel Wood and Fodder Project Scheme (AOFFPS),
(c) Conservation of Non-Timber Forest Produce including Medicinal Plants (NTFPS), and
(d) Association of Scheduled Tribe and Rural Poor in Regeneration of Degraded Forests (ASTRPS).

During the 10$^{th}$ Plan, a new 100% central sector scheme, namely, the National Afforestation

Programme (NAP), was initiated by scaling-up the Samnavit Gram Vanikaran Samridhi Yojana (SGVSY) project experience and converging all afforestation schemes of the 9th Plan period to avoid duplicity or redundancy, with the following objectives:

- To develop forest resources with people's participation, focusing on the improvement of livelihoods of the forest-fringe communities, especially the poor.
- To support and accelerate the ongoing process of devolving forest protection, management and development functions to decentralized institutions of Joint Forest Management Committee (JFMC) at the village level, and Forest Development Agency (FDA) at the forest division level.

Financial support under the NAP scheme is available for the components listed below:

(a) Mobilisation of village JFMC, and micro-planning in project villages

(b) Afforestation – with the following components:

- Aided Natural Regeneration
- Artificial Regeneration
- Bamboo Plantation
- Cane Plantation
- Mixed Plantation of trees having MFP & medicinal value
- Regeneration of perennial herbs & shrubs of medicinal value
- Pasture Development/ Silvipasture

(c) Soil and Moisture Conservation

(d) Entry Point Activity (for village development; average assistance of Rs. 160,000 per village)

(e) Fencing, Monitoring & Evaluation, Training, Awareness-raising, Overheads

### 3.2.8 National Forest Commission

The Prime Minister, while chairing the 21st meeting of the Indian Board of Wildlife on 21 January 2002, recommended that a forest commission be set up to look into restructuring, reforming and strengthening of the entire forest setup and affiliated institutions in the country. In the fulfillment of the said recommendation, a National Forest Commission to review the workings of the forest and wildlife sector was set up by the MoEF through notification S.O. 142E dated 7 February 2003.

At the outset, the National Forest Commission (NFC) endorsed the recommendation of the Forest Policy of 1988 that one third of the landmass of India should be under tree cover, with 60% in the Himalaya, and suggested that within the broad parameters of the National Forest Policy, each state should have its own forest policy statement, for the sustainable management of its forest and wildlife resources. The NFC recognized that making provisions in a national forest policy/state forest policy statement cannot achieve the desired results unless these are properly implemented. A mechanism needs to be put in place at the MoEF and state levels to monitor implementation of forest policy provisions and suggest rectifications.

Practically, all the facets of forestry were deliberated in detail by the NFC leading to 360 recommendations. Some of the important recommendations are listed below:

(a) The country's forests must now be looked upon as ecological entities – regulators of water regimes, watersheds and catchments, gene pools, habitats of wildlife, providers of the needs

of the neighboring communities and as treasure troves of the nation's natural heritage. The country's needs for timber, fuel wood, fodder, industrial wood, and medicinal plants must mainly be met with plantation forestry and through agro-forestry, which therefore must receive much greater attention and support than before. This would also require a change in the role of forests, forestry and forest personnel, with corresponding change in recruitment, training, attitudes and mindset.

(b) A new strategy for social and agro-forestry should be evolved, which would include planned involvement of forest-based industries in the distribution of high-quality seedlings, with buy-back guarantee to the farmers, to ensure qualitative support to the planting programme and market support for the produce. This is to help bring about an additional 10 million ha under farm forestry/agro-forestry and to meet substantially the needs of industry.

(c) Each protected area should have a comprehensive management plan, which needs to be followed and revised periodically. Resorts set up for wildlife and ecotourism must undertake to ensure that at least 60% of their staff and 40% of their salary expenses go to local residents of the area. This must be strictly enforced, especially in tribal areas. Funds generated by tourism should not go to the public exchequer. Rather, these should be used for eco-development of the local communities, especially the tribals.

### 3.2.9 National Action Plan on Climate Change

On 30 June 2008, the Prime Minister released India's first National Action Plan on Climate Change (NAPCC) outlining the existing and future policies and programs addressing climate change. NAPCC identifies measures that promote India's sustainable 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. It further pledges that India's per capita GHG emissions will at no point exceed that of developed countries even as the country pursue development objectives.

NAPCC has eight core missions, the details of which are given below:

**(1) National Solar Mission**

The plan aims to promote the development and use of solar energy for power generation and other uses with the ultimate objective of making solar competitive with fossil-based energy options.

**(2) National Mission for Enhanced Energy Efficiency**

The plan estimates that current initiatives, based on the Energy Conservation Act of 2001, will yield 10,000 MW of savings by 2012. Building on this, the plan recommends mandating specific energy consumption decreases in large energy-using industries, including a system for companies to trade energy savings certificates. It also highlights the use of incentives, including reduced taxes on energy-efficient appliances. Finally, it recommends financing for public-private partnerships for demand-side management (DSM) programmes that reduce energy consumption in the municipal, buildings and agricultural sectors.

**(3) National Mission on Sustainable Habitat**

The plan seeks to promote energy efficiency as an essential component of urban planning. It calls for extending the Energy Conservation Building Code, and emphasises urban waste management and recycling, including power production from waste. In the transport sector, it calls for stronger enforcement of automotive fuel economy standards, using pricing measures to encourage the purchase of efficient vehicles, and providing incentives for the use of public transportation.

**(4) National Water Mission**

The plan sets a goal to improve efficiency in water use by 20% through pricing and other measures.

**(5) National Mission for Sustaining the Himalayan Ecosystem**

The plan targets biodiversity, forest cover, and other ecological conservation in the Himalayan region, home to glaciers that are major sources of India's water supply.

**(6) National Mission for a Green India (or Green India Mission)**

The plan sets an afforestation target of six million hectares of degraded forest lands. It should be noted here that in the draft Green India Mission (GIM) document prepared by MoEF, these targets have been revised (see the section on National Mission for a Green India).

**(7) National Mission for Sustainable Agriculture**

The plan aims to support adaptation to climate change in agriculture, through the development of climate-resilient crops and adapted agricultural practices, as well as the expansion of weather insurance mechanisms.

**(8) National Mission on Strategic Knowledge of Climate Change**

The plan calls for the establishment of a climate science research fund, improved climate modelling capacities, and increased international collaboration. It also seeks to encourage private sector initiatives to develop both mitigation and adaptation technologies through venture capital funds.

The respective ministries were further directed to develop objectives, implementation strategies, timelines, and monitoring and evaluation criteria, through broader stakeholder consultations. So far, the National Solar Mission has been formally launched, and the rest of the missions are in the various stages of formulations and consultations. For instance, the MoEF has prepared a draft mission document and is in the process of finalizing the document through stakeholder consultations.

### 3.2.10 Green India Mission (proposed)

The National Mission for a Green India or Green India Mission (GIM) is one of the eight missions under NAPCC. It recognizes that climate change phenomena will seriously affect and alter the distribution, type and quality of natural resources of the country and the associated livelihoods of the people. GIM puts the “greening” in the context of climate change adaptation and mitigation, meant 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, small timber and NTFPs.

The mission aims at addressing climate change by enhancing carbon sinks in sustainably managed forests and other ecosystems, enhancing the resilience and ability of vulnerable species/ecosystems to adapt to climate change, and enabling the adaptation of forest-dependent local communities in the face of climate variability.

The overarching target of the GIM is to double the area to be taken up for afforestation/eco-restoration in India in the next ten years, thus taking the total area to be afforested or eco-restored to 20 million ha. What this implies is that the mission would treat an additional area of 10 million ha during the period 2010-11 to 2019-2020. This is expected to sequester around 43 million tons of $CO_2$ annually in 2020 due to the increase in the above and below ground biomass in these areas.

**(1) Key Features of GIM**

**Holistic view to 'greening'**: The mission takes a holistic view of greening and the scope is not limited to just planting. Rather, emphasis is placed on restoration of ecosystems and a variety of habitats including grasslands, mangroves, wetlands, etc.

**Integrated cross-sectoral approach to implementation**: The mission proposes an integrated approach that treats forests and non-forest public lands as well as private lands simultaneously in a given sun-watershed/sub-landscape. Vulnerability to climate change projections and potential for carbon sequestration would be the key criteria for selection of the sub-watersheds/sub-landscapes.

**Decentralised forest governance:** The mission envisages a key role for the local communities in project governance and implementation. The mission proposes to strengthen *Gram Sabhas* as overarching institutions, supported by thematic committees and user groups (JFMCs, CFM groups, BMCs, etc.)

**Mission to facilitate development of REDD Plus strategy:** The mission proposes to set-up a REDD Plus cell within the mission directorate to coordinate and facilitate REDD Plus activities within the country. The cell is expected to work out a comprehensive REDD Plus strategy through an inclusive process. In fact, most of the activities undertaken under the mission, including the one on protection and enhancement of forests with relatively dense forest cover, are in line with country's stand on REDD Plus.

**(2) Sub-missions**

The mission has identified the following nine sub-missions for integrating mitigation/adaptation measures and for meeting the mission targets:

- Sub-mission 1: Enhancing climate resilience in moderately dense forests (2 million ha)
- Sub-mission 2: Eco-restoration of open forests (4 million ha)
- Sub-mission 3: Restoration of scrub-grasslands (2 million ha)
- Sub-mission 4: Restoration of new mangroves (0.10 million ha)
- Sub-mission 5: Restoration of wetlands (0.10 million ha)
- Sub-mission 6: Enhancing tree cover in urban and peri-urban areas (0.20 million ha)
- Sub-mission 7: Agro-forestry and social forestry (1.5 million ha)
- Sub-mission 8: Securing corridors to help species adapt to climate impacts (0.10 million ha)
- Sub-mission 9: Improving fuel use efficiency and promoting alternative energy source

### 3.2.11 Tourism and Ecotourism Policies in India

The Government of India's vision for the development of the tourism[1] sector is to:

> *"Achieve a superior quality of life for India's peoples through Tourism which would provide a unique opportunity for physical invigoration, mental rejuvenation, cultural enrichment and spiritual elevation."*

The tangible and intangible values of India's natural and cultural heritage provide the foundation for this vision. Biodiversity and protected areas, which are among the best places to experience wildlife,

[1] Refer to Annexure 3.1 for the concepts of tourism and ecotourism

are identified as important products for tourism, particularly through village tourism and ecotourism at grassroots, community-based levels.

India's National Tourism Policy 2002 is based on 14 principals, of which the following are of particular relevance to the development of an ecotourism in Tamil Nadu:

i. While a revolution in tourism has been sweeping the world, with global tourism increasing from 100 million people leaving their homes to travel in 1964 to 700 million in 2001, India's share in the world tourist traffic has remained constant at 0.38 % in the previous decade.

ii. An institutional framework needs to be evolved that is government-led, private sector driven and community-welfare oriented. Government and the private sector are required to safeguard the stability and socio-economic advancement of local communities.

v. Sustainability should serve as a guiding star of this policy. Development and management strategies should be formulated to ensure that tourism largely acts as a smokeless industry and its ecological footprints remain as soft as possible. No one should be allowed to secure short-term gains by resorting to what is call the 'darker side' of tourism. Over-exploitation should not be permitted nor carrying capacity of tourist sites ignored.

vi. Greater emphasis should be placed on ecotourism. It must help to eliminate poverty, end unemployment, create new skills, enhance the status of women, preserve cultural heritage, encourage tribal and local crafts, improve the overall environment and facilitate a more just and fair social order.

vii. Due importance should be given to domestic tourism and its infrastructure should be so designed as to serve as the backbone of future international tourism.

viii. A new class of young tourists is emerging, with marked preferences for adventure and distant destinations in hills, caves and forests. This class is looking for simple and clean places to stay, not five-star accommodation. Their needs should be met and guest tourism encouraged through Panchayats, and local bodies and associations.

ix. The tourism industry and travel agents should be encouraged to evolve and adopt voluntarily a Code of Ethics and its infringement should be firmly dealt with by Tour and Travel associations.

Seven key areas are identified to provide the thrust to India's tourism development: **S**wagat (welcome), **S**oochana Iinformation), **S**udhiva (facilitation), **S**uraksha (safety), **S**ahyog (cooperation), **S**amrachana (infrastructure development) and **S**afai (cleanliness).

India's Ecotourism Policy and Guidelines 1998 lays out cardinal principles concerned with the importance of involvement of local communities, minimizing the conflicts between tourism and local livelihoods, ensuring that tourism development is compatible with conservation interests and socio-cultural characteristics of the community, and integrated land-use and inter-sectoral planning with commensurate expansion of public services. Standards and codes of conduct for the tour operators, visitors and host communities are included in the guidance. Details of the principles and guidelines are given in Box 2.

Box 2 ECOTOURISM POLICY AND GUIDELINES 1998: General Principles and Guidelines

General Principles

1. It should involve the local community and lead to the overall economic development of the area
2. It should identify the likely conflicts between resource use for tourism and the livelihood of local inhabitants and attempt to minimize such conflicts
3. The type and scale of tourism development should be compatible with the environment and socio-cultural

characteristics of the local community and

4. It should be planned as a part of the overall area development strategy, guided by an integrated land-use plan while avoiding inter-sectoral conflicts and ensuring sectoral integration, associated with commensurate expansion of public services

Guidelines for eco-regional planning to foster eco-tourism

1. Delineation and notification of "fringe areas" (special areas) around identified eco-tourism sites (NPs / WLS) as "Non-Plan Areas under the "City & Country Planning Act" of the States, to avoid cross-sectoral conflicts and to achieve sectoral integration of inputs, for wise landuse to foster eco-tourism as per the operational guidelines.
2. Fostering eco-tourism through eco-development as a land use.
3. Prescription of environmental requirements for such specially notified areas for incorporation in the relevant rules of the State (Appendix-1).
4. The first benefit of eco-tourism must go to the local people (host-community), and in the long run the capacity building in this regard should be built-in for forging partnership with the local people.
5. According statutory protection to such specially notified areas under the Environmental Protection Act, 1986
6. Recognising the local Panchyat as the "authority having jurisdiction", for granting permission for development
7. Constituting a special committee under the chairman-ship of the district Collector, with the respective Protected Area manager as the member-secretary having adequate representatives from concerned Panchyats, Eco-development Committees, apart from local NGOs and honorary Wildlife Wardens, for advising the Panchyats on issues relating to development
8. Creation of village level micro-institutions (VFC/ FPC/ EDC) as per the resolution of the State Forest Dept, and formulation of site- specific eco-tourism plans with indigenous, participatory planning
9. Providing soft loans from Community Credit Programme /Special Trust Funds / Special Central Assistance/ Developmental Schemes of Tribal Department / District- level Integrated Developmental Programme, to identified host- community / beneficiaries for promoting eco-tourism
10. Establishing standards for eco-tourism in the site-specific microplans in tune with the operational guidelines, and the suggested modifications in the State rules, apart from ensuring adherence to these standards by the tourist developers and operators through the Panchyats.

## 3.3 Policies, Strategies, and Development Plans of the State of Tamil Nadu

### 3.3.1 Five Year Development Plan

The Eleventh Five-Year Plan (Working Group Report on Forestry and Wildlife) 2007-2012 prepared by the TNFD has devoted more than 45 pages to describe the commitment to conserve the state's biodiversity (pp. 111-147). The major objectives and strategies proposed in the report are as follows:

1) The objectives of the state-level biodiversity conservation efforts are to be in tune with that of national and international efforts

2) Preparation of biodiversity inventories covering most of the major forest types in the state, and identification of threats and frequent scientific assessment of the ecosystem

3) Strengthening protection of species, habitats, representative ecosystems and genetic variability by networking PAs

4) Prevention and eradication of introduction of alien species that threaten ecosystem, habitats or indigenous species

5) Management of biological resources outside PAs for sustainable use

6) Creation of facilities for ex situ conservation of biodiversity to support in situ conservation efforts

The Working Group Report proposes to fulfill the above six objectives by adopting the following strategies:

1) Inventorying and documentation of biodiversity richness in the state
2) Biodiversity protection in PAs
3) Habitat improvement
4) Man-wildlife conflict mitigation
5) Medicinal plant conservation
6) Ecotourism
7) Eco-development
8) Elephant camp management
9) Ex-situ conservation of species
10) Species recovery programs

### 3.3.2 State Forest Policy (Draft)

The National Forest Commission (MoEF, 2006) has recommended that within the broad parameters of the national policy, each state should have its own forest policy statement for the sustainable management of its forest and wildlife resources. Tamil Nadu, on account of its specific geographical, climatic, edaphic, ecological, environmental and demographic characteristics, has elaborated a state forest policy which focuses on protection of natural forests and wildlife, conservation of ecosystems and their genetic diversity, environmental stabilization, enhancement of forest productivity, augmentation of water resources from the forest, and increasing forest cover all over the state.

Some of the main objectives of the draft state forest policy are:

- Ensuring environmental and ecological stability of the state
- Biodiversity, wildlife and genetic resource conservation
- Rehabilitation and restoration of degraded forests
- Coastal ecosystem conservation and management
- Forest protection for resource management and augmentation
- Enhancing tree cover outside forests for livelihood security
- Water augmentation through forest conservation and catchment area management
- Tribal development to ensure economic prosperity and ecological stability
- Technology support, research and development for scientific forest management

The strategy to achieve the above objectives includes:

1) Conversion of exotic plantation into natural forests for sustaining pollinator population of birds, bees, butterflies, etc.;
2) Increasing the extent of protected areas to 25% of the forest area;
3) JFM through establishment of village forest committee (VFC);
4) Management of fragile ecosystem of coastal areas with a thrust on mangrove forests, wetlands, and the marine national parks;

5) Strengthening and capacity building of the protection machinery to control fire, grazing, encroachment, illicit felling, ganja cultivation and poaching of wildlife;

6) Formulation of innovative strategies for increasing forest and tree cover from present level of 21.25% of the geographical area to 33% by undertaking massive afforestation programme in areas outside forests; and

7) Developing state forest research institute as centre of excellence so that it can provide sound technical and scientific input for management of forests.

The draft policy stipulates that forests should not be looked at as a source of revenue but be viewed as renewable natural resources. Thus, it has recommended the allocation of a minimum of 2% of the budget to the conservation of forests and wildlife and the promotion of tree cultivation in the state for achieving the target of 33% of the land area under forest/tree cover expeditiously.

### 3.3.3 State Forest Commission

In view of the completion of 150 years of existence with rich tradition and great history of TNFD, the state government in 2007 constituted a state forest commission under the chairmanship of Mr. P.V. Rajaraman to look into various aspects of forest and wildlife management, and to make recommendations in this regard. The following are the terms of reference of the state forest commission:

1) To review the existing policy and legal framework of forests in Tamil Nadu and their holistic impact from ecological, economic, social and cultural viewpoints.

2) To make recommendations on specific policy option for achieving sustainable forest management in production forestry, protection forestry, protected area management, and social and extension forestry to bring one third of the land area under tree cover as stipulated in National Forest Policy, 1988 to achieve ecological security and environmental stability of the state.

3) To examine the current status of forest administration to meet the needs of civil society considering production, protection, and social and extension forestry objectives. To identify weakness and inadequacies and suggest appropriate improvement.

The commission deliberated a wide spectrum of subjects relevant to forest conservation and management and gave 162 recommendations which focused on improving forest and wildlife conservation and increasing the green cover in the state. Some of the important recommendations are listed below:

1) The principle of sustainable forest management may be mainstreamed in the management of different types of forests in Tamil Nadu so that the benefits from them flow continuously to improve the quality of life of the present as well as future generations.

2) The forest department may ensure that all the remaining forest fringe villages are brought under the JFM to increase public participation in forest restoration and management.

3) Government may consider forming an ‘ecotourism society’ to promote regulated ecotourism in the forest areas.

4) Tree cultivation in private lands has a great potential to rejuvenate rural economy in the state. To achieve the goal of desired green cover, more than 10 crore seedlings will be required annually. Forest department may ensure increased supply of quality seedlings and extension services to tree farmers. In this context, Tamil Nadu Forest Plantation

Corporation (TAFCORN) may also supply good quality clonal plants to farmers on a large scale.

5) In order to strengthen forest administration in the specialized fields of wildlife management and social and extension forestry, two exclusive wings with separate office may be created in the forest headquarters with adequate administrative and financial powers. However, these two autonomous wings may be under the overall control of the principal chief conservator of forests and head of forest force, who will be the principal adviser to the government.

### 3.3.4 Ecotourism Policy for Tamil Nadu

Recognising the importance of underpinning the development of tourism in Tamil Nadu with principles of conservation and benefit sharing, the state government has recently launched an *Ecotourism Policy for Tamil Nadu* (June 2010). Ecotourism is defined in the policy in accordance with the definition promoted by The International Ecotourism Society (TIES):

> "*Responsible travel to natural areas that conserves the environment and improves the welfare of local people."* (TIES, 1991)

The policy highlights the importance of promoting:

- **Nature-based activities** that are based on the essentials of responsible travel and contribute to the growth of the local economy;
- **Eco-cultural sustainability** so as to minimise impacts of tourism on the cultural values and uniqueness of local communities;
- **Conservation education** with respect to tour operators and tourists; and
- **Involvement of local people to enable benefits to flow to them** through management of ecotourism activities.

The ecotourism wing of the state's Tourism Development Corporation is responsible for implementing ecotourism policies and programmes within Tamil Nadu under the purview of a state-level advisory committee chaired by the Chief Secretary. It is anticipated that destination development will be carried out by the forest department, with the involvement of the local community who will be entrusted to manage such enterprises under a Memorandum of Understanding that specifies respective responsibilities.

Some 25 destinations have been identified in the Annex to the Policy, including many existing protected areas. It is planned for the state to create and maintain a website dedicated to ecotourism, with provisions for on-line bookings and enquiries.

# CHAPTER 4 REVIEW OF TAMIL NADU AFFORESTATION PROJECT – PHASES I AND II

## 4.1 The Project and Accomplishment

The state has about 3,072 forest fringe villages and most of the people living in these villages depend on the forests for their livelihood. Due to the fact that these villages have largely remained excluded from conventional developmental projects, they are distinctly underdeveloped with very high rates of poverty. This continued deprivation has played a major role in degradation of forests and the consequent loss of biodiversity. Earlier efforts in the rehabilitation of these degraded forests through various schemes did not succeed as expected since participation of local communities was ignored.

In 1997, Tamil Nadu launched a massive project titled the Tamil Nadu Afforestation Project Phase I (TAP-I) with a soft loan from Japan Bank for International Cooperation (JBIC) in order to restore degraded forests and alleviate poverty in forest fringe villages. The themes of the Project were people's participation, forest conservation, and poverty alleviation. People who influenced the forests were made part of the conservation efforts. The project employed joint forest management as a major tool.

Encouraged by the success of TAP-I, the second phase (TAP-II) has been launched in 2005-2006, also with financial assistance from JBIC (now JICA). Natural custodians of forest ecosystems, also known as tribals, have been given centre stage in the project. Around 1,775 $km^2$ of degraded and degrading forests and tribal forest areas are being protected and developed to benefit 800 forest fringe and tribal villages. Poverty alleviation is being accorded with greater focus by extending the activities for five years in each village. Research and extension is being taken up for significant contributions to ecosystem protection, conservation and management in technical, institutional, and societal dimensions.

**Features and Achievement of TAP-I & II**

| | TAP-I | TAP-II |
|---|---|---|
| Project Period | 1997/98 – 2004/05 | 2005/06 – 2012/13 |
| Objectives | ♦ To restore degraded forests and alleviate poverty in the project villages | ♦ To bring about ecological restoration of degraded forests<br>♦ To facilitate livelihood improvement of inhabitants of the project villages by afforestation through joint forest management<br>♦ To contribute towards poverty reduction in the area |
| Project area | 946 project villages spread over 27 districts (excluding Chennai, Nagapattinam and Thiruvarur districts) | 800 villages |
| Component, sub-components & achievement | **Afforestation**<br>✓ 480,000 ha of degraded forests and community lands covered<br>**People's Participation**<br>✓ 1,367 Village Forest Councils (VFC) formed with 466,000 villagers as members<br>**Water Harvesting**<br>✓ 23,454 check dams and 2,201 percolation ponds constructed<br>**Technological Thrust**<br>✓ Introduction of GIS | **Afforestation**<br>♦ Integrated Watershed Development<br>✓ 125,000 ha of degraded forests abutting 500 villages being restored<br>✓ 37,500 ha of degraded forests abutting 150 tribal villages brought under JFM<br>✓ 4,152 check dams and 1,177 percolation ponds constructed<br>♦ Integrated Tribal Development<br>✓ 15,000 ha being planted with useful tree species |

| | TAP-I | TAP-II |
|---|---|---|
| | ✓ Computerization down to range level<br>**Integrated Village Developme**nt<br>✓ Community assets like overhead tanks, borewells, hand pumps, VFC buildings, etc. are provided<br>✓ 4722 rural development works implemented by 22 line departments by cross sectoral linkage<br>**Micro-credit**<br>✓ Rs. 530 millions of micro-credit distributed to villagers | **Buffer Zone Activities**<br>♦ Income Generating Activities (IGA)<br>✓ Provision of loans to SHGs and individuals to take up alternative employment<br>♦ Community Development Works (CDW)<br>✓ Infrastructure development in the village such as drinking water facilities, roads, etc.<br>**Infrastructure Improvement**<br>✓ Construction of office buildings, staff quarters and rest house<br>✓ Wireless communication network<br>✓ Purchase of computer and software<br>✓ Purchase of vehicles and equipment<br>**Supporting Activities**<br>♦ GIS<br>♦ Human Resource Development<br>♦ Forest Research<br>♦ Forest Extension<br>♦ Monitoring and Evaluation |

## 4.2 Project Management Structure

Both TAP Phases 1 and 2 were implemented through the existing structure of the TNFD. Although there was no special unit dedicated for the implementation of the Project, one CCF (TAP) and two CFs (TAP-I, TAP-II) were assigned within the office of PCCF. The steering committee in the name of High Level Empowered Committee (HLEC), State Level JFM Committee (State Level Coordination Committee), and District Level JFM Committee (District Coordination Committee) were established during TAP-I. The overall implementation structure, including these committees, was maintained in TAP-II.

### (1) High Level Empowered Committee (HLEC)

The HLEC is the highest decision-making body of the Project. It was constituted in order to facilitate smooth clearance of the budgetary allocation and final decision making for the project. The composition of the committee is shown below.

| | | |
|---|---|---|
| 1 | Minister, Forests | Chairperson |
| 2 | Secretary to Government , Forest Department | Member |
| 3 | Secretary to Government, Finance Department | Member |
| 4 | Secretary to Government, Planning and Development Department | Member |
| 5 | Secretary to Government, Revenue Department | Member |
| 6 | Secretary to Government, Rural Development and Panchayat Raj Department | Member |
| 7 | Principal Chief Conservator of Forest (HOFF) | Member |
| 8 | Chief Conservator of Forests (Planning and Development) | Member |
| 9 | Chief Conservator of Forests (Tamil Nadu Afforestation Project) | Member Secretary |

The main function of the committee is to sanction the annual budget and plans of the project. Its responsibilities also include the review of financial and physical progress of the project, providing recommendations, and approval of important agendas. The committee is authorized to pass administrative sanctions to all individual schemes/proposals which cost up to Rs. 20 crores each for

items contained in the total estimate[1].

### (2) State and District Levels JFM Committee

Two levels of committees (State Level JFM Committee and District Level JFM Committee) were constituted under TAP-I in order to improve living conditions and quality of life of remote villagers by enhancing the inter-departmental linkage for integrated community development. The State Level JFM Committee, headed by Chief Secretary to the Government of Tamil Nadu, is responsible for coordination and monitoring of JFM and allied activities. The committee meets regularly (half-yearly) in order to review the progress of works done by District Level JFM Committees, developmental activities carried out in TAP villages, and work implemented under intersectoral linkage in TAP villages. The state level committee monitors pending works, take necessary action, and follow-up issues by the next meeting. The composition of the committee is shown below.

| | | |
|---|---|---|
| 1 | Chief Secretary to Government of Tamil Nadu | Chairperson |
| 2 | Secretary to Government, Finance Department | Member |
| 3 | Secretary to Government, Social Welfare Department | Member |
| 4 | Secretary to Government, Adi-Dravidar & Tribal Welfare Department | Member |
| 5 | Secretary to Government, Agriculture Department | Member |
| 6 | Director, Animal Husbandry Department | Member |
| 7 | Representatives from Non-Governmental Organizations<br>(Subject to change once in two years to be appointed by Government) | Members |
| 8 | Representative from the Government of India, Ministry of Environment and Forests | Member |
| 9 | Principle Chief Conservator of Forests (HOFF) | Member |
| 10 | Principle Chief Conservator of Forests (Chief Wildlife Warden) | Member |
| 11 | Chief Conservator of Forests (Tamil Nadu Afforestation Project) | Member Secretary |

The state level JFM Committee has formulated guidelines to streamline integration and defined the role to be played by the district level committee in implementing intersectoral linkage.

The district committees aim to enable district administration to focus its attention on remote forest fringe villages and usher them in an inclusive developmental process. The district level committee reviews the function of the VFCs as well as the progress of JFM's overall activities. The most important responsibility of the committee is to integrate other departmental works for community development work in the project villages. By July 2010, 1,741 TAP I & II villages have benefited from 11,609 developmental works[2] worth Rs. 1,675 millions in the past 12 years. As many as 24 departments and state undertakings have contributed in the process.

| | | |
|---|---|---|
| 1 | District Collector | Chairperson |
| 2 | Project Officer, District Rural Development Agency | Member |
| 3 | Joint Director, Agriculture Department | Member |
| 4 | Joint Director, Animal Husbandry Department | Member |
| 5 | Deputy Director, Social Welfare Department | Member |
| 6 | District/Divisional Forest Officer(s) concerned | Member(s) |
| 7 | Two representatives from Non-Governmental Organizations<br>(subject to change once in two years, to be appointed by the Collector) | Members |
| 8 | Five representatives from the Village Forest Council<br>(to be selected by District Collector) | Members |
| 9 | Headquarter's District/Divisional Forest Officer | Member Secretary |

[1] Scheme/proposal above Rs. 200 millions are sent to the Chief Minister's Office for sanction.

[2] This includes roads, bridges, drinking water and sanitation, improvement of water bodies, school improvement, electrification, group housing etc.

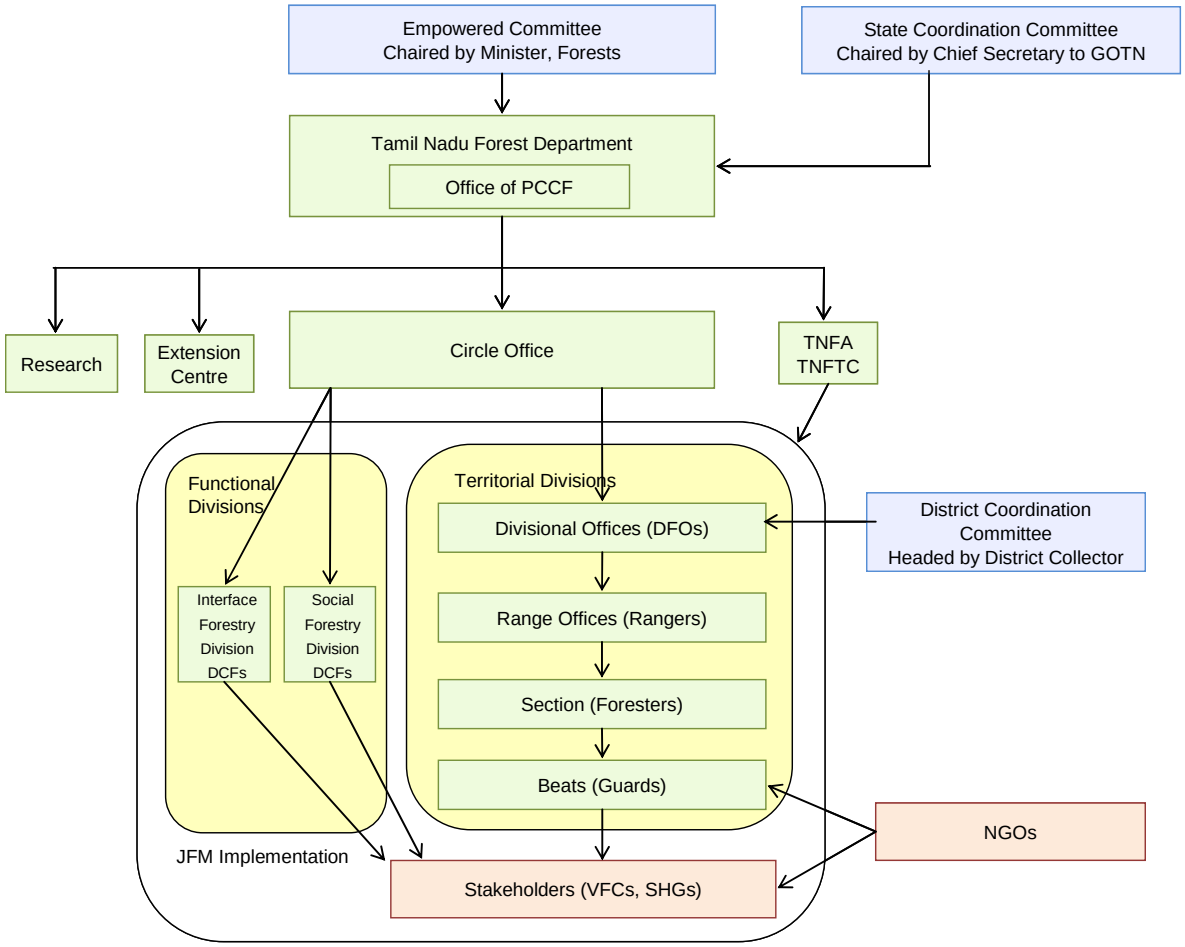
The Training institute at Coimbatore is well established with required infrastructure and is well suited and conducive location for conducting trainings because of inherent advantages such as equidistant from northern, eastern and southern part of the state. The centre is equipped with facilities such as lecture halls, Auditorium, Hostel facility for 180 persons, Rest House, Library with around 13,500 books, 20 computers (although they are 7 to 8 years old), projector, OHP etc. The centre needs to be equipped with the required computer hardware and software so that GIS based trainings could be arranged in the centre.

## 4.3 Implementation Procedures

The CCF TAP with the support of two CFs (TAP I & II) are entrusted with the job of assisting PCCF in coordinating and executing the project. Overall JFM activities are being carried out by the territorial division and most of the functional divisions throughout the states. The project components have been implemented through relevant units e.g. Forestry Extension Centre for activity related to social forestry. The training component was designed at the headquarters, in which most of the training courses have been imparted at TNFA and TNFTC. Through the instructions of respective CCFs, the project activities are loaded into the existing departmental structure and executed by the frontline staff. The CCF (TAP I) and CFs (TAP II) are responsible for overall data management, budgeting and disbursement, reporting, progress monitoring, and internal as well as external coordination.

### (1) Implementation of JFM

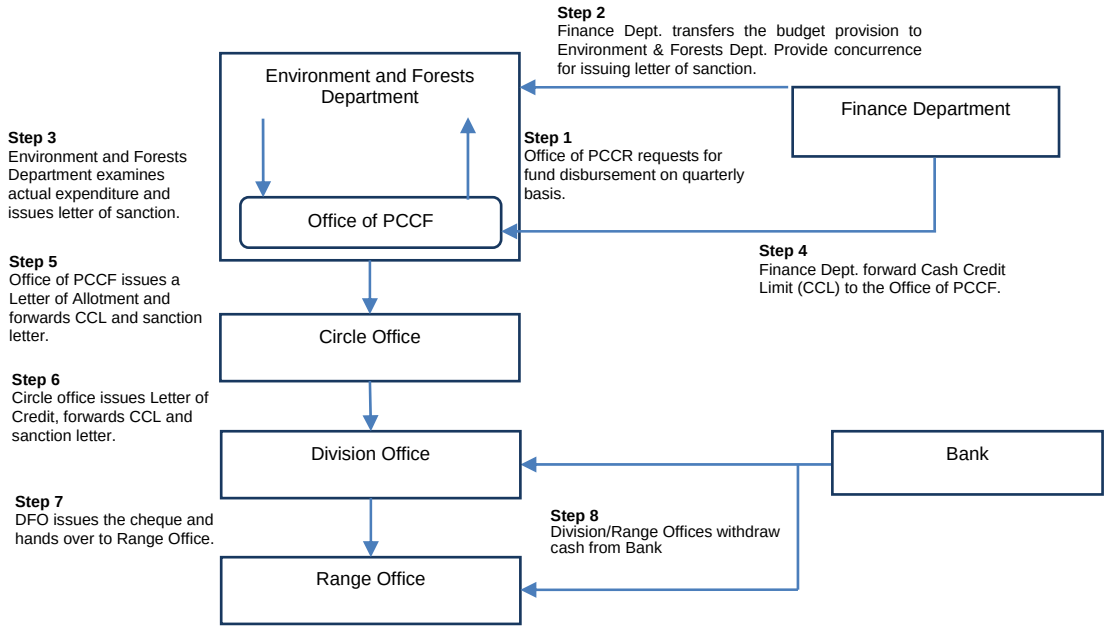
The headquarters allocated a number of target villages and project funding to 12 forest circles and monitored the progress through reports submitted by the circle offices. The circles then distributes those target villages into divisions (both territorial and functional) as well as monitor the activities. Divisions play a major role in the execution and day-to-day management of the project. Range offices and beats are the frontline of JFM activity. They are supported by local NGOs for community organizing process in the initial stage. The overall implementing structure is illustrated below.



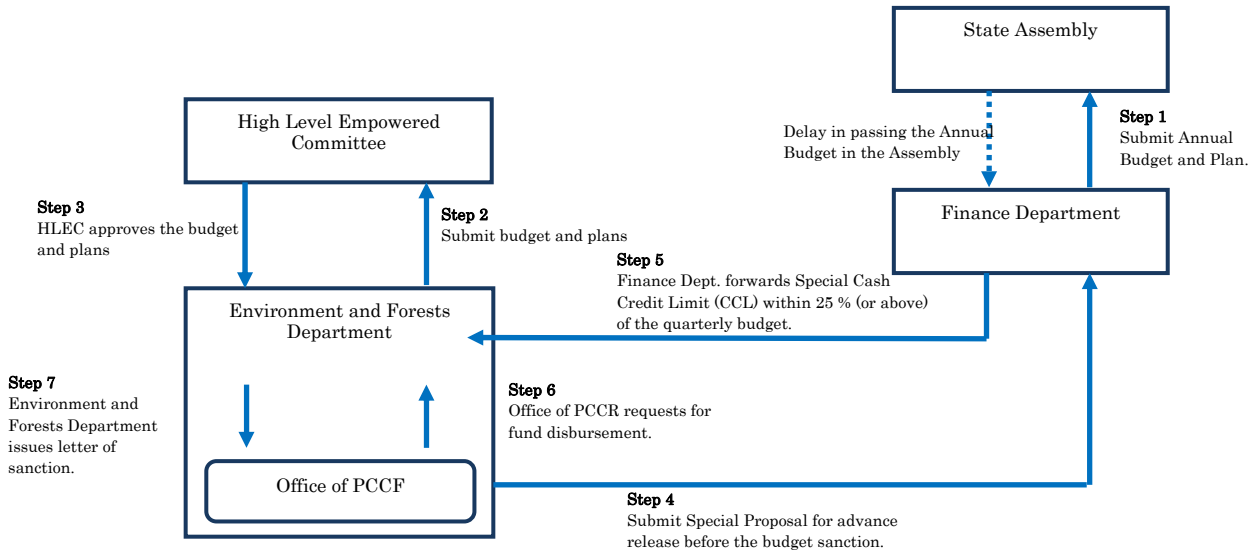

**Implementing Structure of TAP I & II**

## (2) Procedure for Actual Fund Request and Disbursement of TNFD

The general financial flow for TNFD is shown in the next page. Expenditures to be incurred by field level operation, the regular letter of credit (LOC) system is adopted. The division offices receive cheques to spend for day-to-day expenditures. Division and range offices are mainly responsible for financial management of field activities. Range offices and above can appoint petty contractors for minor activities valued below Rs. 10,000. The division office can approve tender for a medium activity valued below Rs. 50,000 per package. On the other hand, activities valued above Rs. 50,000 are subject for approval from the circle office. The circle office can approve tender valued above Rs. 50,000 for division offices. Field activity costs are allocated only for division/range offices and beats.




**General Financial Flow for the Tamil Nadu Forest Department**




**Special Arrangement for Advanced Fund Release under TAP**

The Government of Tamil Nadu is quite fast in budget preparation and fund release procedures. However, it often tends to be delayed in sanctioning the annual budget. This restricts the activities for nearly the first half of the financial year. The TNFD adopted a special system to cope with constraints (as shown in the figure above). After the annual plan and budget is approved by HLEC, the department, based on G/O, can submit a special proposal of around 25% of the quarterly budget to the Finance Department. After the annual budget for the project is approved by the HLEC, the Finance Department then may allocate the funds to TNFD before the official sanction of the budget[3].

[3] This special provision does not always work. The forest department succeeded in receiving nearly 40% of its quarterly budget in 2009, but failed in 2010.

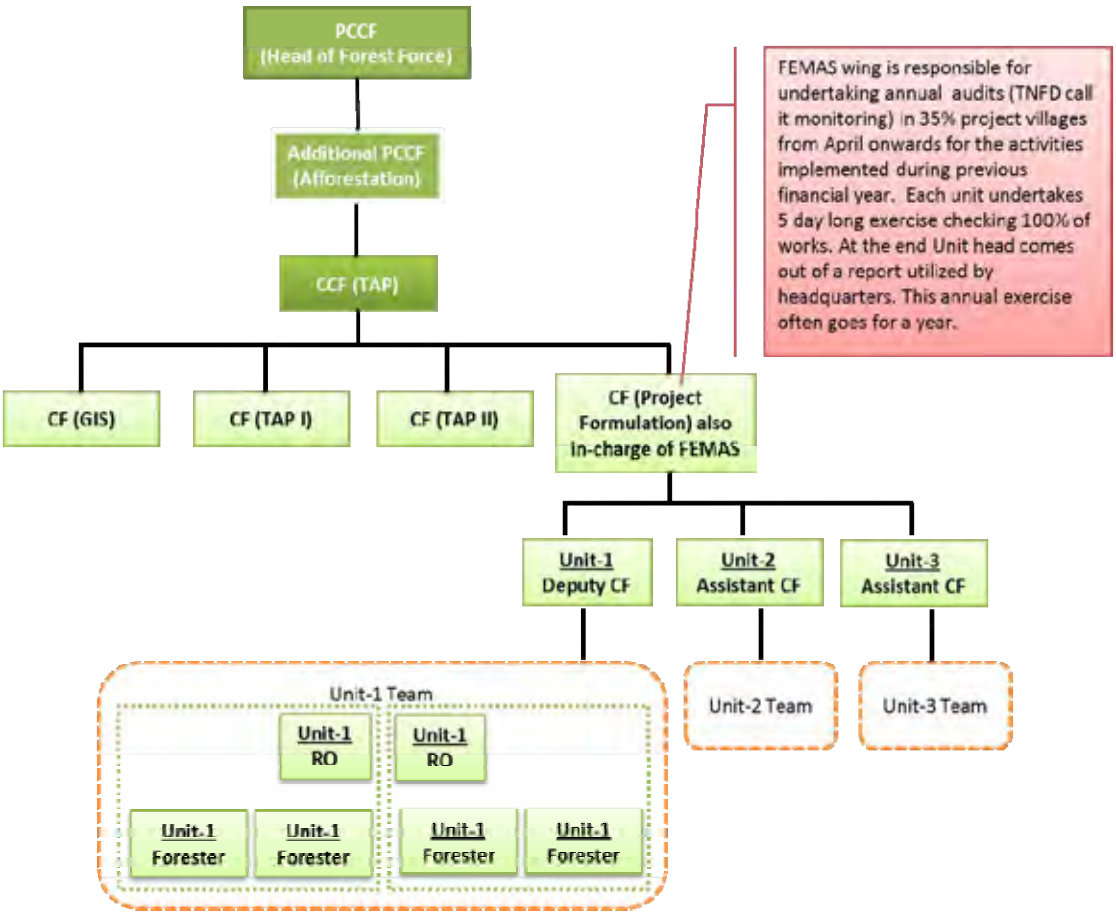
## 4.4 Monitoring and Evaluation

The M&E framework of TAP-II includes the following:

1) Undertaking field inspections as a part of internal monitoring mechanism,
2) Comprehensive evaluation by FEMAS of both quantity and quality of works,
3) Periodic reviews at both state and circle levels, and
4) Studies by hiring consultants.

Some twelve formats were designed to capture information from the field level of tracking: physical vis-à-vis financial achievements, status of expenditures against sanctioned amount, site profile, plantation details, nursery details, permanent assets created in the village, loan details and recovery status, revolving fund utilization, awareness/medical camps, information on forest dependents, activities undertaken through VFC, utilization of VFDF fund, well monitoring, rainfall details, VFC particulars, VFC/EC meetings, and SHG details.

This data was recorded and kept at the range or division level but information on only few parameters like physical vis-à-vis financial achievements, status of expenditures against sanctioned amount, plantation details, and nursery details etc. were regularly reviewed at the state level during monthly meetings. Other details were obtained during the annual monitoring exercise by FEMAS.




**Institutional Arrangement for Evaluation by FEMAS under TAP-II**

While this framework has been effective in tracking targets and achievements, it had not been quite efficient to oversee processes, particularly at the field or community level. Also, the information captured through semi-structured formats were not analysed for all parameters and also not effectively utilised for planning and improving on the implementation strategy over a period of time.

As an external monitoring mechanism, the following studies were undertaken by hiring consultants:

1) Socio-economic studies
2) Water table status studies
3) Vegetational change studies
4) Sociological studies
5) Trainer's training
6) Marketing of products generated under IGA

All of the studies were planned to be conducted in two phases. The first phase has been completed except for two studies, namely the water table status and vegetational change. The reason for this was that firms were not responding to announcements made by TNFD to undertake these studies for limited cost provisions (Rs. 10 lakhs per study for two rounds) given the scope of work. These studies have been recently completed, and reports are being examined by TNFD. Thereafter, a second phase of conducting studies would be taken-up. Shortcomings identified in the existing M&E framework are listed below:

- Baseline information is created but not utilized for comparing results during mid-term evaluation
- Data collected at various operational levels were not efficiently analyzed and utilized for planning and improving implementation strategy over a period of time
- Though extensive efforts has been made to strengthen spatial information using GIS techniques, limited effort has been made to link MIS and GIS datasets
- Strategy to commission studies and utilization of results were not very sound; neither exercise has been planned to collectively analyze the results for all independent reports i.e. establishing correlations amongst various parameters.
- Mechanism to utilize reviews undertaken by the District Level JFM Committee and to track performance of community institutions created at the lowest level
- Project logframe and project performance indicators have not been visualized

## 4.5 GIS, Remote Sensing and MIS

### (1) Background

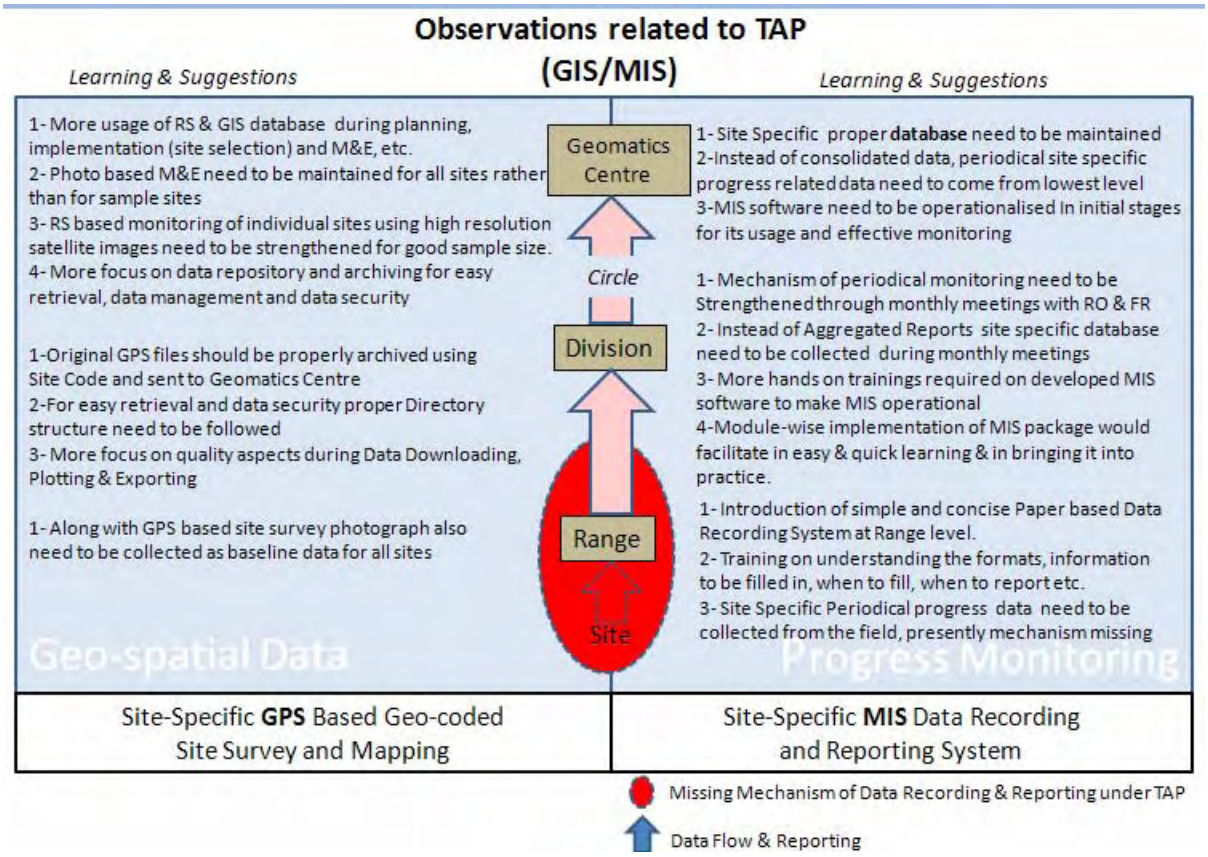
As per the APCCF, prior to the establishment of the GIS unit within the department, TNFD used to depend on the RRSSC, Chennai, located in the premises of Anna University. Over a period of time TNFD felt the necessity to establish the facility in-house so that the staff of the department can take care of the requirement by use of GPS-based data collection from the field, collected data processing, thematic data layer creation and analysis in the GIS environment along with remote sensing-based analysis for better planning and monitoring of the forest resources.

### (2) Progress Made

The TAP I & II projects have provided TNFD with an opportunity to establish a GIS unit at TNFD Headquarters, and also to develop the staff's capacity in the field of GIS. The TAP-I (completed) and TAP-II (ongoing) are considered as one of the most successful forestry projects in India supported by JICA. TNFD was very much successful with respect to the establishment of GIS facility and the development/strengthening of required skill sets. According to the report of JICA (prepared by external evaluator: Koichi Ishii, Pegasus Engineering Corporation, field survey in January 2008), it was indicated that "…the facilities of TNFD were improved almost as planned, and monitoring using the geographical information system (GIS) began in some sections of the area". This in itself speaks about the functioning of GIS at that stage.

### (3) Current Status

The staff members were handpicked by TNFD for undergoing professional training in geomatics from prestigious institutions. The availability of trained manpower and sound infrastructure has helped the Geomatics Division to showcase and establish a mechanism of GPS-based mapping, data transfer, and plotting geospatial field data in GIS environment. Satisfactory performance has thus far been achieved under the two projects. But there is still room for further improvement in order to make it functional throughout the state. This mainly covers aspects such as sound geospatial database development, regular updating of data, analysis, mechanism for faster retrieval of data and its practical usage in order to fully harness the capability of GIS and MIS technology as a planning and monitoring tool. The Geomatics Centre has done change detection analysis using temporal satellite data (IRS LISS-III) for some TAP villages.




### (4) Infrastructure – Hardware and Software

Considering the objective behind the establishment of the Geomatics Centre, it is important for the said centre to start developing required state level GIS data layers for decision-making and monitoring of forest or tree resource and to fully harness the true capabilities of GIS and remote sensing. Under TAP I and II projects, funded by JICA (formerly known as JBIC), good infrastructure has already been developed.

In order to keep up with the changing technology, GIS & Image Processing software is upgraded from time to time. At present, the Geomatics Centre has a valid license for ArcView/ArcGIS (ver. 9.x) – 5 no., ERDAS Imagine (ver. 8.4) – 2 no., ENVI (ver. 4.6) – 1 no., and Idrisi Taiga (ver. 16.01) – 1 no. at headquarters. Moreover, additional ArcGIS/ArcView software were also procured and supplied to respective circles (17 no.) and divisions (26 no.). Detailed information with respect to infrastructure is given in **Annexure 4.1** (Existing infrastructure details-Computer Hardware-Software).

### (5) Management Information System (MIS)

A hard copy based MIS system is functional under TAP-II in which reporting periodicities are monthly, quarterly and annually. Consolidated reports come from range to division and consolidated division level reports comes to headquarters. At headquarters, project site-specific MIS data are not being maintained although field-based GPS data are maintained at the Geomatics Centre. Under TAP-II, MIS software was developed by Lastech Private Limited (located at Chennai) which covers modules related to TNFD's functioning. Also, project-specific MIS software with a total project cost of Rs. 9.7 lakhs was developed in Visual Basic as front end and MS-Access as back end (for data base). The stand alone software was developed and installed at all divisions in 2005 and also trainings were organized by the software development agency but unfortunately the software based MIS system has not been operational yet. Currently under TAP-II, the consolidated reports are being sent by respective divisions either in Excel-based formats or in hard copies.

### (6) Training of Staff at Field Level

Under TAP-I and TAP-II, several TNFD staff members were sent to long-term international and national level training in the field of GIS. After setting up infrastructure and trained manpower, the Geomatics Centre organized trainings (GPS usage and field based location specific data collection) for field staff. It is learned that at range level, 462 staff members have basic understanding of GPS and GPS based survey and data collection.

### (7) Web-Based GIS Applications

As part of the component of web-based GIS application development and procurement of required hardware under TAP-II, the work was outsourced to Electronics Corporation of Tamil Nadu (ELCOT) for necessary procurement and software development in 2005-06. But the web-based GIS application is not yet developed and functional.

ELCOT is a wholly-owned Government of Tamil Nadu undertaking, which is registered under the Indian Companies Act (1956). ELCOT is the nodal agency for information and communication technology projects for the Government of Tamil Nadu. It is also the optional procurement agency (G.O.Ms.No.58 of Finance (BPE) Department dated 16.2.1999, Letter No.624/MIE.2/99-2 dated 21.10.1999) for the procurement of computer hardware and software for government, departments, organizations or boards.

**The Preparatory Survey**
**on**
**Tamil Nadu Biodiversity Conservation and Greening Project**

**Final Report**

# PART III: IMPLEMENTATION PROGRAMME

# CHAPTER 5 PROJECT RATIONALE

## 5.1 Biodiversity Conservation in Tamil Nadu

The Western Ghats, together with Sri Lanka, is one of the world's 34 biodiversity hotspots. Hotspots are defined as regions where 75% of the planet's most threatened mammals, birds and amphibians survive within habitat covering just 2.3% of the Earth's surface[1]. By definition, this means that the Western Ghats/Sri Lanka hotspot holds at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics; and that it has lost at least 70% of its original habitat due to the impact of human activities. Such is the importance of the Western Ghats that the Government of India has recently (2010) nominated it for inclusion in the World Heritage List.

As a signatory to the Convention on Biological Diversity[2], India is obliged to identify and monitor the components of biological diversity that are important for its conservation and sustainable use. These provisions are contained in Article 7 as reproduced in **Box 2** below. This obligation requires extensive field surveys to prepare the inventory of species and ecosystems of which they are a part. This also provides a benchmark, or record in time and space, against which future changes can be measured. Such surveys and repeat surveys provide the means of monitoring changes in biological diversity, assessing its conservation status and informing its management.

Box 3 Convention on Biological Diversity Provisions for Identification and Monitoring of Biodiversity

ARTICLE 7 Identification and Monitoring

Each Contracting Party shall, as far as possible and as appropriate, in particular for the purposes of Articles 8 to 10:

(a) Identify components of biological diversity important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I;

(b) Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use;

(c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and

(d) Maintain and organize, by any mechanism data, derived from identification and monitoring activities pursuant to subparagraphs (a), (b) and (c) above.

ANNEX I Identification and Monitoring

1. Ecosystems and habitats: containing high diversity, large numbers of endemic or threatened species, or wilderness; required by migratory species; of social, economic, cultural or scientific importance; or, which are representative, unique or associated with key evolutionary or other biological processes;
2. Species and communities which are: threatened; wild relatives of domesticated or cultivated species; of medicinal, agricultural or other economic value; or social, scientific or cultural importance; or importance for research into the conservation and sustainable use of biological diversity, such as indicator species; and
3. Described genomes and genes of social, scientific or economic importance.

The Project provides a major opportunity to improve information and access to knowledge on the diversity, distribution and conservation status of plant and animal species within Tamil Nadu's existing protected areas and reserve forests, particularly with respect to those comprising part of the Western Ghats. This can be achieved through a variety of initiatives that feed into a centralised spatial

[1] Mittermeier, R.A., Robles Gil, P., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J., and da Fonseca, G.A.B. 2004. *Hotspots Revisited*. Mexico: CEMEX

[2] India ratified the Convention on Biological Diversity in 1994.

database of species records. Such initiatives will include the collation of spatial data from previous and ongoing surveys of flora and fauna, research and monitoring surveys undertaken by the Project for a variety of different purposes, and notably the establishment of a long-term programme to monitor climate change and other impacts on biodiversity. The knowledge gained from these interventions will inform and strengthen future management and expansion of the state's protected areas network, particularly in response to climate change and other environmental impacts.

## 5.2 Needs to Increase the Natural Resource Base

With a total recorded forest area of 17.6% and forest cover of 17.9% of the total geographical area in Tamil Nadu, there is little possibility for achieving the national goal of 33% forest and tree cover and meeting the growing timber, wood and non-wood forest products (NWFP) requirement without expanding tree cultivation and strengthening tree growing culture in areas outside forests. Apart from increasing the supply of tree products, tree cultivation on private land would also help increase the green cover and density of trees per unit area outside the forest area. The National Forest Commission (NFC 2006) has also advocated increasing tree resources on private land.

There is a growing demand and consumption of timber and wood as supported by the fast growing economy, expanding urbanisation and increasing industrialisation. On the other hand, supply of forest products from 'traditional' forest areas has been either declining or stagnant due to the degradation of forest resources. Also, the increase of focus on managing the forest for environmental services leads to the increasing demand-supply gap. The increasing demand-supply gap is being met by 'unrecorded' harvesting particularly of fuelwood from the natural forest as well as increasing supply of timber and pulp from other countries. In order to reduce pressure on natural forests, it is essential that the natural resource base is both improved and increased. ***Without addressing the increasing demand-supply gap for forest products and the issue of increasing pressure on natural forests, it would be difficult to effectively or sustainably achieve the project goal of biodiversity conservation in natural forest areas.***

Within the last thirty years, there have been concerted efforts by TNFD under different donor-supported programmes to create plantations outside forests and to rehabilitate degraded forests with community participation. Although specific data on the supply of forest products to industries from various sources could not be made available, it is estimated that a significant amount of timber, pulpwood and fuel wood requirements are currently being met from plantations outside forests. Most of the common land (tank foreshore) are already under plantations created under forestry development projects in the past. In the coming years, supply can also be augmented through silvicultural management of presently degraded forests – most of which are now under JFM regime and covered under previous JBIC/JICA supported programmes. Farm forestry and extension forestry have been established as regular activities of the forest department. In some parts of the state, tree cultivation has become an integral part of the farming system. ***This trend needs to be further expanded and strengthened in order to further reduce pressure on natural forests.***

Increased green cover and number of trees outside forest areas would augment the supply of fuelwood, fodder, wood and NTFPs. It would also meet the increasing demand of wood-based industries for timber, plywood, pulpwood, matchwood and various other cottage industries which use wood as raw material. As trees render various ecological services, a carefully planned programme aimed at the increase of green cover could lead to the improvement of the following: village ecosystem, microclimate, diversity of flora per unit area, habitat conditions for fauna, and carbon sequestration. Also, tree planting in private fallow land could lead to economic utilisation of unutilised assets. Even in non-fallow land, the economic returns from a carefully planned agro-forestry model are greater than that from the cultivation of only agricultural crops. This is also justified by the existence of different agro-forestry models in pockets of all seven agro-climatic zones of the state.

## 5.3 Compliance with the Government Policies and Strategies

### (1) Biodiversity Conservation

The project is in compliance with the National Forest Policy, 1988 since it aims at increasing forest and tree cover without denying local communities of benefits that arise out of such intervention, and at the same time keeping in view the problems of human-wildlife conflict along the fringes of forests and other protected wildlife habitats.

The project is also in compliance with the yet-to-be adopted National Biodiversity Strategy and Action Plan that recommends the following: restoration of degraded areas and critical habitats such as high altitude grasslands; widening the scope of people-oriented interventions such as JFM, agro-forestry, social forestry and eco-development; adoption of watershed-based management strategy; and strengthening of symbiosis between forests, local communities and managers.

### (2) Forest Resource Management

The National Forest Policy, 1988 primarily aims at maintaining ecological balance and environmental stability that is vital to the sustenance of all life forms (human, floral and faunal). The policy also calls for making direct economic benefits from forests but this is subordinate to the principal objective. The policy seeks to achieve these objectives by bringing under forest or tree cover at least 33% of the total land area of the country and also at least 66% of the total hill area.

Forests have a vital role to play in the fight against global warming. Being home to much of the world's biodiversity and supporting the livelihood of over a billion of the world's poorest people, forests also have significant economic and ecological value as a provider of ecosystem services. In this respect, the tree planting on private land component is in compliance with the National Forestry Policy, 1988 and it will contribute to biodiversity conservation of the project area.

### (3) Climate Change

The National Mission for a Green India (Green India Mission - GIM) is one of the eight missions under the National Action Plan on Climate Change (NAPCC, 2008). The mission aims at addressing climate change by enhancing carbon sinks in sustainably managed forests and other ecosystems.

The Project, through tree cultivation on private land (TCPL), will increase tree cover and contribute to NAPCC.

## 5.4 Compliance with International Conventions

Three international conventions are relevant to the Project: Convention on Biological Diversity (CBD), Convention on Wetlands of International Importance (called Ramsar Convention), and United Nations Framework Convention on Climate Change (UNFCCC). India is a signatory of the conventions. The proposed project is in conformity with the government's action to biodiversity conservation, wise use and conservation of wetlands, and climate change, not only for international commitment but also for national security.

## 5.5 Necessity of JICA's Assistance

The mid-term policy of Japan's Official Development Assistance (ODA) puts priority on the following: (i) poverty reduction, (ii) sustainable growth, (iii) global issues particularly environmental problems and natural disasters, and (iv) peace-building. The project is relevant to priority items (ii) and (iii) through biodiversity conservation, and the increased and sustainable use of natural resources. Hence it meets Japan's ODA priorities.

On the other hand, JICA's ODA policy to India focuses on "promotion of economic development", "poverty alleviation and environmental improvement", and "capacity development".

JICA has had substantial experiences assisting several forestry projects in India. It is also the largest donor in the forestry/natural resource sector of the country. Its accomplishments have been remarkable and notable, especially for the achievement of the Joint Forest Management (JFM).

Recently, JICA has expanded its support in the forestry and natural resource management sector of India, from afforestation and JFM towards conservation of biological diversity. The activities planned under the proposed project cover biodiversity conservation, increase of natural resource bases, and REDD Plus including capacity development. Hence, the experiences of JICA are quite useful and could best fit the project.

# CHAPTER 6 SCOPE OF THE PROJECT

## 6.1 Basic Approach

The main set of issues and problems identified by TNFD regarding the conservation of biodiversity is linked to the unprecedented growth of human and livestock populations. These growths have placed tremendous pressure on existing wilderness areas which are shrinking due to the process of accommodating economic development. The problem is aggravated by the lack of a state level policy that prevents further degradation of ecosystems, habitats, and associated plants and animals.

There are still major gaps in knowledge and understanding on the impacts of global warming and climate change on biodiversity. Whether the growing stock of vegetation will be affected by climate change? Which are the plants and animals that are vulnerable?[1] Important conservation issues identified are listed in Section 2.5.5. These issues may be broadly grouped as follows:

(1) Deficiencies in the implementation of existing national and state policies that govern conservation of biodiversity;

(2) Lack of replicable models wherein biodiversity conservation has been integrated with sustainable human development (e.g. failure of the biosphere reserves model);

(3) Deficiency in scientific resource base that can guide long-term conservation planning and implementation;

(4) Difficulty to conserve biodiversity in natural forest areas without addressing the increasing demand-supply gap for forest products (needs to expand tree cultivation and tree-growing culture outside forest areas due to inability to supply forest products from 'traditional' forest areas);

(5) Deficiency in in-house capacity of TNFD in managing natural habitats other than forests;

(6) Deficiency in data for monitoring the impacts of conservation projects on species, habitats and ecosystems; and

(7) Deficiency in infrastructure and trained manpower for assessing and dealing with ecological challenges that extend beyond the system of PAs.

The proposed project has set biodiversity conservation as its goal and identified two major pathways for achieving it namely: 1) restoration of ecosystems, and 2) regulation of future human pressure on ecosystems. To achieve this, the project has envisaged the following approach.

| **Goal** | | **Biodiversity Conservation** | |
|---|---|---|---|
| **Pathway** | | Restore habitats & species within PAs [**Biodiversity Conservation**] | Increase tree cover/ biomass outside PAs and forest areas [**Increasing Natural Resource Base**] |
| **Activity** | Research & interventions | Yes | Yes |
| | Socio-economic development | Yes | Yes |
| | Capacity development | Yes | Yes |

[1] Source: PCCF/TNFD, undated, Eleventh Five Year Plan: 2007-2012

## 6.2 Scope and Target Areas of the Project

The survey team deliberated the scope of the project considering the proposal of TNFD as well as the criteria agreed upon between JICA and TNFD in June 2010 as attached in **Annexure 6.1.**

### 6.2.1 Biodiversity Conservation

The geographic scope of the biodiversity conservation component is based on the following criteria applied to the selection of natural areas for conservation management and of villages for ecologically sustainable development:

- **Natural areas** include protected areas (national parks and sanctuaries), elephant reserves and reserve forests. Tiger reserves are excluded because they are well-supported under the Government of India's centrally sponsored Project Tiger scheme. All 12 bird sanctuaries are included (only one of which within the Western Ghats) in order to address a wide range of wetland management issues, while also recognising the importance of these sites for visitors and in the case of more accessible sites, opportunities by ecotourism.

- **Villages**, of which at least 80% of residents are tribal, are included provided that they have not benefited from the Tamil Nadu Afforestation Project (TAP Phases I and II) and other notable past interventions. Tribal villages within the Eastern Ghats are excluded because they already received support under the Government of India's Tribal Sub Plan. A further criterion for inclusion within the Project is that the village lies within five km of a protected area or reserve forest.

- **Ecotourism destinations** include natural (and cultural) sites of interest within or in close proximity to protected areas and reserve forests (i.e. located within TNFD land).

In order to maximise impact of the Project on conserving and enhancing biodiversity, it is important to ensure the following:

- Interventions are focused on a smaller rather than larger number of geographically discrete regions;

- Engagement of as many forest-dependent communities as possible within each of these regions in participatory micro-planning and other processes in order to develop more ecologically and socio-economically sustainable livelihoods;

- Opportunities for community-based ecotourism and TCPL within these regions should be maximised to enhance the synergy generated by Project interventions.

A review of ten readily available management plans for sites that were earmarked for inclusion in the Project shows that the key threats to biodiversity documented for many existing PAs are livestock grazing, fire, invasive species, and firewood collection. Encroachment, poaching and timber removal are issues in a smaller number of PAs. Human-wildlife conflict is also a common management issue. Training in wildlife management is identified to be a common priority needed in almost every PA (**Table 6.1**).

A total of 63 tribal villages that have been identified within the vicinity of protected areas and reserved forests in these ten districts. Further 25 sites with ecotourism potential will be supported by the Project to help these communities reduce their dependency on forest resources and/or develop more sustainable livelihoods.

**Table 6.2** indicates divisions concerning the component. **Table 6.3** shows the target areas of the proposed biodiversity conservation component. **Tables 6.4** and **6.5** provides the list of 63 tribal

villages.

### 6.2.2 Increasing the Natural Resource Base

This component focuses on increasing the natural resource base on private lands through tree cultivation. The component has two main sub-components, as follows:

1) Tree Cultivation on Private Land (TCPL), and
2) Research on Production Forestry, Agro-forestry and Farm Forestry.

The proposed TCPL programme is based on the experience and learnings gained from previous farm forestry programmes, in general and the state-funded TCPL implemented in 2007-08, in particular. Many features of the state-funded TCPL programme have been adopted for the proposed TCPL sub-component. These include the following:

1. Focus on small and marginal farmers,
2. Planting seedling by the Forest Department, and
3. Incentive of Rs. 2,500 per hectare.

Changes are proposed in certain aspects with respect to the proposed TCPL in order to strengthen the programme to achieve the objectives of the sub-component more effectively. The areas in which changes are proposed include the following:

a) Process and method of selecting TCPL villages,
b) TCPL planning and implementation process,
c) Criteria for selection of farmer and land for TCPL,
d) Plantation model design (to suit the needs of small & marginal farmers as well as semi-arid regions),
e) Incentive distribution system (staggered, criteria for eligibility), and
f) Monitoring and evaluation system.

TCPL is proposed to be implemented in about 5,000 villages spread over 32[2] districts in the state. The extent of district-wise coverage would vary according to availability of fallow land in each district. The villages would be selected based on multiple criteria such as availability of fallow land, interest of farmers, etc. as described in Section 7.4.1.

## 6.3 Project Management Structure

It is recommended to have a project management unit (PMU), which will be autonomous at the state level based on findings of the review of TAP I & II as shown below:

1) Slow Fund Flow

Fund flow at the beginning of the financial year is relatively slow as every fund disbursement needs to be routed through the government after the issuance of administration sanction. This delay affects the timely and adequate funds delivery to project implementations. To cope with this constraint, a special proposal is submitted to the Finance Department in order for TNFD to obtain Letter of Credits (LOC) from the said department before the administration sanction. However, this does not always work. The

[2] Given the lack of availability of fallow land in certain districts such as Chennai, it is likely that the TCPL programme is limited to only 30 or 31 districts.

proposal was not sanctioned in 2010. In addition to that, issuing LOC for the special proposal took more than four months after the request was sent from the PCCF office.

2) Human Resources

TNFD is constantly facing difficulty in human resource management, especially in terms of new recruitment. TNFD is often unable to fill vacant posts due to government restrictions; e.g. GIS specialist has been unfilled for more than ten years after its sanction. The department is also facing aging of staff, which is a serious problem. Regular direct recruitment of foresters in the department has not been conducted since 2000. Plot watchers and social forestry workers that were appointed temporarily during the Social Forestry Project is a huge burden for TNFD as these workers have to be given priority for promotion to be regular watchers or mails as per the government order.

The PMU could govern itself with its own by-laws and internal policies that are impartial to existing departmental administration rules and regulations. Although the PMU is an autonomous society, field-level project execution will be done by existing units within TNFD (division and range offices and extension centres) in order to avoid any jurisdictional and work-charging conflicts. TNFD and the autonomous PMU will enter into an agreement to bestow the project management responsibilities to the PMU.

# CHAPTER 7 THE PROJECT

## 7.1 Project Objectives

Tamil Nadu Biodiversity Conservation and Greening Project aims to strengthen biodiversity conservation by improving ecosystem and the management capacity as well as undertaking tree planting outside the recorded forest areas, thereby contributing to environmental conservation and harmonized socio-economic development of Tamil Nadu.

## 7.2 Project Components

The project entails following three (3) components:

| Project Components and sub-components |
|---|
| **1. Biodiversity Conservation** |
| 1.1 Habitat restoration, enhancement and management |
| 1.2 Resource protection |
| 1.3 Mitigate human-wildlife conflict |
| 1.4 Ecologically sustainable development |
| **2. Increasing the Natural Resource Base** |
| 2.1 Tree cultivation on private land |
| 2.2 Research on production forestry / agro-forestry / farm forestry |
| **3. Support Activities** |
| 3.1 Capacity development |
| 3.2 Monitoring and evaluation |
| 3.3 Construction of buildings |
| 3.4 Augmentation of office facilities & equipment |
| 3.5 Strengthening mobility |
| 3.6 Project management |
| **4. Consulting Services** |

## 7.3 Biodiversity Conservation

### 7.3.1 Habitat Restoration, Enhancement and Management

#### (1) Approach

This sub-component is focused on restoring and enhancing biodiversity within the existing network of protected areas (PAs), elephant reserves and reserve forests (RFs) by strengthening scientific understanding, building the technical capacity of the TNFD through training and working in partnership with scientific and academic institutions (including universities) and, thereby, deliver more effective protection and management of ecosystems and habitats through a range of interventions initiated under the Project.

Interventions are focused on wetlands, which are the principal ecosystem represented in all of the state's 12 bird sanctuaries, controlling alien species that have invaded sholas and dry forests, and developing and implementing conservation plans for selected endemic species of plants and animals that are confirmed by further field surveys to be seriously in danger of becoming extinct in the wild.

Where appropriate, including all bird sanctuaries and a number of other protected areas, existing management plans will be strengthened through participatory processes that address the key issues identified for biodiversity and those communities living in the vicinity.

A further major intervention will be to design and initiate a programme for long-term monitoring of the impacts of climate change on biodiversity in different habitat types, representative of the full range of climatic and topographical prevailing within the State. Monitoring sites will need to be located within the least disturbed (core) parts of protected areas, given the long-term (30+ years) nature of this initiative which might otherwise be jeopardized by changes in land use. Long-term monitoring will inform future management of biodiversity for conservation and sustainable use, while also providing valuable baseline data on biodiversity inventoried within these key, least disturbed sites. It will also enable priorities to be identified with respect to the future management and possible extension of the existing protected areas network in order to mitigate against some of the adverse impacts of climate change on biodiversity.

**(2) Rationale**

The Western Ghats, together with Sri Lanka, is one of the world's 34 biodiversity hotspots. The defined regions where 75% of the planet's most threatened mammals, birds and amphibians survive within habitat covering just 2.3% of the Earth's surface[1]. By definition, this means that the Western Ghats/Sri Lanka hotspot holds at least 1,500 species of vascular plants (> 0.5 percent of the world's total) as endemics; and that it has lost at least 70% of its original habitat due to the impact of human activities. Such is the importance of the Western Ghats that a set of seven clusters of national parks, sanctuaries reserved forests and other areas, stretching from Maharastra to Tamil Nadu and comprising 39 representative sites, has been nominated very recently (2010) by the Government of India for inclusion in the World Heritage List. This serial nomination is considered to be of *outstanding universal value*[2] with respect to: representing major stages of earth's history (Criterion viii of the Operational Guidelines); and containing among the most important and significant natural habitats for in-situ conservation of biological diversity (Criterion x)[3].

India, as a signatory to the Convention on Biological Diversity[4], is obliged to essentially identify and monitor the components of biological diversity for its conservation and sustainable use. This obligation requires extensive field surveys to perform an inventory of species and the ecosystems of which they are a part, providing a benchmark, or record in time and space, against which future changes can be measured. Such surveys and repeat surveys provide the means of monitoring changes in biological diversity, assessing its conservation status and informing its management.

The Project provides a major opportunity to improve information and access to the knowledge on the diversity, distribution and conservation status of plant and animal species within Tamil Nadu's existing protected areas and reserve forests, with special focus on the Western Ghats. This can be achieved through a variety of initiatives that will include the collation of spatial data from previous and ongoing surveys of flora and fauna, research and monitoring surveys undertaken by the Project for a variety of different purposes and, notably, the establishment of a long-term programme to monitor climate change and other impacts on biodiversity. The data will be managed in a centralised spatial database and the knowledge gained from these interventions will inform and strengthen the

[1] Mittermeier, R.A., Robles Gil, P., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J., and da Fonseca, G.A.B. 2004. Hotspots Revisited. Mexico: CEMEX

[2] Outstanding universal value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole. The Committee defines the criteria for the inscription of properties on the World Heritage List. (Operational Guidelines for the Implementation of the World Heritage Convention, World Heritage Centre, 2008)

[3] The nomination is currently being evaluated by IUCN, an Advisory Body to the World Heritage Committee, prior to being considered for listing at the Committee's next meeting in July 2011.

[4] India ratified the Convention on Biological Diversity in 1994.

future management and expansion of the State's protected areas network, particularly in response to climate change and other environmental impacts.

**(3) Strategies**

### *1.1.1 Strengthen Wetland Planning and Management*

There are 12 Bird Sanctuaries within the State, of which all but Pulicat Lake (154 $km^2$) comprise small water bodies ranging in size from less than 30 ha to 593 ha. They are located within the eastern arable parts of the State and attract large numbers of birds during the winter migratory season. Over the years there have been changes in water quality, fish composition (at least partly in response to the introduction of exotic species) and, at some sites, the trees have died due to the accumulation of phosphates from bird droppings. These water bodies are managed by the PWD for irrigation purposes and the nutrient-enriched water is beneficial for agriculture to the extent that villagers do not need to apply fertilizers to their crops. While all/most of the Bird Sanctuaries have management plans, these require strengthening. Currently, they focus on the development of infrastructure and facilities for visitors and lack clear management objectives based on an understanding of wetland ecology and the identification of conservation priorities. Existing plans also highlight the need for training of staff in wildlife and natural resources management (**Table 7.1**).

The Project will strengthen and develop the Forest Department's technical capacity in wetland management, using participatory processes that enable key stakeholders (e.g. PWD and village communities) to express their aspirations, engage in the formulation of plans and contribute to their implementation. It is proposed that a renowned wetland institution will be commissioned to run tailor-made training courses for the Department's wetland managers, including the hands-on design and implementation of a participatory process and development of a wetland action plan to strengthen the management of each site. This will be followed up by a five-year technical assistance and mentoring period during which managers will be supported in the development and implementation of action plans for their respective wetlands, which will be subject to approval by the Chief Wildlife Warden. Monitoring of appropriate indicators of water quality and biodiversity will be an integral part of this training. Managers will also receive basic training in routine checking for outbreaks of avian flu and any other diseases transmitted by birds.

Implementation of the wetland action plans will provide a means of monitoring the effectiveness of this intervention since these plans will be based on clear objectives in the strengthened management plans that address such issues as water quality, aquatic vegetation, fish diversity and abundance, avian diversity and irrigation requirements for the local communities.

**Target Area**

11 bird sanctuaries, Point Calimere WLS, and Tirupudaimaruthur CR (training only)
(*Note: Pulicat Lake BS is excluded because it is being funded separately under a World Bank Project, but provision is made to include its staff in the training programme.*) - See **Table 6.3**

**Action 1 Training in wetland management, planning and implementation**

| | |
|---|---|
| 1.1.1.1 | Procure contractors/partners |
| 1.1.1.2 | Training on Wetland Management (TNFD staff) |
| 1.1.1.3 | Wetland Participatory Management Planning |
| 1.1.1.4 | Implement Wetland Action Plans |
| | a) Enhance aquatic habitats and aquatic species diversity/composition |
| | b) Enhance peripheral and nearby terrestrial habitats for birds |

***Implementation***

- Outsource training and participatory management planning to a national institution that will work in partnership with TNFD over the long-term, ideally beyond the duration of the Project.
- The Consultant's inputs will be phased over the initial 24 months and comprise training on wetland management, combined with on-site participatory management planning that will culminate in a series of five-year wetland action plans agreed by the principal stakeholders (TNFD, PWD and local communities, in most cases). Thereafter, the Consultant will provide technical support throughout the implementation of these action plans in order to consolidate on the initial training and management planning.
- Training should cover 3 field personnel (FD and, where possible and appropriate, PWD to establish a collaborative approach to management) from each of the 14 target sites (Pulicat BS is included for training purposes only). It should be phased and conducted during the appropriate seasons with respect to water levels and bird migration.
- The focus of training should be on hydrology (including water management during years of drought) and the maintenance of aquatic plant and fish communities for avian diversity. It should also take into account the ecological requirements of important endemic freshwater fish species, especially those that might be nationally threatened. Training should include participatory management planning and address the management of natural resources considering multi-stakeholder interests (e.g. local communities and PWD).
- Participatory management planning should be carried out as part of the training programme and phased over the first year, culminating in the production of an action plan for each site. Where appropriate, management planning should be integrated with micro-planning in any neighbouring villages, particularly with respect to ecotourism and TCPL opportunities.
- Habitat enhancement opportunities may include, where appropriate, the introduction of water lilies, lotus and other native species, such as *Trapa*, *Neptunia*, Indian fern and *Oryza rufipogon*, etc.

**Action 2 Survey and monitoring**

| | |
|---|---|
| 1.1.1.5 | Monitor water flows, water quality and aquatic vegetation |
| 1.1.1.6 | Monitor fish and bird diversity and abundance |
| 1.1.1.7 | Routinely survey birds for contagious diseases (e.g. bird flu) |

***Implementation***

- Monitor water levels monthly in the tank/lake/reservoir, and maintain register.
- Maintain data on water quality by testing samples on a monthly basis (standard procedures are available and labs are operational throughout the state).
- Establish specific points within PA to document the density, species composition of aquatic vegetation, including patches of invasive species such as water hyacinth, Ipomoea carnea, Pistia, Salvinia etc.
- Conduct fish sampling quarterly using nets and traps; list species and their abundance; and maintain samples in alcohol/formaldehyde for future reference.
- Create infrastructure in a section of the 13 PAs (including refrigerator, cold packs) for storage/transport of samples of dead birds and fish as a means of observing outbreak of contagious diseases/poisoning.

**Action 3 Documentation, interpretation and information sharing**

| | |
|---|---|
| 1.1.1.8 | Interpret and display research findings in multi-media for the benefit of visitors (Tamil, Hindi, English) |
| 1.1.1.9 | Enter georeferenced data in biodiversity database/GIS |

***Implementation***

- Enhance existing visitor/interpretation centres with new interpretative materials and handouts, posters, booklets, pamphlets on biodiversity of BS.
- Establish information kiosk in each centre, providing computer-based interactive learning facility for visitors and internet facility for local community members.
- Provide live video images of wildlife at the BS, using a big screen linked to video camera trained on individual animals (birds) to observe their behaviour close up (young, courtship, feeding etc). (Note: This will provide large numbers of visitors (e.g. school groups) with simultaneous access to close-up views of birds, improving on existing spotting scope facilities.) Where possible with respect to transmission opportunities, such live images will also be made accessible via the internet for educational purposes and to raise the profile of these BSs.
- Geo-referenced database will be managed centrally at the GIS Unit in Chennai.

### *1.1.2 Improve critical habitats (terrestrial and aquatic) by removing invasive and alien species*

In order to address the control and management of invasive, alien species of plants in an objective and informed manner, using best practices gained from experience elsewhere in the state and from further afield, an invasive species expert will work with TNFD officers to develop a strategy based on field visits to sites earmarked for the removal of such exotics. It may also be appropriate to establish an advisory group of experts to review the strategy and provide guidance on its implementation.

Some of the experience in Tamil Nadu is summarised in the Proceedings of the Seminar on Invasive Alien Species, organized by the State's ENVIS Centre (C.Thompson Jacob *et al*., 2009). Other relevant sources of expertise and best practice include the IUCN SSC Invasive Species Specialist Group (ISSG), comprising some 200 members from over 40 countries, and the Global Invasive Species Programme, supported by four partners (CAB International, IUCN, South African National Biodiversity Institute and The Nature Conservancy). The ISSG promotes and facilitates the exchange of invasive species information and knowledge across the globe and facilitates the linkage between knowledge, practice and policy so that decision-making is informed. Its three core activity areas are policy and technical advice, information exchange and networking.

In the case of shola forests, there is a consensus that large-scale clearance of wattle can be achieved readily by employing local labour. It is anticipated that pioneer species, notably fern (bracken) and Strobilanthus sp., will initially proliferate and subsequently be succeeded naturally by tree species. There are few studies concerning the removal of *Prosopis* and *Lantana* from dry forests, both with respect to impacts on biodiversity and the most cost effective method (e.g. clearing or shading out by nurturing trees). Thus, it is recommended that options be reviewed, decided and, if appropriate, experimented on a site-by-site basis. Biodiversity baseline surveys of flora and fauna diversity should be undertaken prior to the large-scale removal of alien species and subsequently monitored.

Recent experience in other parts of India suggests that *Lantana* can be successfully eradicated without the use of chemicals by a combination of (i) initial removal by cutting the rootstock, (ii) weeding of saplings from beneath tree perches used by generalist birds that disperse the seeds and from surface drainage channels originating from the removal area, and (iii) ecological restoration of weed-free landscapes, preferably to the grassland or forest to prevent reinvasion of the same species or

secondary invasion by other alien species[5]. The cost of *Lantana* removal and the restoration of weed-free landscapes is about Rs 9,000 per hectare. This method will also be piloted.

Provision is also made for removal of aquatic invasive species, notably water hyacinth, where appropriate. Such species may be a management issue in some of the wetlands included within the scope of this Project. Protocols established for managing invasive species will be documented in a handbook and the results of the biodiversity baseline and monitoring studies should be reported annually.

**Target Area**

15 sites: 5 PAs and 10 Divisions in Elephant Reserves - See **Table 6.3**

**Action 1 Training and field review of alien species management**

| | |
|---|---|
| 1.1.2.1 | Procure contractors/partners |
| 1.1.2.2 | Training on management of alien species, with field review of species to be removed (TNFD staff) |
| 1.1.2.4 | Strategy and manual on management of invasive alien species (Tamil and English) |

***Implementation***

- Outsource training activities to alien species management experts, who will facilitate workshops and field visits to candidate sites, to review conditions and methods for the removal of alien species.
- If considered appropriate, in order to distill knowledge and best practices from a wider range of experience, establish an advisory group to review the strategy and manual on managing invasive alien species, and guide the implementation of the strategy.
- Training sessions to include field personnel of Guindy NP, Mukurti NP, Vallanadu Blackbuck Sanctuary, Point Calimere WLS and all Elephant Reserve Divisions (excluding those that overlap with Tiger Reserves).
- Manual should focus on science (theory) and best practice, including: list of potentially invasive species globally recognized and present in India and Tamil Nadu; illustrations of potential and known invasive species in the State; scientific knowledge on impacts and successful models of control, eradication and management; design of field study and data management; and useful indicator species/surrogate taxa for monitoring change.
- The manual should also provide guidance on survey methods and a framework for monitoring the spread of invasive species and their impacts on biodiversity before and after removal.
- The manual should be bilingual (English and Tamil)

**Action 2 Survey, monitoring and reporting**

| | |
|---|---|
| 1.1.2.3 | Baseline survey of biodiversity in critical habitats prior to removal of alien species |
| 1.1.2.6 | Monitor biodiversity in critical habitats after removal of invasive species |
| 1.1.2.5 | Monitor impact of fencing and removal of exotics from shola / grassland habitats |
| 1.1.2.7 | Enter georeferenced data in biodiversity database/GIS |

[5] Amit Love, Suresh Babu and C. R. Babu, 2009. Management of *Lantana*, an invasive alien weed, in forest ecosystems of India. *Current Science* 97: 1421-1429.

***Implementation***

- Baseline surveys and monitoring to be outsourced, with the involvement of trained forest personnel in carrying out surveys.
- Monitoring should initially be done annually for five years, within the scope of the Project. Subsequently, as appropriate, it may be continued by the Department at two-, three-, and five- year intervals in a sample of plots, thereby extending beyond the life of the Project (total of 15 years monitoring).
- Guidance and the monitoring framework provided in the manual should be followed.
- Biodiversity selected for monitoring should focus on regeneration of native plants and diversity of butterflies, birds, amphibians, reptiles and mammals.
- Geo-referenced field data will be managed centrally at the GIS Unit in Chennai.
- Results of baseline survey and monitoring will be reported annually.

**Action 3 Removal of invasive species**

| | |
|---|---|
| 1.1.2.5 | Remove invasive species after field assessment and biodiversity baseline survey |
| | a) Phased removal of Lantana, Prosopis from dry forest |
| | b) Phased removal of wattle from shola ecosystem in the hills |

***Implementation***

- Trial removal of Lantana, Prosopis and wattle to include uprooting, turning the soil and immediate replanting with grasses and shrubs, as appropriate. Recent experience in eradication of Lantana should also be utilized (Love *et al*., 2009).
- Removal will be phased for monitoring and review of potential impacts.
- Where appropriate, enhance water holding capacity of waterholes and other waterbodies inside PAs and Elephant Reserves by removing water hyacinth and Ipomea carnea.
- Construct waterholes, as appropriate, in locations within Elephant Reserve ranges where Lantana/Prosopis is a menace, after clearing such areas.
- Employ community members in works to enhance their incomes.
- Quantitative records of areas cleared (using GPS), time (person-hours) and cost spent in the removal will be maintained by the contracting authority. Such data will be subject to cost-benefit analysis and results reported annually to inform future interventions.

### *1.1.3 Conserve critically endangered/endangered species of flora and fauna*

A large number of studies have been undertaken on threatened plants and animals, much of which informs the allocation of categories of threat to species based on IUCN criteria. It will be necessary to prioritise selected CR (Critically Endangered) and EN (Endangered) species for the development of conservation action plans, of which there are 35 angiosperm species strictly endemic to Tamil Nadu (listed in table below) and around 30-40 species of endangered and endemic vertebrate animals.[6] In the case of some Data Deficient (DD) species that are thought to be candidates for CR or EN status, more extensive field surveys should be undertaken under the auspices of the Project. Most important will be the collation of species distribution and abundance data from the many research studies and, where appropriate, their incorporation within the GIS managed by the Forest Department. It is quite

[6] Includes 11 fish,and 15 reptile species, the rest being amphibians. No endangered species of birds or mammals is known to be strictly endemic to Tamil Nadu.

likely that other institutions within the State, India and overseas will have similar repositories of data and, therefore, it will be appropriate to develop partnerships and data sharing protocols, subject to the provisions of the Biological Diversity Act 2002.

*Ex situ* conservation may be necessary for certain Critically Endangered plant and animal species. In the case of plants, the Forest Department has proposed using the gene-pool garden at Nadugani. The Survey Team was unable to visit this facility so the feasibility of this proposed intervention may require further consideration.

**List of 35 EN Species of Angiosperm that are Strictly Endemic to Tamil Nadu**

| Family | Species (Binominal) | Habitat | Distribution |
|---|---|---|---|
| Acanthaceae | *Santapaua madurensis* | Herb | Madurai |
| Acanthaceae | *Stenosiphonium wightii* | Shrub | Tirunelveli |
| Asclepiadaceae | *Caralluma nilagiriana* | Herb | Nilgiri |
| Asclepiadaceae | *Marsdenia tirunelvelica* | Twining Undershrub | Tirunelveli |
| Asclepiadaceae | *Toxocarpus beddomei* | Climber | Tirunelveli |
| Gesneriaceae | *Didymocarpus missionis* | Herb | Kanniyakumari |
| Gesneriaceae | *Didymocarpus ovalifolia* | Herb | Kanniyakumari, Tirunelveli |
| Labiatae | *Pogostemon nilagiricus* | Herb | Nilgiri |
| Melastomataceae | *Memecylon flavescens* | Large shrub | Nilgiri |
| Melastomataceae | *Memecylon sisparense* | Large shrub | Coimbatore, Nilgiri |
| Melastomataceae | *Sonerila pulneyensis* | Herb | Madurai |
| Orchidaceae | *Bulbophyllum albidum* | Pseudobulbs | Nilgiri and Tirunelveli |
| Orchidaceae | *Bulbophyllum nodosum* | Epiphyte | Nilgiri |
| Orchidaceae | *Bulbophyllum proudlockii* | Herb | Nilgiri |
| Orchidaceae | *Habenaria elwesii* | Herb | Nilgiri |
| Orchidaceae | *Vanda wightii* | Epiphyte | Nilgiri |
| Piperaceae | *Piper barberi* | Climber | Kanniyakumari, Tirunelveli |
| Poaceae | *Agrostis schmidii* | Grass | Nilgiri |
| Poaceae | *Eragrostis rottleri* | Grass | Thanjavur |
| Poaceae | *Eriochrysis rangacharii* | Grass | Nilgiri |
| Poaceae | *Isachne oreades* | Grass | Nilgiri |
| Poaceae | *Ochlandra scriptoria* var. *sivagiriana* | Grass | Madurai |
| Rubiaceae | *Hedyotis barberi* | Shrub | Tirunelvel |
| Rubiaceae | *Hedyotis gamblei* | Shrub | Kanniyakumari, Tirunelveli |
| Rubiaceae | *Hedyotis sisparensis* | Undershrub | Nilgiri |
| Rubiaceae | *Hedyotis villosostipulata* | Shrub | Kanniyakumari |
| Rubiaceae | *Ixora monticola* | Shrub | Madurai |
| Rubiaceae | *Ixora saulierei* | Tree | Madurai |
| Rubiaceae | *Knoxia sumatrensis* var. *linearis* | Herb | Tirunelveli |
| Rubiaceae | *Neanotis monosperma* var. *tirunelvelica* | Herb | Tirunelveli |
| Rubiaceae | *Ophiorrhiza incarnata* | Undershrub | Nilgiri |
| Rubiaceae | *Ophiorrhiza pykarensis* | Undershrub | Nilgiri |
| Rubiaceae | *Pavetta oblanceolata* | Shrub | Tirunelveli |
| Rubiaceae | *Psychotria globicephala* | Shrub | Tirunelveli |
| Symplocaceae | *Symplocos monantha* | Shrub | Tirunelveli |

Source: ENVIS, Dept. of Environment, Govt. of Tamil Nadu [http://tnenvis.nic.in/PDF/endemic%20plants/table-5.pdf]

## Target Area

7 PAs, 10 Divisions in elephant reserves, 8 districts in east coast (dugong and sea turtles), Nadugani and other sites to be identified during review of EN/CR species - See **Table 6.3**

**Action 1 Develop species conservation plans**

| | |
|---|---|
| 1.1.3.1 | Procure contractors/partners |
| 1.1.3.3 | Develop species conservation plans (Tamil, English) |
| | a) Develop species conservation plans for dugong in Palk Bay (5 years) |
| | b) Develop species conservation plants for sea turtles in 8 coastal divisions/districts (5 years) |
| | c) Develop species conservation plans for plants/other animals |

***Implementation***

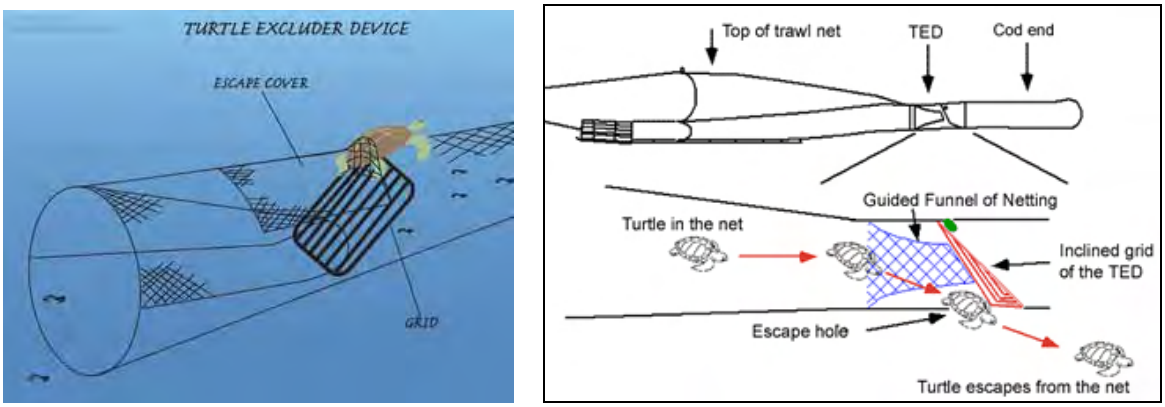
- Outsource the preparation of species conservation plans.
- Develop list of EN/CR/DD plants and animals, and prioritise those for species conservation plans, including DD species potentially EN/CR but requiring further field surveys.
- Include provisions to establish ex-situ hatchery for sea turtles in Chennai, Kancheepuram, Cuddalore, Nagapattinam, Ramanathapuram, Thoothukudi and Kanyakumari districts.
- Conservation plan for dugong will include training and capacity building on underwater surveys and habitat assessment (for TNFD Staff at Gulf of Mannar/Palk Bay).

**Action 2 Implement species conservation plans**

| | |
|---|---|
| 1.1.3.4 | Implement conservation plans, including ex-situ measures as appropriate |
| | a) Implement conservation plans (dugong) including ex-situ measures as appropriate (5 years) |
| | b) Implement conservation plants (sea turtles) including ex-situ measures as appropriate (5 years) |
| | c) Implement species conservation plans for plants/other animals, including ex situ measures for priority CR plants in Nadugani gene-pool garden |
| 1.1.3.5 | Immunise livestock in periphery of all PAs to prevent transmission of diseases to wildlife |

***Implementation***

- Establish sea turtle hatcheries in coastal districts, beginning with an initial pilot in one district.
- Provide coastal fishermen with turtle excluder devices (allows captured turtle to escape from shrimp trawling nets, as illustrated below), and train them on how to use such devices; 500 devices recommended.
- Outsource annual marine biodiversity conservation education and training workshops for school children in seven coastal districts.
- Conserve *ex situ* Critically Endangered trees at Nadugani, including provisions for nature interpretation centre.
- Organise cattle immunization camps at strategic locations in collaboration with the Animal Husbandry Department, and immunize cattle on an annual basis around selected Pas and Divisions of Elephant Reserves (i.e. excluding Tiger Reserves which their have own provisions).




**Turtle excluder device**

**Action 3 Survey, monitoring and documentation**

| | |
|---|---|
| 1.1.3.2 | Undertake status and distribution surveys of selected CR/EN/DD taxa in the wild |
| 1.1.3.6 | Create GIS database of threatened and endemic flora and fauna based on past and present research |

***Implementation***

- Outsource collation of published/unpublished data on endemic and threatened flora and fauna, and the establishment of a spatial database to be managed centrally by the GIS Unit, Chennai..
- Outsource field surveys of CR/EN and DD species for which additional status/distribution data are a conservation priority.
- Conduct overseas training to TNFD staff in all coastal divisions to carry out underwater surveys of species and habitats, especially dugong.
- Conduct local training to TNFD staff from coastal divisions on the conservation and management of sea turtles and turtle nesting habitat
- Update information base by conducting annual seminars/workshops on the Status of Endangered Species in Tamil Nadu; one workshop a year at one of the five regional extension centres.

### *1.1.4 Improve management of water, habitat and herbivores in Guindy National Park*

Guindy is a small (2.8 $km^2$) national park that lies in Chennai, providing an important 'green lung' and conservation education opportunity for the city's residents and visitors. It is most valuable, in biodiversity terms, for its Tropical Dry Evergreen Forest, which is limited elsewhere within the State to scattered coastal patches and Point Calimere WLS. It also has dense populations of spotted deer and the Near Threatened blackbuck, which are a main attraction for visitors.

Key management issues are as follows:

- The forest is being invaded by *Prosopis* sp.
- The herbivore populations have probably exceeded their carrying capacity (predators are absent, except for an occasional jackal), encouraged by winter feeding when the grasslands are dry and overgrazed.
- Water is in short supply during the dry and winter seasons. However, during the monsoon season, the National Park is sometimes inundated, making it necessary to break through

the boundary wall to release flood waters. Water is required not only for the wildlife but also to supply the children's zoo and park, and staff quarters.

Hydrological surveys need to be undertaken to inform the development of a Water Management Strategy and Action Plan, which in turn will provide the basis for strengthening the existing management plan, from which clear objectives and interventions (e.g. removal of exotics, increased storage capacity of water, management of herbivore populations) will need to be defined to address the sometimes competing demands.

**Target Area**

Guindy National Park: water resources and native habitats - See **Table 6.3**

**Action 1 Training on water resource management, planning and implementation**

| | |
|---|---|
| 1.1.4.1 | Procure contractors/partners (NGO/consultant/university & civil work contractor) |
| 1.1.4.2 | Assess water resources and develop Water Management Strategy and Action Plan to address biodiversity and supplementary supply needs |
| 1.1.4.4 | Strengthen Management Plan by adopting Water Management Strategy and Action Plan |
| 1.1.4.6 | Water storage and distribution interventions (including underground storage and invasive removal) |
| | a) Create permanent waterholes |
| | b) Improve water storage and supply |

***Implementation***

- Outsource water resources assessment and Water Management Strategy and Action Plan, working in close collaboration with Hydrology Department, Ground Water Board and/or Tamil Nadu Water Supply and Drainage Board (TWAD). Strategy and Action Plan are subject to approval by the Chief Wildlife Warden.
- Implement water storage and distribution interventions, having first taken into account habitat and herbivore requirements based on habitat assessment (see Action 2).
- Topographical interventions to increase water holding capacity must, at the same time, avoid water-logging during rains, in accordance with provisions in the Water Management Strategy.

**Action 2 Habitat management and enhancement**

| | |
|---|---|
| 1.1.4.1 | Procure contractors/partners (NGO/Consultant/University & civil work contractor) |
| 1.1.4.3 | Assess capacity of present vegetation to support current herbivore population |
| 1.1.4.4 | Strengthen management plan |
| 1.1.4.5 | Remove invasive species to retain integrity of vegetation and provide grazing for herbivores |

***Implementation***

- Warden or senior research officer to receive training overseas in habitat management in relation to herbivore populations (e.g. The Macaulay Land use Research Institute, Scotland with its extensive research experience in ungulate ecology and grazing management).
- Develop habitat-cum-herbivore management plan to sustain native vegetation at capacity, while providing a clear strategy for management of blackbuck and spotted deer populations in the absence of natural predators.

- Removal of invasive species to be based on guidance and best practice developed under Activity 1.1.2.

### *1.1.5 Improve management of water, habitat and herbivores in Vallanadu Blacbuck Sanctuary*

Vallanadu is a relatively small (16.4 $km^2$) sanctuary. It was established specifically to protect blackbuck, a species native to the Indian subcontinent, but now remaining only in India due to pressures from hunting, habitat destruction and grazing competition with livestock. Its estimated population size is approximately 50,000 and the species is currently listed by IUCN (2003) as 'near threatened'. The species now exists only in four other locations in Tamil Nadu: Guindy National Park, Mudumalai Sanctuary and Point Calimere Sanctuary and at Sujjalkuttai in Sathyamangalam Sanctuary.

Vallanadu is located on a small hillock in the South Deccan Plateau. The typical vegetation type is southern thorn scrub, with many xerophytic species. Some 20-40 blackbucks reside in the sanctuary, this being the southernmost extent of the species present range.

The key management issues, highlighted to some extent in the management plan (**Table 6.1**), are:

- Much of the grazing land has been colonised by Prosopis, to the extent that blackbuck move into adjacent cultivated land in search of fodder.
- According to the management plan, some 4,293 cattle (including 100-200 feral cattle), 3,702 goats and 3,994 sheep frequent the sanctuary.
- Water bodies are seasonal.

**Target Area**

Vellanadu Blackbuck Sanctuary: water resources and invasive species in relation to conservation of blackbuck - See **Table 6.3**

**Action 1 Enhance water resources and grazing to sustain blackbuck population**

| | |
|---|---|
| 1.1.5.1 | Procure of contractor |
| 1.1.5.2 | Develop Water Management Strategy and Action Plan and strengthen management plan |
| 1.1.5.3 | Improve water retention capacity within seasonal water bodies |
| | a) Create permanent waterholes |
| | b) Improve water storage & supply |
| 1.1.5.4 | Increase grasslands for blackbuck by removing previously introduced woody scrub |

***Implementation***

- Outsource development of Water Management Strategy and Action Plan (e.g. SACON - Salim Ali Centre for Ornithology and Natural History, Coimbatore).
- Implement Water Management Action Plan. Measures to include installation of small check dams (up to 10) along gullies to enhance storage of runoff.
- Improve grazing for blackbuck by removing previously introduced scrub, based on guidance and best practice developed under Activity 1.1.2. Measures may include:
  - Clearance of two patches of 10 ha each, allowing grass and scrub to colonize. Monitor the impact and, if successful, add another two patches of 10 ha each after three years.

- Supplement grass cover with preferred species (e.g. millets - Cumbu, Ragi) to encourage blackbuck to remain within Sanctuary rather than wander into adjacent private lands in search of fodder.

- Experience in blackbuck management in other parts of India, especially in male territories and habitat requirements, should be reviewed and incorporated within the various interventions as appropriate.
- Field staff to be trained to estimate age and population size of blackbuck.
- The above measures should be integrated with the existing management plan, enhancing the conservation of the blackbuck as the flagship species.

**NB** The huge numbers of livestock in the sanctuary needs to be addressed by the authorities as a matter of priority. Otherwise, the above measures will not unreservedly benefit the blackbuck. A clear plan of action should be developed and implemented at the same time as the above.

### *1.1.6 Improve management of water in other PAs and RFs*

Water is considered by managers to be a limiting fact during the dry season for wildlife in many PAs and other sites, although it is not specifically highlighted as an issue in any of the five wildlife sanctuary management plans made available to and reviewed by the survey team during this preparatory survey. Often, shortage of water for wildlife reflects degradation of the habitat in recent decades due to anthropogenic factors such as reduced canopy cover from timber removal, loss of understory and forest litter from livestock grazing and repeated forest fires, and interventions for irrigation and public water supplies resulting in reduced flows in rivers and loss of perennial streams. Thus, in the first instance, priority should be given to habitat protection and restoration measures to enhance natural processes and functioning of ecosystems as this approach is far more sustainable over the longer term.

The second point is that assumptions are already made with regard to wildlife requirements for water, with little or no tangible evidence. Large mammals are adept at finding water. Thus, this leads to speculation in the absence of significant numbers of emaciated carcasses during periods of drought.

In light of the above comments, it is important to invest in water-harvesting structures wisely as such interventions are costly. Moreover, funds may otherwise be used more effectively to device protection measures for addressing underlying causes of water shortage. Thus, one or more of the following criteria should be met when investing in water-harvesting structures:

- There is evidence that former perennial streams cease flowing during the dry season.
- There is evidence that large mammals move outside the PA/RF during periods of drought.
- There is evidence of large mammals dying from dehydration during periods of drought.
- Creation of a water body in certain strategic locations is part of a strategy to contain animal movements and migrations (e.g. elephant, gaur) to PAs and wildlife corridors, thereby reducing potential levels of human-wildlife conflict.
- Creation of a water body enhances opportunities for viewing wildlife as part of an ecotourism strategy.

In the event of investing in water-harvesting structures, the following principles should apply:

- Water bodies for wildlife should not be created in the vicinity of settlements as this increases the likelihood of human-wildlife conflicts.

- Where possible, the tanks and waterholes should be constructed at locations that also provide opportunities for ecotourism (i.e. viewing wildlife).
- Eco-friendly practices should be adopted in the construction of water-harvesting structures, minimizing hard engineering solutions.

**Target Area**

16 sites: 6 PAs and 10 Divisions within elephant reserves. The total excludes Guindy National Park and Vellanadu Blackbuck Sanctuary which are covered under Activities 1.1.4 and 1.1.5 above. - See **Table 6.3**

**Action 1 Enhance water resources for wildlife**

| | |
|---|---|
| 1.1.6.1 | Procure contractors/partners |
| 1.1.6.2 | Develop Water Management Strategy and Action Plan |
| 1.1.6.3 | Improve water retention capacity within seasonal water bodies |
| | a) Create permanent waterholes |
| | b) Improve water storage and supply |
| 1.1.6.4 | Monitor biodiversity and socio-economic impacts of interventions |

***Implementation***

- Develop a Water Management Strategy and Action Plan for the PA/Elephant Reserve that is consistent with the existing management plan objectives. In the case of elephant reserves, such strategies should take into account elephant movements and existing corridors, for which it may be appropriate to hire knowledgeable experts in relation to the proposed development.
- Construct check dams/water holes at strategic points in Grizzled Giant Squirrel WLS (up to 5 structures), Megamalai WLS (≤ 3), Kanyakumari WLS (≤ 5), Point Calimere WLS (≤ 5), Satyamangalam WLS (≤ 5) and ≤ 3 in each of the ten elephant reserve divisions (up to 53 interventions in total).
- Water holes in elephant reserves may be constructed, as appropriate, at sites where invasive plants such as *Lantana/Prosopis* have been removed (see *1.1.2.5* for justification)
- Implementation of Water Management Strategy to be monitored, as appropriate, including availability of water throughout the year and its impacts on biodiversity (e.g. wild ungulate diversity and population sizes, diversity of other vertebrates including aquatic species) and local livelihoods (e.g. ecotourism development, human-wildlife conflict levels).

### *1.1.7 Monitor impacts of climate change on biodiversity*

As described in Section 7.1, India has an obligation to identify and monitor components of its biodiversity that are important for its conservation and sustainable use (Convention on Biological Diversity, Article 7). Climate change is having significant impacts on the status and distribution of habitats and their constituent flora and fauna. As much of the least disturbed habitats and their rare and threatened species remains in PAs and RFs, with little or no option for such biodiversity to spread beyond such refugia because surrounding lands are cultivated, mined/quarried, or built upon, some components of biodiversity are likely to become increasingly threatened by the changes in temperature and rainfall patterns. Long-term monitoring is necessary to detect such changes and inform future management and development of PA systems to mitigate and/or minimize potential impacts.

The Project provides an unrivalled timely opportunity to initiate a long-term monitoring programme for the state, considering the recent nomination of the Western Ghats for inclusion under the World Heritage Convention. Hopefully, such an initiative will be instrumental in encouraging other states sharing this global biodiversity hotspot to develop complementary long-term monitoring programmes so that the Western Ghats can be monitored in a systematic and holistic manner.

Criteria for the establishment of such a long-term monitoring programme include the following:

- Monitoring plots must be located in undisturbed or least disturbed sites to minimize the influence of other more direct anthropogenic factors (e.g. fire, livestock grazing etc, harvesting of timber and NWFPs) on biodiversity. By default, therefore, sites will be located necessarily in PAs and RFs.
- Plots should be located within large areas protected for biodiversity, ideally located within core areas surrounded by buffer zones.
- Sites should be representative of different ecosystems and vegetation types within the state, with a focus on the Western Ghats, given its global importance for biodiversity. They should also be representative of the east-west U-shaped rainfall gradient and the rather steep and linear east-west temperature gradient.
- Control plots, subject to anthropogenic disturbances, should also be monitored in each study site in order to compare these with undisturbed plots in terms of parameters other than climate change.

**Target Area**

6 PAs and 4 RF's: Point Calimere WLS, Pitchavaram, Kanyakumari WLS, Vallanadu Blackbuck Sanctuary, Grizzled Giant Squirrel WLS, Megamalai WLS and Mukurti NP, Pachamalai, Javadis, Harur - See **Table 6.3**

**Action 1 Establish long-term programme to monitor impacts of climate change on biodiversity**

| | |
|---|---|
| 1.1.7.1 | Procure contractors/partners |
| 1.1.7.2 | Identify vegetation types representing climatic/topographic gradients in Tamil Nadu |
| 1.1.7.3 | Undertake baseline surveys of biodiversity distribution and status in vegetation types |
| 1.1.7.4 | Manual on monitoring and analysis protocols (Tamil and English) |
| 1.1.7.5 | Undertake second surveys of biodiversity following 5-year interval |
| 1.1.7.6 | Enter georeferenced data in biodiversity database/GIS |
| 1.1.7.7 | Report on survey results (Tamil and English) |

***Implementation***

- This long-term research and monitoring programme requires the establishment of a formal partnership with a leading conservation biology research institution that can be sustained beyond the life of the Project. It may even be advantageous to establish a consortium of partners comprising several national and international research institutions, as appropriate. (The Smithsonian Institute, in partnership with the University of Peradeniya and Forest Department, for example, has been monitoring biodiversity plots in Sri Lankan tropical forests since the 1980s.)
- Establish a network of monitoring stations in five to six locations based on the criteria identified above and following a thorough reconnaissance of candidate locations.

- Develop an appropriate methodology for monitoring climate change impacts, based on experience gained and protocols established elsewhere internationally. This includes determination of optimum plot size, which is likely to be at least 50 ha.
- Initiate the method in Year 1 and, thereafter, prepare a field manual that describes the method in detail and analytical procedures to be used.
- Plots should be permanently marked unobtrusively and GPS coordinates taken in detail – at regular intervals (20-30 m) along the boundary of each plot.
- The baseline survey should be completed within three years and a second survey of each plot undertaken after five years, within the life of the Project.
- Primary data on species richness and abundance will be collected covering a wide range of taxonomic plant and animal groups, as dictated by readily available expertise, existing knowledge, ease of identifying and collection of specimens in the field and the sensitivity of a group to climate change impacts. Flowering plants, mosses, lichens, fungi, mollusks, butterflies, amphibians, reptiles and birds, for example, would be appropriate choices of species.
- All field records will be geo-referenced and stored in a biodiversity database maintained by the GIS Unit in Chennai.
- Data analysis and reporting should be undertaken at the end of the baseline and second surveys. Results should be disseminated widely and made available via the Project's website

### 7.3.2 Resource Protection

#### (1) Approach

Biodiversity that has been protected and managed throughout the state is the resource base for all future conservation and sustainable use. Protecting the resource base can be achieved in a number of ways, among which the following, developed for this Project, are of primary importance:

- Securing the boundaries of the existing PAs and RFs.
- Creating a buffer, where necessary, between wild animals and the people who live in close proximity to wildlife habitats.
- Reducing threats to plants, animals and their habitats from fire, livestock grazing and vegetation degradation.
- Managing invasive alien species so that they do not spread into newer and pristine habitats.
- Protecting humans and wild animals from the spread of contagious diseases.
- Strictly preserving some of the 'natural laboratories' for long-term research on biodiversity, climate change and other critical issues that confront the biosphere.

Resource protection requires well-trained and equipped field staff who are vigilant and strategic in their patrolling, backed up by good communications systems and additional support as required to deal with emergencies (e.g. fires, smugglers).

Such work is labour-intensive and authorities rarely have adequate budgets to maintain presence throughout PAs, particularly vast wildlife-rich areas such as Elephant Reserves. Working with village community members is an effective strategy for increasing patrolling on the ground, while also gaining access to intelligence in the case of illegal activities. Protection duties involve hard and, sometimes, dangerous work. Recognition of diligence, commitment and courage is an important part

of raising awareness and the profile of staff on the ground.

Interventions are focused on augmenting existing provisions for field staff in PAs and elephant reserves with anti-poaching squads and equipment, demarcating forest boundaries and providing incentives such as training awards for outstanding work.

**(2) Rationale**

As highlighted in Section 7.2.1 and exemplified in **Table 6.1**, natural resources in PAs (and RFs) are under huge pressure from local communities dependent on forest resources at varying extents, for their livelihood needs and, in some cases, from smugglers involved in illicit poaching and timber removal. Securing the resource through protection is paramount, not only for biodiversity conservation but also its sustainable use where provisions for certain types of resource use are legitimate and appropriate.

**(3) Strategies**

### *1.2.1 Strengthen resource protection*

**Target Area**

16 PAs: 6 sanctuaries and 10 Divisions within elephant reserves - See **Table 6.3**

**Action 1 Strengthening field protection staff**

| | |
|---|---|
| 1.2.1.1 | Solar-powered torches for night protection staff |
| 1.2.1.2 | Train village volunteers in resource protection skills |
| 1.2.1.3 | Augment TNFD protection units with anti-poaching squads (1 TNFD staff per squad of 4 villagers) |
| 1.2.1.4 | Annual training fellowships awarded to meritorious anti-poaching staff |
| 1.2.1.5 | Monitor incidences of fire, poaching and encroachment in PAs and RFs |
| 1.2.1.6 | Consolidation of forest boundaries by construction of RF Cairns |
| 1.2.1.7 | Enter georeferenced data in biodiversity database/GIS |

***Implementation***

- Train village volunteers and anti-poaching squads using TNFA, local institutions and NGOs, as appropriate. Establish anti-poaching squads in at least five PAs per year so that all are strengthened within three years.
- Identify one meritorious anti-poaching staff member per year from each of the 16 PAs and award a training fellowship of Rs 100,000 per individual[7]. Para-military type training in the use of field equipment and advanced communication systems and field craft such as rock climbing, mountaineering, boating, rescue and first aid may be covered under the fellowship. An age limit of 40 years is recommended.
- All field staff to be trained in use of equipment (e.g. GPS, compass etc.) and in recording biodiversity and related observations (fire, poaching incidences etc) for subsequent entry into georeferenced database system.
- Location of boundary markers should be geo-referenced using GPS and entered into the database system.

[7] As such awards would be applicable only for permanent Forest Department employees, other incentives will need to be identified for those employed on a daily wage basis.

- Information should be maintained both centrally at the GIS Unit in Chennai and be readily accessible within Forest Divisions via web-based system.
- Sign boards in Tamil and English to be erected at sites most vulnerable to fire.
- Data on areas most vulnerable to fire should be integrated with the control of Lantana camara invasion (see Action 1.1.2.5).

### 7.3.3 Mitigating Human-Wildlife Conflict

#### (1) Approach

Human-wildlife conflict varies in intensity and impact depending on the animals involved. In the Kalakad-Mundanthurai Tiger Reserve, for example, elephants, wild boar and other ungulates invade agricultural crops. Common langurs occasionally damage human property in the fringes, while leopards and sloth bears stray into villages. In general, the magnitude of the problem is higher in villages abutting PAs where there is a greater density of elephants. Probably, the most damage to crops is caused by elephants and wild boars, followed by deer. Meanwhile, the most frequent causes of loss of life and injury are probably due to elephants and snakes.

While the TNFD has adopted various mitigation measures to deal with the problem, e.g., solar-powered electric fencing, trenches, driving animals back, capturing and relocating stray wild animals, there has been a generally increasing trend in the number of casualties. Consequently, the amount of compensation has increased from Rs 8.594 million in 2006 to Rs 11.387 million in 2010, of which the TNFD has paid 50% of the total (**See table in Section 2.5.4**).

In the Eleventh Five-Year Plan (2007-2012) of the State, it is proposed to erect 360 kms of solar-powered electric fence at a cost of Rs 160,000/km. Investments in solar-powered electric fencing for the previous years varied. In 2006-07, 262.5 km were fenced at a cost of Rs 42.4 million. In 2007-08, 315.75 km were fenced at a cost of Rs 80.82 million. In 2008-09 an additional 331.25km were fenced at a cost of Rs 52.90 million and in 2009-10, 258 km were fenced at a cost of Rs 41.535 million. Satyamangalam (170 km) and Coimbatore (129.5 km) are the two forest divisions that have installed most fencing, followed by Tirunelveli (99 km), Hosur (94 km), Pollachi (87 km) and Kanyakumari (85 km). Full details are provided in **Table 2.1**.

This sub-component is focused on reducing human-wildlife conflicts, principally through enhancing provisions for elephant movements via corridors, and by protecting villages and cultivations from marauding animals by fencing.

#### (2) Rationale

Human-wildlife conflict is a major conservation, social and economic issue that tends to impact most of those living in rural areas at subsistence levels near the wildlife refugia. It is an inevitable consequence of increasing human populations and declining space for wildlife, particularly large mammals. However, this can be managed while risks of death and injury can been reduced to a minimum, damages to livestock and crops can be minimized and, when incurred, mitigated through compensation. It does require significant investment but the economic gains in terms of livelihoods can outweigh the costs. Moreover, the social benefits are huge with respect to increased security. Ultimately, conservation benefits from the increased support from local communities and the public at large for the proper controls and good management. Many conservationists would argue conservation and co-existence is essential to maintain ecosystem services such as livelihood, and indeed that if properly managed the presence of wildlife represents an opportunity, a possible escape route from poverty (Philip Muruthi, 2005, Human Wildlife Conflict). This can only be achieved through close cooperation with local communities and, therefore, is linked very closely to participatory management and micro-planning process with Eco Development Committees (EDCs) and village forest councils

(VFCs).

**(3) Strategies**

### *1.3.1 Train field staff and village volunteers in wildlife conflict management*

**Target Area**

14 sites: 4 PAs and 10 Divisions within Elephant Reserves - See **Table 6.3**

**Action 1 Training in wildlife conflict management and monitoring wildlife movements**

| | |
|---|---|
| 1.3.1 | Train field staff and village volunteers in wildlife conflict management |

***Implementation***

- Train local field staff and village volunteers using TNFA, local institutions and NGOs, as appropriate.
- Intensive programme to establish anti-poaching squads and train them and field staff, such that all 14 sites are covered within three years.
- Training to be field-based and include monitoring wildlife movements using GPS, driving elephants back into the forest and migratory corridors, anti-depredation patrols, and maintenance of accurate records and observations for entry in the GIS database system.
- Training to be scheduled/prioritised according to the magnitude of conflict experienced at each site.
- A maximum of 20 participants to be trained per site.

### *1.3.2 Identify and manage traditional migratory routes (elephant and gaur)*

**Target Area**

14 sites: 4 PAs and 10 Divisions within Elephant Reserves. - See **Table 6.3**

**Action 2 Current status of traditional migratory routes and management requirements**

| | |
|---|---|
| 1.3.2.1 | Procure contractors/partners |
| 1.3.2.2 | Review historic data and information on large mammal movements |
| 1.3.2.3 | Monitor migratory movements of wildlife (elephant and gaur) using GPS |
| 1.3.2.4 | Consolidate existing corridors and designate new ones, based on monitoring results |
| 1.3.2.5 | Drive elephants back to forest and corridors |
| 1.3.2.6 | Enter georeferenced data in biodiversity database/GIS |

***Implementation***

- To be outsourced or implemented in partnership with experts in elephant migratory movements.
- Available historic and recent data to be digitized when possible and stored in GIS in accordance with date and time of day/night to facilitate appropriate analysis of seasonal and diurnal movements.
- Areas frequently used by elephant and other large mammals not yet designated as corridors should be identified and earmarked as potential corridors.

- GIS system to be developed to accommodate data from field staff and anti-poaching squads, using proforma provided to those in the field. It should be regularly updated and integrated with other data to inform Project interventions.
- GIS analyses to be reported annually.

### *1.3.3 Establish wildlife-proof barricades around villages*

Of the many different types of barricade used to protect villages and crops from damage by elephants, in particular, and also other large herbivores (wild boar and deer), electric fences have generally proved to be the most cost effective in South Asia[8] and also Africa[9]. Ditches and moats have been used with more limited success. Their problem is the massive investment required both to construct and maintain them, the latter because of their extreme vulnerability to soil erosion. Elephants learn to kick in the sides of trenches and cross them, and are also undeterred by narrow stretches of water.

By contrast, electric fencing technology is simple and definitely deters elephants, provided it is continuously kept under meticulous management. Moreover, experience in Africa has shown that fences may not need electrification as much in areas where elephants appear not to be so persistent at crop raiding (Hoare, 2003). Well-implemented electric fencing in strategic locations, along with community support involving people in the design, execution and maintenance, is essential to positively influence people's attitudes and may go a long way in successful human-elephant conflict resolution. Such steps are underway in areas surrounding Waynad Sanctuary in Kerala State (Fernando *et al*., 2008).

Live fences have been tried out in a number of locations in Sri Lanka but none has been successful. A row of Agave planted along the electric fence at Uda Walawe and Yala national parks has proved ineffective. Similarly a cactus fence tried out along the Weerawila farm perimeter failed completely. Key issues concern the spacing between plants, the depth of the bio-fence and its maturity prior to being used to deter wildlife.

In the light of such experience, it is recommended that solar-powered electric fencing should be the preferred method employed to keep elephants and other large herbivores out of land inhabitated and cultivated by villagers, while recognizing that other forms of barricade may need to be adopted in particular instances. Crucially important will be ownership of responsibility by village communities for effectively checking and maintaining such fences on a regular basis.

**Target Area**

13 sites: 3 PAs and 10 Divisions within Elephant Reserves. - See **Table 6.3**

**Action 1 Protecting village lands and properties from marauding wildlife**

| | |
|---|---|
| 1.3.3.1 | Provide and maintain for 5 years elephant-proof trenching where appropriate |
| 1.3.3.2 | Provide and maintain for 5 years solar-powered fencing where appropriate |
| 1.3.3.3 | Monitor incidences of human-wildlife conflict |
| 1.3.3.4 | Monitor and report on effectiveness of wildlife-proof barricades around villages |

[8] Prithiviraj Fernando, M. Ananda Kumar, A. Christy Williams, Eric Wikramanayake, Tariq Aziz, Sameer M. Singh, (2008). *Review of Human-Elephant Conflict Mitigation Measures Practiced in South Asia*. World Bank-WWF Alliance for Forest Conservation & Sustainable Use.

[9] Richard Hoare (2003), Fencing and other barriers against problem elephants. IUCN SSC African Elephant Specialist Group. Technical Brief Series. http://www.african-elephant.org/hec/pdfs/hecfencen.pdf

***Implementation***

- Assess the terrain and effectiveness of any earlier interventions at the site before finalising the choice of barrier to wildlife. Unless there are good technical or social reasons for doing otherwise, adopt solar-powered fencing as recommended above. Communities may have their own preferences with respect to their perceptions of maintenance costs and risks to children (e.g. electric shock, falling into trenches) and these should be respected, while also ensuring that members are fully aware of the full set of advantages and disadvantages to any one type of barrier.
- Train farmers, village leaders and forest guards in maintaining solar fences and recording all instances of wildlife conflicts (e.g. animals breaking through the barrier). Time invested in checking fences and their maintenance and repairs should also be monitored closely in order to generate information on the effectiveness of these types of barriers.
- Environmental impacts should be minimized and monitored, especially with respect to waste materials from construction works.
- Monitoring will be undertaken by members of the anti-depredation squad. FD personnel will responsible for ensuring that records are entered into the GIS database system. Monitoring should be year-round and begin during the training period.
- Monitoring data will be collated, analysed and reported on an annual basis. These will inform future interventions.

**Action 2 Establish mobile veterinary units**

| | |
|---|---|
| 1.3.3.5 | Translocate animals as required |
| 1.3.3.6 | Establish and operate mobile veterinary facility |

***Implementation***

- The Project will provide a lump-sum to cover costs of translocation operations[10] around these 13 sites for an initial 5 years, with provision to carry over/forward unspent funds until the end of the loan period. The available sum may be used discretionally as and when situation demands maintaining detailed reports of every event, the animal involved, the site of operation, the mode (whether traps, tranquilizers were used).
- At present only two full-time veterinary doctors (one in Chennai and another at Coimbatore) are available to handle translocation/emergency services throughout the State. Considering the frequency of human-wildlife conflict situation and the kind of injury/trauma often inflicted on animals, it is proposed to establish 4 mobile veterinary units at Dharmapuri, Erode, Madurai and Tirunelveli Circles to deliver a more rapid service. These units should also be equipped with appropriate vehicles, fit for purpose.

### 7.3.4 Ecologically Sustainable Development

#### (1) Approach

This component is focussed on mainstreaming village level, community-centred development initiatives into the overall goal of biodiversity conservation. It takes into consideration the fact that the state of Tamil Nadu is a progressive state as exemplified by rather significant achievements in the spheres of literacy and conventional development parameters such as low crude birth rates, infant and maternal mortality rates, and improved access to health infrastructure. Further, it is recognized as the second most urbanized state of the country. It is also important to recognize that the state pioneered

[10] Note that JICA does not fund immobilisation equipment.

the cause of social equity through concerted programmes such as reservation for backward and scheduled castes and scheduled tribes as also leadership programmes for women and representatives of the most marginalized communities.

It is also rather well known that certain districts within Tamil Nadu (for example, Chennai, Kanchipuram, Coimbatore and Kanyakumari) are highly developed in comparison to districts that are in the hilly, semi arid and arid tracts of the state. The less developed districts also rather interestingly are home to some of the primitive tribal groups such as the Kurumbas, Kanis and Paniyars. Tamil Nadu has about 1.04 percent of its total population being categorized as Scheduled Tribes (2001 Census), with the Irulars and Malai alis being the numerically most dominant. While the entire population is not found to be residing within or in the near proximity of forests and other natural resources, about 80-85 percent of the total tribal population is known to be directly dependent on the forests for survival.

Tamil Nadu has 36 tribal groups of which six are considered to be Primitive Tribal Groups. These are Toda, Kota, Paniyan, Kurumba, Irula and Kattunayakan (although it is to be recognized that the nomenclature of Kurumba, Irula and Kattunayakan is rather generic). Other forest dwelling tribal groups include the Paliyar, Muthuvar, Irula, Sholigas, Kani, Kadar, Malasar, Malai Malasar and Mudugar. While the Malai alis are known to reside in the Eastern Ghats of Tamil Nadu and the Irulars are numerically dominant along the East Coast, the Western Ghats supports a rather diverse groups of tribals living in small hamlets.

In addition to the Scheduled Tribes, a number of Scheduled Caste communities are also known to reside in the immediate periphery of the forests deriving their livelihood through collection, and subsistence agriculture.

Studies have revealed that the distinct socio-cultural fabric of the tribal and other forest dwelling communities of Tamil Nadu has evolved on the principles of subsistence, prudence and reverence for natural elements. This is exemplified by their deities, sacred groves and customary rules and regulations of harvest.

The TNFD in its 11th Five-Year Plan states rather categorically that it would strive to make tribal and other forest-dwelling communities as partners in the forest management and development process, and engage them in a meaningful manner in forest policy issues. It further states that efforts would be made to enter into a legal partnership framework for enabling the overall purpose of biodiversity conservation.

**(2) Rationale**

The project provides a major opportunity to develop and establish community-centred programmes that can harmonise conservation and development goals, using the approach of community mobilisation, micro-planning and establishment of village-based livelihood programmes. Providing further impetus to this component is the dedicated strategy and programme that has evolved for ecotourism.

**(3) Strategies**

### *1.4.1 Socio-economic and forest dependency surveys of village communities*

**Target Area**

63 villages spread over the state of Tamil Nadu. - See **Table 6.3**

**Proposed Activities**

| | |
|---|---|
| 1.4.1.1 | Procure contractors/partners and hold state-level workshop |
| 1.4.1.2 | Survey socio-economic and forest dependence status at outset of Project |
| 1.4.1.3 | Survey socio-economic and forest dependence status five years after initial survey |
| 1.4.1.4 | Prepare and publish manual on survey and analysis protocols (Tamil and English) |
| 1.4.1.5 | Enter georeferenced data in 'peoples' database/GIS |
| 1.4.1.6 | Report on survey results (Tamil and English) |

***Implementation***

A study on the socio economic status and forest dependency of the villages abutting PAs (e.g.,Kanya Kumari, Sathyamangalam, Srivilliputtur wildlife sanctuaries and Elephant Reserves) or RFs is essential not only to understand the current levels and trends in dependency by communities on forest-based resources, but also enable strategies to address the issue in a comprehensive manner to evolve during the subsequent micro-planning exercise. It is also a premise that the baseline data thus generated could be used to monitor the impact of the project in terms of socio-economic status and livelihoods of the local communities. Villages selected for this sub-component will fall under tribal and non-tribal categories. They are located within 5 km from the boundary of a PA or RF.

The following activities are proposed:

- Identification of credible non-governmental organizations and/or research institutions, and/or academic institutions as partners
- Reclassification of the area of operation into regional clusters (e.g. north-west, central and south) may be appropriate.
- Development of common working arrangements including terms of reference and consultancy charges with the partner organizations
- Development and finalization of the study design through state level consultative workshops involving experts and the designated project personnel
- Development of a manual on the design study, including field study protocols and data sheets, data analysis, reporting, etc.
- The manual would facilitate a multi-centric study conducted by field teams comprising the staff of the partner organizations, nominees from the village and the department. The manual is also essential to ensure adherence to a uniform set of procedures and data analysis
- The results of the study would be shared with to the communities through village level consultative workshops; while also being made available through a centralized georeferenced database at the PMU
- Repeat of the survey during the fifth year of operation of the Project to assess impact and changing trends.

### *1.4.2 Community biodiversity registers*

***Approach***

In pursuance of the Convention on Biological Diversity (CBD) and the Biological Diversity Act, 2002 and Rules, 2004, all local bodies in the country, namely, Gram, Taluk, and Zilla Panchayats, the municipalities and municipal corporations would have the responsibility of documenting the following:

1 Comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them;

2 Data about the local vaids and practitioners using the biological resources;

3 Details of the access to biological resources and traditional knowledge granted, details of the collection fee imposed, and details of the benefits derived and the mode of their sharing

Much of the pertinent information on the status and dynamics of the local ecosystems, as well as uses of their components, resides with people who still depend on it for their day-to-day sustenance. This information needs to be compiled in a systematic manner, protected and stored at village level institutions in the form of registers known as the community biodiversity registers. The possibility of this data becoming part of a national meta database is also being explored by the Government of India.

The Project proposes to undertake this pioneering effort for the state of Tamil Nadu through a state-wide process involving a number of village communities. The baseline information thus compiled would be used for developing intervention strategies such as eco enterprises in the current project, and also lead to tangible products such as guidebooks and posters that facilitate eco tourism.

**Target Area**

88 project villages covering sites abutting PAs, villages on the periphery of RFs, ecotourism sites. - See **Tables 6.3, 6.4 and 6.5**

**Action 1**

| | |
|---|---|
| 1.4.2.1 | Procure contractors/partners |
| 1.4.2.2 | Train field staff and village ecotourism guides in compiling biodiversity registers |
| 1.4.2.3 | Provide communities with expertise in plant/animal identification, survey methods, oral history, etc, to record biodiversity |
| 1.4.2.4 | Survey biodiversity in village revenue lands and ecotourism sites/routes |
| 1.4.2.5 | Enter georeferenced data in biodiversity database/GIS |
| 1.4.2.6 | Produce guidebooks, posters, etc, for ecotourists in three languages (Tamil, Hindi, English) |

***Implementation***

Compiling community biodiversity registers at the level of villages in the 88 target villages necessitates an approach that blends scientific expertise, community mobilization and skill training, field surveys, compilation and presentation. The following activities would hence form part of this component:

- Identification of technical agency with proven expertise in compiling community biodiversity registers
- Development of standard protocols and datasheets through consultative state level workshops
- District level and village level skill training workshops on the compilation of community biodiversity registers
- Establishment of field teams; with opportunities for volunteer participation at the level of the village such as nominees from EDCs, VFCs, etc

- Identification of district level technical experts to provide additional back up for the field teams (such as species identification)
- Compilation of community biodiversity registers
- Creation and maintenance of a state level georeferenced database supported by field level availability of registers with a custodian agency designated by the community

### *1.4.3 Eco-development activities in villages abutting PAs in 30 villages*

Tamil Nadu has, in the past, successfully implemented an eco-development project in and around Kalakkad Mundanthurai Tiger Reserve, and also made significant inroads in other wildlife sanctuaries of the state, such as Kanyakumari, Grizzled Giant Squirrel, Sirivilliputtur and Sathyamangalam.. The current project, while drawing up the lessons learned from past experiences proposes to develop and launch eco-development activities in some of the lesser known wildlife sanctuaries of the state. The sanctuaries are located along the Western Ghats and are home to some of the country's primitive tribal groups. It is also to be noted that these communities are categorized as severely disadvantaged with no access to continued livelihoods or other social benefits such as education and health.

**Target Area**

30 villages situated either on the fringes of Sathyamangalam WLS, Kanyakumari WLS and Srivilliputtur WLS or lie within 5 km radius of a RF boundary within an Elephant Reserve - See **Tables 6.3 and 6.4**

**Action 1**

| | |
|---|---|
| 1.4.3.1 | Procure contractors/partners and hold state-level workshop |
| 1.4.3.2 | Orientate communities on scope and purpose of Project |
| 1.4.3.3 | Assess socio-economic and ecological infrastructure of villages and their periphery as necessary |
| 1.4.3.4 | Establish and train mixed gender field staff teams to design and facilitate participatory processes using appropriate tools |
| 1.4.3.5 | Facilitate participatory planning of eco-development plans |
| 1.4.3.6 | Facilitate study tours to expose EDCs to other successful VCFs/EDCs/ Self-Help Groups (SHGs) |
| 1.4.3.7 | Establish protocols and coordination mechanisms with appropriate village institutions (Panchayat and/or Grama Sabha) |
| 1.4.3.8 | Constitute EDCs and their Executive Committees |
| 1.4.3.9 | Identify and prioritise viable livelihood options (linked to CBRs and socio-economic/forest dependency surveys) |
| 1.4.3.10 | Prepare eco-development plans, addressing socio-economic and ecological requirements and opportunities through series of business plans |
| 1.4.3.11 | Implement eco-development plans via series of business plans for eco-enterprises, including skills training programmes |
| 1.4.3.12 | Participatory assessment of impacts of interventions |

***Implementation***

Implementation of the project is to be executed over three broad overlapping phases. While the first phase would be devoted to identification of field-based non-governmental organizations with credible experience in the area of conservation and community mobilization, the second phase would be dedicated to field surveys, community-level planning and mobilization. A distinct activity of the project is that which entails orienting the local community to the purpose and scope of the project. This has been included keeping in view the growing recognition that people need to be fully informed consensual partners in any project that is designed for their benefit. The third phase of the project is dedicated to creating and enhancing livelihoods among local communities through a process that

blends in-depth market and feasibility study by expert organisations, assessment of local resources including manpower, development of eco-plans and establishment of village-based, viable eco-enterprises. It is also to be noted that the establishment of eco-enterprises will be guided by the principles of inclusive growth and measured against the conservation goals.

### *1.4.4 Ecologically sustainable development in 33 tribal villages peripheral to RFs*

The state has about 3,072 forest fringe villages and most of the people living in these villages are dependent on the forests for their livelihood. In view of the fact that these villages have largely remained excluded from the conventional developmental projects, they are distinctly under developed with very high rates of poverty. This continued deprivation has played a major role in the degradation of forests and consequent loss of biodiversity. Earlier efforts in rehabilitating these degraded forests through various schemes did not meet with the expected success since the participation of local communities was ignored.

To reverse this situation, Tamil Nadu launched a massive project captioned Tamil Nadu Afforestation Project (Phase I) from 1997. The project aimed to protect, conserve, and manage the biodiversity at the local or micro-level. The theme of the Project was people's participation, forest conservation, and poverty alleviation. People who influenced the forests were made part of the conservation efforts. The Project employed Joint Forest Management as a major tool for local biodiversity conservation. The local communities were organized into a grass-root level institution called VFCs. From 1997 to 2004, 1,367 VFCs were formed and nearly 466,000 local people became active members in the co-management of the forests. The Project attempts to enlarge the ambit of this intervention further; with lessons learned from the implementation of TAP I and the ongoing phase of TAP II.

**Target Area**

33 villages located around RFs that are part of Nilgiris-Eastern Ghat and Nilambur-Silent Valley-Coimbatore Elephant Reserves. Certain tribal villages located near PFs in Kallakurichi and RFs in Vellore divisions are included. - See **Tables 6.3 and 6.5**

**Action 1**

| | |
|---|---|
| 1.4.4.1 | Procure contractors/partners and hold dtate-level workshop |
| 1.4.4.2 | Orientate communities on the scope and purpose of the Project |
| 1.4.4.3 | Assess socio-economic and ecological infrastructure of villages and their periphery |
| 1.4.4.4 | Establish and train mixed gender field staff teams to design and facilitate participatory processes using appropriate tools |
| 1.4.4.5 | Facilitate participatory planning of micro-plans |
| 1.4.4.6 | Facilitate study tours to expose VCFs/SHGs to other successful VCFs/EDCs/SHGs |
| 1.4.4.7 | Establish protocols and coordination mechanisms with appropriate village institutions (Panchayat and/or Grama Sabha) |
| 1.4.4.8 | Constitute VCFs/SHGs and their Executive Committees |
| 1.4.4.9 | Identify and prioritise viable livelihood options (linked to CBRs and socio-economic/forest dependency surveys) |
| 1.4.4.10 | Prepare eco-development plans, addressing socio-economic and ecological requirements and opportunities through series of business plans |
| 1.4.4.11 | Implement eco-development plans via series of business plans for eco-enterprises, including skills training programmes |
| 1.4.4.12 | Participatory assessment of impacts of interventions |

***Implementation***

The state of Tamil Nadu has the distinction of successfully creating viable village-based Women's

Self Help Groups (SHGs) and Village Forest Councils These entities have also demonstrated that village-based credit and thrift groups, when supported by continued training and skill inputs, have a greater reach and effectiveness. The Project, therefore, proposes to use the same mechanism to enable local communities to engage in micro-planning with specific focus on the social, economic and ecological infrastructure of the village. Social infrastructure includes roads, community child care centres, common water treatment facilities, etc. Economic infrastructure includes existing livelihoods and resources that can enable derivation of income, while ecological infrastructure includes natural resources such as open forests, wetlands, pasture lands, etc.

The results of the assessment would be used for developing micro-plans, which in turn would lead to the identification of other livelihood options. The feasibility of institutionalizing certain livelihood options as eco-enterprises would be examined by an expert organization which would also be entrusted with the responsibility of developing business plans. It is also proposed to support alternate income-generation activities with the creation of a revolving fund.

### *1.4.5 Community-based ecotourism in 25 sites*

In keeping with the Tamil Nadu State Policy on Ecotourism 2010, this subcomponent is intended to comprise a series of low input, low impact and sustainable initiatives that involve active community participation. In contrast to other ecotourism initiatives, the TNFD plans to showcase a variety of natural features located at 56 sites within their RFs, develop nature trails and make available facilities for trekking and overnight camping. Such initiatives will be managed and facilitated by local communities, whose capacity will be developed to provide a range of services including hospitality, catering, tracking wildlife and guides.

For the first time in Tamil Nadu, resource and educational material for tourists will be produced under the auspices of the Project. This will ensure that authentic yet aesthetic 'take home' material will be made available to visitors. Importantly and uniquely, the Project will take a leading role in the development of community-based ecotourism, with all aspects relating to food, accommodation, transport and sightseeing, awareness and learning which will be handled by local communities. Potentially, this is the key strength of the Project, whereby ecotourism becomes a sustainable livelihood option for local communities. To ensure that women are not overlooked in this initiative, provisions will be made to develop and implement activities that involve their active participation, such as through the formation of SHGs.

In order to provide visitors with a variety of experiences and maximize benefits for local communities, ecotourism strategies are required to integrate the provision of a range of activities and facilities within a cluster of destinations/site and villages. This should comprise a range of accommodation including tents, homestays and ecolodges to meet the needs of different types of visitors, without sacrificing ecotourism principles in order to meet unsustainable expectations of environmentally unaware visitors. Thus, there is a provision for the development of five ecolodges in strategic locations throughout different parts of the Project area. Each ecolodge will comprise five cottages with double rooms and attached bathrooms, along with a central, open-sided, thatched communal dining area. All buildings should be constructed from renewable resources, with walls of sun-baked bricks, bamboo frames, and corrugated bamboo roofs overlain with thatch for insulation from the sun or cold during winter.

Considering that the TNFD has been given the lead in the state's ecotourism policy for developing destinations with local community involvement, it is particularly important that ecotourism principles are observed, high standards are adopted and best practices are demonstrated. A number of guiding principles, as follows, should underpin the promotion and development of ecotourism by the Project:

- **Nature and culture focus**, providing visitors with the opportunity to personally and directly experience nature and local culture.

- **Interpretation** to provide opportunities to experience nature and local culture in ways that enhance understanding, appreciation and enjoyment.
- **Environmental sustainability**, demonstrating best practice in the selection and use of materials and pursuit of activities.
- **Contribute directly to the conservation of natural areas**.
- **Benefit local communities** by direct employment and use of their services.
- **Cultural sensitivity and respect** towards local people and traditions in the area.
- **Customer satisfaction**, ensuring that visitor expectations are consistently met (within environmentally sustainable norms).
- **Responsible marketing**, based on honest and accurate promotion so that realistic expectations are formed.

Ecotourism destinations should be developed in line with the characteristics described in **Box 4.**

Box 4 ECO-DESTINATION CHARACTERISTICS

- Natural features conserved within a protected landscape.
- Low-density development, where natural areas are abundant and the built landscape does not dominate.
- Evidence that tourism is not harming natural systems such as waterways, coastal areas, wetlands and wildlife areas.
- Small, thriving community businesses, including food stands and other types of craft enterprises owned by local people.
- Plenty of designated outdoor recreation zones that are designed to protect fragile resources, including bike paths, trails or boardwalks that are shared by locals and visitors alike.
- Thriving, locally-owned lodges, hotels, restaurants and businesses that provide genuine hospitality with friendly, motivated staff.
- A variety of local festivals and events that demonstrate an on-going sense of pride in the local community's natural environment and cultural heritage.
- Clean and basic public facilities for tourists and locals to share, such as public showers and toilets.
- Friendly interaction between local people and visitors in natural meeting places, such as local shops and markets, or benches by the sea and along river banks.

(Source: Wood, Megan Eplar (2002). *Ecotourism: principles, practices and policies for sustainable development.* United Nations Environment Programme and The International Ecotourism Society.)

Similarly, ecolodges should comply with the criteria on services and management (**Box 5**), and construction (**Box 6)**.

Box 5 CRITERIA FOR ECOLODGE FACILITIES

- It conserves the surrounding environment, both natural and cultural.
- It has minimal impact on the natural surroundings during construction.
- It fits into its specific physical and cultural contexts through careful attention to form, landscape and colour, as well as the use of localised architecture.
- It uses alternative, sustainable means of water acquisition and reduces water consumption.
- It provides careful handling and disposal of solid waste and sewage.
- It meets its energy needs through passive design and combines these with their modern counterparts for greater sustainability.
- It endeavours to work together with the local community.
- It offers interpretative programmes to educate both its employees and tourists about the surrounding natural and cultural environments.
- It contributes to sustainable local development through research programmes.

(Source: Mehta, Hitesh, Baez, Ana L. and O'Loughlin, Paul eds (2002). International Ecolodge Guidelines. The International Ecotourism Society)

Box 6 GUIDELINES FOR ECOLODGES

Use local architecture and building materials Build the lodge to look like a traditional home or house. Construction materials should be local, such as bamboo, rattan, wood, locally-made bricks or stone. This is often the cheapest and most common way to build a house in many rural areas, so most carpenters know very well how to do it in this fashion.

Minimise the use of energy Avoid air-conditioning and other electrical devices that use too much electricity. Install solar energy to meet some power needs, such as lighting and hot water.

Use local products and minimise the use of chemicals in daily operations Use local food products (not canned imported products), locally-produced bed sheets, table cloths and other items in the lodge. Do not buy chemical bug sprays, poisons or toxic cleaning fluids when there is a suitable substitute. Install screens to keep out the bugs, use non-toxic rat poison (or have housecats) and use simple soap and water for cleaning. All of these ideas will save money and the environment.

Minimise and manage waste Do not use things that make a lot of waste, such as disposable water bottles, canned foods, or foods wrapped in plastic. Recycle and reuse items when possible, especially glass and plastic.

Employ local people and support their community Lodges should give work opportunities to nearby villagers. Also support the community by helping with activities at a nearby school.

Minimise negative impacts on nearby villages Provide information to tourists on cultural do's and don'ts. Speak with local villagers regularly to learn how to help them and to learn if there are any problems created by tourists that stay at the lodge.

Support conservation of nature Provide information to guests about nature tourism in the area. Also help by not selling wildlife products and by supporting the conservation activities in a protected area nearby. Another simple way is to protect the trees around the lodge and prohibit hunting on the property.

(Source: Fischer-Zernin and Schipani, 2005 Fischer-Zernin, Vincent and Steven Schipani (2005). Designing and operating an ecolodge in the Lao PDR. Mekong Tourism Development Project, Vientiane, Lao.)
http://www.ecotourismlaos.com/directory/publications/designing_and_operating_an_ecolodge_in_the_lao_pdr_english.pdf

It will be crucially important for all ecotourism initiatives to be developed under the auspices of community institutions, usually EDCs or VFCs. However in their absence, SHGs will probably be the best alternative, rather than owned by individuals or groups to ensure that benefits are shared to some extent among all members of the community. For this purpose, communities located in and around sanctuaries will be constituted as EDCs and those in forest divisions as VFCs. These institutions

will be registered under the Societies Registration Act. Those managing facilities or leading activities should be employed by the community corpus, so that profits accrue to the benefit of the community.

**Target Area**

7 destinations are located around four wildlife sanctuaries, 18 other sites in 12 forest divisions[11] - See **Table 6.3 and Annexure 7.1.**

**Action 1 Documentation, interpretation**

| | |
|---|---|
| 1.4.5.1 | Procure contractors/partners and conduct state-level workshop |
| 1.4.5.2 | Assess socio-economic infrastructure of villages and opportunities for ecotourism based on natural and cultural heritage |
| 1.4.5.3 | Visit candidate sites, assess potential ecotourism activities and identify opportunities for synergy within clusters of sites |
| 1.4.5.4 | Develop ecotourism strategies for clusters of sites, with feasibility studies of target sites and synergies between sites |
| 1.4.5.5 | Constitute ecotourism SHGs in the absence of EDCs or VFCs |
| 1.4.5.6 | Develop business plans for ecotourism enterprises, including skills training programmes |
| 1.4.5.7 | Implement business plans and establish ecotourism enterprises |
| | a) Construction of tourism-related infrastructure |
| | b) Equipment (powered by renewable resources) |
| | c) Training of community members (hospitality, catering, lodge management, nature and culture guiding, health & safety etc) |
| | d) Revolving funds |
| 1.4.5.8 | Develop village ecotourism charters as benchmark for participatory monitoring of sustainability of interventions |

***Implementation***

- Members of local communities will participate in the development of ecotourism destinations from the outset, taking due account of their social and economic context and the opportunities these might afford.
- Ecotourism expert(s) to be contracted to develop strategies for clusters of destinations. Strategies will include feasibility studies of identified activities discussed in open meetings with community members.
- Experts to develop business plans and facilitate establishment of enterprises.
- Training of community members in necessary skills for specific service and activities to be scheduled well ahead of their commencement.
- Local craftsmen and laborer to be employed and trained in constructing ecolodges and other visitor facilities and infrastructure.
- Communities to be facilitated to adopt village/community charters for self-regulation and implementation of ecotourism policies and strategies. This will help ensure that ecotourism activities are monitored regularly and no compromises are made with respect to the overall goal of biodiversity conservation and equity.
- Destinations and activities will be marketed largely via an ecotourism website to be developed by the Project. This will include an on-line booking facility.

[11] The 25 sites were given by TNFD just before finalizing the report. Out of 25 sites, only 5 sites were common to the previous list. This is an indicative list of potential sites and hence the feasibility of the sites should be reviewed at the onset of the project.

## 7.4 Increasing the Natural Resource Base

### 7.4.1 Tree Cultivation on Private Land (TCPL)

#### (1) Scope for Tree Cultivation on Private Land

The scope for Tree Cultivation on Private Land (TCPL) is determined by availability of fallow land in general and its availability with focus on small and marginal farmers.[12]

***Availability of fallow land***

According to the Land Use Statistics, Department of Economics and Statistics, Government of Tamilnadu a total of around 2.5 million ha (19% of total geographical area) is categorized as one or other category of fallow.

**Land Use Change in Tamilnadu**

| Land Use | % of total geographical area | | |
|---|---|---|---|
| | 1979-80 | 2000-01 | 2007-08 |
| Barren and Unculturable land | 4.69 | 3.7 | 3.8 |
| Land put to non-agricultural uses | 12.94 | 15.3 | 16.6 |
| Permanent pastures & other grazing lands | 1.27 | 0.9 | 0.8 |
| Land under miscellaneous tree crop & groves | 1.5 | 2 | 2 |
| Culturable wasteland | 2.7 | 2.7 | 2.7 |
| Fallow land other than current fallows (other fallow) | 3.5 | 9.5 | 11.5 |
| Current fallows | 9.67 | 8.7 | 7.5 |
| Net are sown | 48.15 | 40.8 | 38.9 |

Source: Season & Crop Reports of various years. Directorate of Statistics & Economics.

The land use pattern has of the state has undergone rapid structural changes over the period of last thirty years. For the state as a whole, comparison of the land use data over past 30 years indicates that area under 'other fallow' category has increased substantially And it still shows an increasing trend. On the contrary the 'net sown area' and permanent pastures show a declining trend. This indicates that farmers are shifting to other economic activities while preferring to leave more and more land fallow.

Given that TCPL targets about 110,000 ha – 150,000 ha of fallow land, which is 5-6% of the total fallow land available and 8-10% of the 'other fallow', there seems to be sufficient land available for implementation of TCPL. However, one has to make a safe assumption that only a portion of such land would be available and out of the land that could be suitable and available for plantation, there would be competing demands from other departments (Agriculture, Horticulture) for the same category of land to implement their schemes.

78% of the 'other fallow' land is located in 16 of the 32 districts. The 16 districts – located in North-eastern, Western, and Southern agro-climatic zones – are characterized by low rainfall and semi-arid conditions.

***Availability of land with small and marginal farmers***

While data on availability of fallow land with small and marginal farmers could not be made available in the limited time, the following analysis has been done to understand land holding pattern with different category of farmers which could be a proxy indicator for fallow land available with different category of farmers.

[12] Although the focus is on the small and marginal farmers, the scope is not limited to them and also includes medium & large farmers with a maximum limit restricted to 2 ha extent.

Agricultural census data available for the year 1995-96 indicates that there were about 8 million operational holders under different categories covering close to 7.3 million ha. of agricultural land. The land ownership is quite skewed. The small and marginal farmers constitute 89.7% of the total farmers in the state but own only about 54% of the total agricultural area. The other category of farmers constitute less than 11% of the total farmers but own about 46% of the total area.

**% Change in No. of Landholders in Different Categories & Area under their holding**

| Category of Operational Holdings | 1976-77 | | 1995-96 | |
|---|---|---|---|---|
| | No. | Area | No. | Area |
| Marginal (below 1 Ha.) | 64.7% | 21.1% | 74.3% | 30.3% |
| Small (1-2 ha.) | 18.4% | 20.8% | 15.4% | 23.6% |
| Semi-medium (2-4 ha.) | 11.2% | 24.6% | 7.5% | 22.2% |
| Medium (4-10 ha.) | 5.0% | 23.1% | 2.5% | 15.5% |
| Large (10 ha. & above) | 0.8% | 10.4% | 0.3% | 8.4% |

The table shows that over a period of 30 years, there has been significant decline in the number of large and medium farmers and significant increase in the number of marginal farmers.

The average size of land holding has also been declining over the years. The average size of holding which was 1.25 ha in 1976-77 declined to 0.91 ha in 1995-96. Declining holding could also be responsible for sharp increase in the fallow land, as the small holding makes agriculture non-remunerative and the farmer starts looking for other livelihood options. Per capita land holding could also be a major factor in adoption of TCPL.

### (2) Objectives of TCPL

The proposed objectives of the TCPL programme are as follows:

a) To contribute to the national goal of bringing 33% of the geographical area under forest and tree cover by increasing the tree cover in the villages

b) To increase the supply of wood and non-wood products from private land for industrial as well as household consumption contributing to reduction of pressure on forest land

c) To establish tree-based farming system as a sustainable and viable economic enterprise for farmers especially small and marginal farmers

d) To build and strengthen institutional and technical capabilities of the farmer to create farm plantations and market the products

### (3) Target Area and Farmers

The TCPL sub-component is proposed to be implemented in about 4,000 - 5,000 villages spread over 32[13] districts in the state. The extent of district wise coverage would vary according to availability of fallow land in the district. The villages would be selected based on multiple criteria such as availability of fallow land, interest of farmers etc as described in (6) of this Section.

Private fallow land and farm bunds covering a *notional* area[14] between 110,000 ha to 150,000 ha

[13] Given the lack of availability of fallow land in certain districts such as Chennai, it is likely that the TCPL programme is limited to only 30 or 31 districts.

[14] The coverage of area is estimated based on number of seedlings. For Casuarina, 10,000 seedlings is taken as equivalent to one ha; for certain other species such as Ailanthus 1,000 seedlings are considered equivalent to one ha and for species such

would be planted with a variety of tree species. About 3,000 ha of proposed area would be covered under short-rotation tree crop – mainly Casuarina. The rest would be covered with medium and long rotation crops. About 50% of the area would be covered under plantations that are primarily targeted to supply raw materials to forest-based industries and 50% of the plantations would be multi-species and multi-purpose in nature to meet the domestic as well as income needs of the farmer.

Although the component would target all categories of fallow land, it would focus on 'other fallow' category of land for creating compact block plantations. The 'current fallow' category of land would be targeted only for farm boundary plantations and inter-cropping (agro-forestry) models.

All categories of farmers are proposed to be covered under TCPL. Small and marginal farmers would be given priority in selection as beneficiaries.

**(4) Approach & Strategies**

Farm Forestry programmes in India and Tamil Nadu have suffered primarily due to absence of a comprehensive strategy for promoting tree cultivation on private lands. The main strategies adopted under public programmes on farm forestry have been to supply tree seedlings at free of cost or at subsidised cost; provision of survival incentives and creation of extension infrastructure. However, experience has proved that supply of seedlings and incentives alone are not effective. Some of the important issues observed in relation to past farm forestry programmes are:

- Low survival of seedlings
- Low density of trees per unit of farm land
- Low productivity of farm forestry plantations
- Low adoption of farm forestry by small and marginal farmers
- Low success in semi-arid regions

There are increasing opportunities for farm forestry as more and more private fallow land becomes available as farmers are shift from agriculture to other livelihood options influenced by host of reasons – availability of more remunerative livelihood options; shortage of labour for farm work; declining return from agriculture due to increased input costs; declining size of land holding and returns from agriculture; higher risks associated with agricultural cash crops etc. Other opportunities include rising prices of timber and wood fueled by growing demand-supply gap due to growing economy.

The constraint for promotion of farm forestry, however, is that majority of such opportunities are in semi-arid regions of the state. The agrarian structure and the farming system in semi-arid regions do not present a condition in which the adoption of farm forestry becomes an automatic choice. Semi-arid regions are characterized by intense competition for moisture between crops and trees and very few tree species are identified which have a strong complementary effect on annual crops (e.g. Prosopis cineraria). In these regions, a farmer's decision to plant trees has to take into account herding practices of the village (cattle are left free to graze in non-agricultural seasons making protection problematic); distance of the field from house; availability of irrigation etc. Semi-arid regions also are characterized by availability of vast but degraded open access land belonging to forest department or revenue department. Availability of tree as a free good obtained from public lands also inhibits personal investment of labour, land and capital for tree planting by the farmer. The market is also more exploitative in these regions, as the farmers are less organized and lack access to market information.

as Teak , Red sanders, fruit trees, multi-purpose trees 500 seedlings are supposed to constitute one ha. Similarly 400 bamboos constitute one notional ha.

The semi-arid regions, however, also present opportunities other than vast availability of land. Different agro-forestry models are found in semi-arid areas. See **Annexure 7.2 & 7.3** for details on various Agro-forestry systems existing in different Agro-climatic zones in Tamil Nadu. Farm forestry programmes in the past in semi-arid regions have suffered as they did not build upon the existing agro-forestry practices of the farmers. High targets set for farm forestry and focus on achieving the targets in past led to promotion of high density plantations, rather than promoting low input tree cropping more suitable for agro-forestry. The technical package was accordingly designed to suit this, and seedlings which could be raised in 3-5 months are given priority over seedlings which require more time. As the infrastructure of permanent and hi-tech nurseries are rarely utilized for farm forestry, institutional arrangement for the raising of Multi-product Trees (MPTs) requiring longer period at the nursery stage does not exist.

The proposed approach and strategies for TCPL are based on: 1) review of best practices related to farm forestry; 2) TCPL being a stand-alone activity in most of the project villages; 3) focus on covering small and marginal farmers under TCPL and 4) conformity with the project goal of bio-diversity conservation.

The main elements of the strategy for TCPL are:

1) Financial support and incentives for creation and maintenance of plantations
2) Technical support in the form of quality planting stock and planting by forest department.
3) Beneficiary contribution and participation -- involvement of beneficiaries in planning, implementation and monitoring.
4) Cluster approach to village selection for coverage under TCPL.
5) Enlarged basket of species and planting models to suit the needs of different socio-economic, farming and agro-climatic conditions.
6) Informed choice of species and planting models by farmers.
7) Transfer of skills to (women) farmers for nursery and planting operations.
8) Capacity building of farmers for proper management of plantations.
9) Formation and strengthening of farmers institutions to facilitate extension and marketing.
10) Farmer-Industry Linkages and Wood Market Information System (WMIS).
11) Robust monitoring system

### (5) Preparation of Extension Material for TCPL

Different extension material would be needed at different times. Following materials would be prepared in the preparatory phase of the project, updated and used from time to time:

- Extension material to explain the details of the TCPL programme including the plantation models; terms and conditions related to eligibility; subsidy and incentives.
- Extension material on various agro-forestry models for different agro-climatic zones
- Extension material on uses and market (major buyers; price; product quality specification) for different tree species
- Extension material on nursery and planting techniques for different species

## (6) Overall TCPL Process

The proposed TCPL process is based on principles of good governance – participation, transparency and accountability – as well as keeping in mind the practicality and ease of project implementation and management.

The main stages of the process are:

| | |
|---|---|
| 2.1.1 | Village Cluster Selection and Rapid Appraisal |
| 2.1.2 | Procurement of Resource Organisations |
| 2.1.3 | Village Entry & Formation of Farmer Interest Groups |
| 2.1.4 | Preparation of Micro-plan for TCPL |
| 2.1.5 | Implementation of Micro-plan (Annual Action Plan) |
| 2.1.6 | Participatory Monitoring & Evaluation |
| 2.1.7 | Cluster Exit Strategy -- Facilitating support institutions and mechanisms for sustainability |

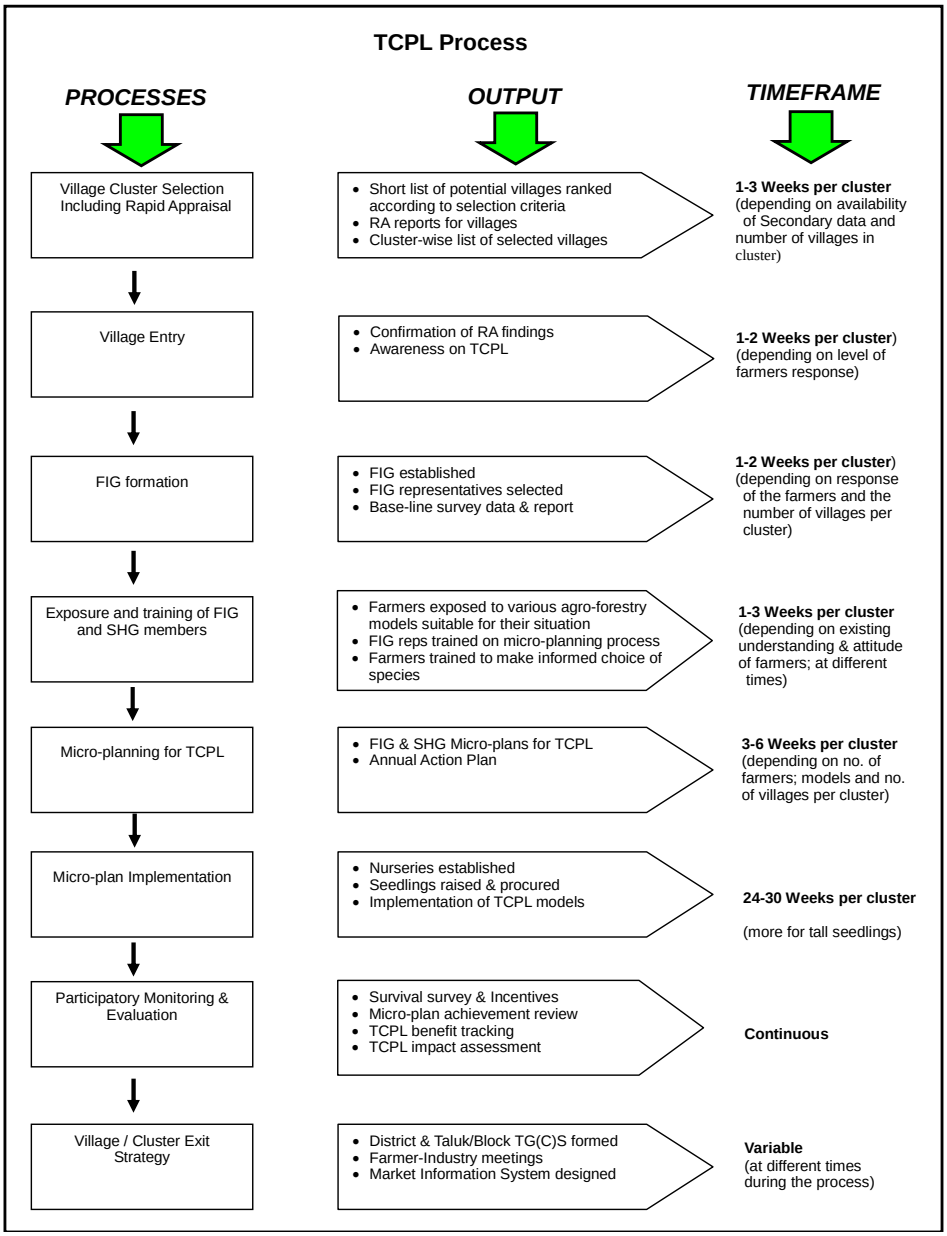



**Figure 7.1 illustrates the TCPL process by responsible stakeholders.**

### *2.1.1 Village Cluster Selection and Rapid Appraisal*

**Proposed Activities**

| | |
|---|---|
| 2.1.1.1 | Multi-criteria based screening of villages |
| 2.1.1.2 | Preparing guidelines for Rapid Appraisal (RA) |
| 2.1.1.3 | Orientation of DMU / FMU staff in RA process and tools |
| 2.1.1.4 | Rapid Appraisal of potential villages |
| 2.1.1.5 | Village-wise Rapid Appraisal Reports |
| 2.1.1.6 | Preparation of list of selected villages |

***Multi-Criteria Selection System for Cluster Village Selection***

Given the focus and characteristics of TCPL, proper village selection is critical for success a Multi-Criteria Selection System (MCSS) for Cluster village selection is proposed. Multiple criteria should be used for the initial screening of villages for TCPL related intervention. Criteria identification can be based on:

- direct relevance to the project's intervention models and focus beneficiaries;
- quantifiable from available secondary data either directly or through proxy indicators;
- should not take too long to collect or analyse

The cluster village selection would be a two stage process – 1) Screening of all villages based on secondary data to prepare the list of potential villages; and 2) Rapid Appraisal of short-listed villages to arrive at a final list of villages for TCPL.

***Initial Screening for Identifying Potential Villages for TCPL***

Following criteria are to be adopted for initial screening of villages:

1) Land availability criteria – Minimum 30 ha[15] of "other fallow" category of land is available (Source: Directorate of Statistics & Economics / Village Land Use Data from BDO / Other source)
2) Socio-economic criteria – Extent of land holding by small and marginal farmers out of the total farm land in the village (Source: Directorate of Statistics & Economics / Village Landholding Data from BDO / Other source – 2001 census)
3) Existence of SHGs in the village (Source: Office of District Collector / Other source such as State-level Agency dealing with SHGs)
4) Physical planning criteria – village to be part of a contiguous cluster of 4-6 villages all with similar high potential (Source: http://tnmaps.tn.nic.in)
5) Proximity and access to market for wood and/or non-wood tree products

[15] Could be increased or decreased if the village land use database indicates that too many or too few villages fulfill this criteria. Considering that 4,000 - 5,000 villages are expected to be covered under TCPL, it would be ideal to use the criteria that provides a list of around 8,000-10,000 villages from initial screening.

**Suggested Scores and Weighting Factor**

| Criteria | Raw Data | Score | Weighting Factor |
|---|---|---|---|
| Availability of more than one year old fallow land | >30ha<br>21-30ha<br>11-20ha<br><5ha | 1<br>0.75<br>0.5<br>0 | 4 |
| % of land owned by small and marginal category of farmers | >75%<br>61-75%<br>40-60%<br><40% | 1<br>0.75<br>0.5<br>0 | 3 |
| Proximity to wood-based industries | <50 km<br>50-100 km<br>100-200 km<br>> 200 km | 1<br>0.75<br>0.5<br>0.25 | 2 |
| Availability of SHGs | More than 3<br>2-3<br>1<br>0 | 1<br>0.75<br>0.5<br>0 | 1 |

A cluster approach for targeting villages is suggested for TCPL, with each cluster comprising of 4-6 villages (on an average five villages). Clustering of villages will have the following benefits:

(a) Ease of project logistics (extension, training, input supply, monitoring etc.);

(b) Ease of information sharing between villages leading to demonstration and spread effect;

(c) Better visibility of TCPL interventions

(d) Easier procurement by industries / joint marketing of farm forestry products by farmers especially small and marginal farmers

An Excel-based weighted scoring system can be developed to identify the potential clusters and villages.

***Preparing Guidelines for Rapid Appraisal (RA) & Orientation of DMU/FMU staff in RA Process***

The PMU would prepare the RA guideline (including RA interview guide in report format), which would be applied by the Deputy Conservator of Forest (DCF)/Range Officer (RO) led team – after training -- to arrive at a final short-list for decision on the selection of cluster villages by the CF/PMU.

***Rapid Appraisal and Final Selection of TCPL Villages***

Rapid Appraisal (RA) process is designed to confirm and update the data collected from secondary sources[16], assess the scope for different plantation models and confirm the interest of the farmers in TCPL. During RA the following would be considered as desirable criteria:

1. Estimate on the extent of fallow land available with farmers in general and small and marginal farmers in particular
2. At least 30 ha of 'other fallow' category of land would be available for inter-crop and block Plantation models
3. Interest of farmers in tree-planting on farm land, especially of small and marginal farmers

[16] Use of secondary data in any MCSS has risks, since the data may be out of date, inaccurate or incomplete. Consequently, during the RA exercises, the MCSS data could be updated from Block Development Office and/or Gram Panchayat / Village Administrative Officer (VAO) records.

4. Tree-planting practices on irrigated and dry land; presence of different types of agro-forestry models
5. Proximity and access to market for wood and/or non-wood tree products
6. Availability and number of women SHGs

FMU will prepare village-wise RA reports. DMU will consolidate the reports and submit it to PMU.

### *2.1.2 Procurement of Resource Organisations*

Local NGOs would be identified and engaged in each district on cluster basis to facilitate the process related to village entry; FIG formation; micro-planning; participatory monitoring and evaluation; capacity building and training; and facilitating farmer institutions. Organizations such as Society for Social Forestry Research and Development (SSFRD) could play an important advisory role in the process given their understanding and experience of tree husbandry practices, especially agro-forestry, in areas outside forest.

Local NGOs facilitating the field-level process would be engaged for a total of 12 months per cluster (one cluster = 5 villages), over a period of 4-5 years. In the first year they would be involved for 5-6 months and in subsequent years for 1-3 months depending upon the need.

### *2.1.3 Village Entry & Formation of Farmer Interest Groups*

**Proposed Activities**

| | |
|---|---|
| 2.1.3.1 | Awareness programmes on scope, purpose and protocols of TCPL |
| 2.1.3.2 | Preparing guidelines for Farmer Interest Groups (FIG) |
| 2.1.3.3 | Formation of FIGs |
| 2.1.3.4 | Exposure visit for FIG & SHG members |

***Village Entry & Awareness Generation on TCPL***

The VE process would serve the purpose of:

- Introducing the project/field staff to the village;
- Publication of the TCPL programme and clarifying various aspects of TCPL, including the main conditions, process, key procedures and time-frame;
- Starting the process of creating a positive attitude of the villagers for tree plantations, in general and TCPL in particular – clearing misconceptions and explaining advantages;
- Reconfirming availability of sufficient fallow land for planting

The Field Management Units (FMU) staff would organize the VE process with the help of the resource organization/NGO in-charge of the cluster. The strategy for the VE would include organizing community meetings to explain the TCPL programme and clarify the doubts; distribution of material explaining the TCPL programme; and a cultural programme on the theme of tree plantation on private land and explaining the TCPL programme. Publicity material related to TCPL, explaining its scope, objectives, criteria and conditions, subsidy and incentives, roles of forest department and farmers etc. would be prepared in advance.

***Preparing Guidelines for Farmer Interest Groups (FIG)***

The process and procedures of constituting a FIG, its role and responsibilities, its working and management norms and procedures etc. would be described in a trainer's manual that would be

prepared by an expert in community development / community-based institutions hired by the PMU. The concept is well established in agriculture sector and PMU may decide to take the help of institutions such as Tamil Nadu Agriculture University in this regard.

***Formation of Farmer Interest Groups (FIG)***

Following the VE process, a list of interested farmers and SHGs would be prepared. This could be done either in small group meetings or through household visits. The method for preparing the list would be left to the resource organization and FMU staff.

Based on the list, potential members of the FIG and the total number of FIGs to be formed in the village could be decided. The concept of FIG is more suited to small and marginal farmers – who are the focus group for TCPL -- who do not enjoy the economy of scale in their farm production system and have low bargaining / negotiating strength. Under TCPL, they FIG would play an important role in programme governance (planning, implementation and monitoring) at the village level.

In case of TCPL, FIGs would **start as an informal group of farmers** who are interested in tree plantation on their private land. It is expected that the FIG forums would evolve into more formal farmer institutions – such as Tree Grower Societies (TGS) or Tree Grower Cooperative Societies (TGCS) -- which, in turn, could play pivotal role in sustaining, strengthening and extending the programme. The project would create mechanisms and enabling conditions to facilitate such an evolution. The concept of FIG is described in **Annexure 7.4**.

Innovations are also possible in creation of FIGs and would be encouraged. Within the general interest for tree plantation, one can also identify a sufficient large group of farmers interested in some specific plantation model or species. One can also identify and constitute an FIG based on the proximity of their land taken up for TCPL. In case the number of farmers interested in participating in TCPL is large (say more than 30), the FIG could have the scope for nominating representatives to deal with various logistical matters that may arise in it's the course of planning and implementation of TCPL programme.

The FMU staff and members of the resource organization (local NGO) would be trained in the process of FIG formation and management.

***Exposure visit***

After formation of the FIGs, exposure visit of the FIG members would be arranged by DMU/FMU to identified areas within or outside the district – but within the same agro-climatic zone – to expose them to successful agro-forestry, farm boundary and block plantation models suitable for dry-land farming as well as irrigated conditions.

### *2.1.4 Preparation of Micro-plan for TCPL*

**Proposed Activities**

| | |
|---|---|
| 2.1.4.1 | Manual on Micro-planning for TCPL |
| 2.1.4.2 | Training of staff and FIG representatives in micro-planning |
| 2.1.4.3 | Base-line survey of farmers and potential land for TCPL |
| 2.1.4.4 | Participatory Assessment & Planning |
| 2.1.4.5 | Approval of Micro-plan and Annual Action Plan |

***Micro-planning Manual***

A micro-planning manual would be developed by an expert on participatory planning engaged by

PMU. The manual would describe the process and procedure as well as the tools to be used for collecting and recording data and preparing a simple report. The manual would be used to train the FMU staff and members of the resource organization / NGO engaged for facilitating the process.

***Base-line survey***

A base-line survey using pre-designed questionnaire would be conducted for farmers in the village to establis base-line for farmers and available land for monitoring and evaluation purpose. A base-line survey format would be developed by PMU (with assistance from the PMC) focusing on the socio-economic characteristics and land details including land use, area, availability of irrigation, details of existing trees on the land (dispersed or on farm boundary) etc. It is proposed to cover even those farmers who have fallow land but are not interested in TCPL.

***Micro-planning***

Micro-planning for TCPL would be a group-based exercise and relatively a simple process compared to micro-planning for JFM as no common assets are planned under TCPL. The micro-planning exercise would serve the purpose of preparing a common strategy with respect to planting – e.g. species selection -- by some if not all the farmers; building transparency in the process of selection of beneficiaries and land and result in a commonly agreed schedule for coverage of all the interested farmers over a five year period. It would also identify the training needs of farmers with respect to tree planting, maintenance and management. The micro-plan process would consist of:

- **Participatory assessment and analysis** of availability and suitability of fallow land for TCPL in the village; problems faced by farmers in maintaining and managing the plantations on farm land; suitability of land and soil for different tree species and plantation models; etc.

- **Preparation of micro-plan** on coverage of available fallow land under TCPL models – The available land in a village / cluster would be covered under plantation over a period of three to five years. This would ensure that the farmer has easy access and regular contact with the FMU staff. The plan would include farmer-wise and model-wise list and number of seedlings of different tree species required for plantation. The plan would also clarify the division of responsibilities between the FMU staff and the farmers.

- **Annual Action Plan (AAP) and Application from individual farmers and SHGs –** Based on the micro-plan, Annual Action Plan would be prepared giving details of each farmer and land to be covered during the year and number of seedlings of different species required. This would be supported with Application by farmers who are to be covered during the year in a pre-designed format. The application, among other things, would include a declaration by farmer to maintain and protect the plantation and not to harvest the trees pre-maturely.

- **Approval of Micro-plan and Annual Action Plan** – After the micro-plan is discussed and approved in the FIG meeting, the micro-plan and the AAP would be sent to the DMU/Circle CF for final approval.

Given the fact that forestry operations are time-bound and season linked, it is important that the micro-planning process is completed at least six months before the planting season begins, in order to effectively plan for raising sufficient number of seedlings for different species.

***Conditions for Selection of Farmer and Land for TCPL***

During micro-planning process, a clear understanding on criteria to be used for selection of farmers, land and/or species would facilitate quick decision and reduce the possibility of conflict over who is covered first under the programme.

Box 7 SELECTIONS OF FARMERS FOR TCPL

- All farmers are eligible but priority to be given to small & marginal farmers and women SHGs for selection as TCPL beneficiaries – they would be provided the first chance to benefit from the programme.
- Large and medium farmers to be supported for maximum 2 ha of fallow land. *To be reduced to 1 ha if the fallow land study finds availability of sufficient area of fallow land with small and marginal farmers.*
- Only farmers who are willing to plant at least 50 seedlings and groups (SHGs) who are willing to plant at least 200 seedlings would be selected as beneficiaries under TCPL. *(Note: In the on-going state-funded TCPL, a limit f at least 20 trees per farmer has been practiced but monitoring requirements are not rigorous.*)
- Only small, marginal and semi-medium farmers would be supported for Casuarina planting under TCPL

Box 8 SELECTION OF LAND FOR TCPL

- At least one year old fallow land to be prioritized for TCPL
- More than 5 year old fallow to be taken for TCPL plantation only after an assessment of natural regeneration on the site. Based on the assessment it could be taken up for gap planting without disturbing the natural regeneration / existing vegetation.
- 'Current fallow' to be considered mainly for boundary plantation and inter-cropping (agro-forestry) models
- Land suitable for dry-land farming to be avoided for growing short-rotation and quick growing species.
- Land which is already under Casuarina plantation by farmers would not be taken up under TCPL for replanting Casuarina.
- No pure Casuarina plantation would be undertaken under TCPL by a single farmer

The proposed criteria can be modified based on experience and more criteria can be added without diluting the focus on small and marginal farmers or increasing the possibility of diversion of land from agriculture.

***Species Selection***

Indicative list of species used TCPL is provided as follows:

**Indicative List of Species under TCPL**

| Group | Indicative List of Species for IFP | No. of plants / ha | Market / Use |
|---|---|---|---|
| Short rotation | Casuarina equisetifolia<br>Casuarina junghuniana | Upto 10,000 / ha | Construction works & as poles<br>Paper industry |
| Long rotation | Ailanthus excelsa | Up to 1,000 / ha | Match industry |
| | Dalbergia sissoo | | Carving industry |
| | Kaya senegalenis | | Construction industry |
| | Melia dubia | | Veneering industry |
| | Albizzia richardiana | Up to 500 / ha | Pencil industry |
| | Tectona grandis | | Furniture industry |
| | Red Sanders | | |
| | Dalbergia latifolia | | |
| | Bambusa vulgaris (thornless species) | Up to 400 / ha | Various |

List of other species used for agro-forestry for various agro-climatic zones of Tamil Nadu is provided in **Annexure 7.5** and **7.6.**

Under TCPL, it is proposed to have a proportionate mix of both the models with short rotation crop (Casuarina) constituting a maximum of 30% of the seedlings (up to 50% in case of small and marginal farmers) and a minimum of 70% in case of medium and long rotation crops (a minimum of 50% in case of small and large farmers) within the overall planting target.

Three planting designs would be followed for both the models – compact block planting; inter-crop planting and farm boundary planting. *Compact block planting to be done only more than one year old fallow land, inter-crop plantations can be taken up on 'current fallow' land as well*. Land use status is immaterial for farm boundary plantations.

Casuarina plantation would be limited to 30% of the total seedlings proposed to be planted). Miscellaneous species and timber would constitute the rest 70%. The total target under TCPL would be limited to 100 million seedlings of which a maximum of 30 million would be constituted by Casuarinas and 70 million by other miscellaneous and timber species. Proportionately, an area of 3,000 ha would be covered under casuarinas (@ 10,000/ ha) and 110,000-140,000 ha under timber and other miscellaneous species (@ 500-1,000/ ha). The total target under TCPL under two types of planting would govern the total coverage.

Box 9 CRITERIA FOR SPECIES SELECTION

- Based on climatic and edaphic factors
- Marketability and assured return
- Farmer's preference
- Multi-purpose character of tree species
- Suitability as Agro-forestry species (Intercropping)
- Bamboo could be common species planted in mix with other species

Indicative list of species used for agro-forestry for various agro-climatic zones of Tamil Nadu is provided in **Annexure 7.5 &7.6**.

Box 10 SHG PLANTATIONS

Apart from supporting individual farmers under TCPL, it is proposed to identify existing women SHGs whose members could be interested in tree-pantation on the private land owned by them or their family. The main purpose for considering SHG as a unit as well for creating TCPL plantations is to create space for women in selecting the species that is planted on the farm, which otherwise is mostly determined by men.

In case of SHG plantations, the SHG would be the unit for planning for TCPL for women beneficiaries. The SHG members would identify the list of different species they want to plant. In case of women SHG members, the conditions related to minimum number of trees per farmer could be relaxed to at least 20 trees per SHG member. The SHG members can also plant the trees in their homestead instead of farms.

In villages where the project plans for ecologically sustainable development and SHGs would be formed and supported for Income Generating Activities through loans from a Revolving Fund, further incentives could be built in the credit mechanism. For example, among other things, the eligibility of SHG for loan from Corpus Fund could be based on the SHG planting a certain number of trees. Rate of interest charged on the loan could also be used an incentive by linking it with survival of trees.

### *2.1.5 Micro-plan Implementation*

**Proposed Activities**

| | |
|---|---|
| 2.1.5.1 | Organizing farmer-industry meetings |
| 2.1.5.2 | Establishing cluster nurseries |
| 2.1.5.3 | Planting operations |
| 2.1.5.4 | On-site training of FIG & SHG members related to maintenance & management |

The implementation of micro-plans would be according to AAP and would involve following tasks:

- On-site training of farmers & SHG members on nursery, planting and maintenance techniques; on agro-forestry models, particularly different suitable agricultural crops for inter-cropping.
- Organizing farmer-industry meetings
- Establishing cluster nursery
- Procuring tall & older seedlings (for MPTs, fruit trees, bamboo) and clonal seedlings from Permanent and/or Hi-tech nurseries
- Plantation by forest department in farms.

Only quality seedlings raised from the seeds obtained from the 'Seed stands'. 'Seed Production Areas', 'Seed Orchards' and 'Plus trees', 'proven clones' would be supplied to the farmers. For meeting the needs of quality raw materials required by the industries adequate quantity of quality seeds have to be procured. Forest Department would establish the required number of 'quality seed sources' as early as possible, in a time bound manner. It is proposed to establish 100 Nurseries throughout the State for supply of quality seed and planting materials including clonal plants.

### *2.1.6 Participatory Monitoring & Evaluation (PME)*

**Proposed Activities**

| | |
|---|---|
| 2.1.6.1 | Manual for Participatory Monitoring and Evaluation and Survival Survey |
| 2.1.6.2 | Training of FIG, SHG and FMU on PME |
| 2.1.6.3 | Participatory Monitoring & Evaluation |
| 2.1.6.4 | PME Report including Seedling Survival Survey |
| 2.1.6.5 | Distribution of survival incentives |

Given the fact that farm forestry programmes in the past have also suffered due to lack of effective monitoring, it is proposed to adopt a robust monitoring and evaluation system for TCPL. The PME would be in addition to the monitoring taken up by departmental staff and would not replace it. The scope of PME includes survival assessment surveys.

The monitoring system proposed for TCPL would have following characteristics:

- Participation process and tools for monitoring and evaluation, including survival surveys
- Maintenance of paper record at the farmer, FIG and SHG level. At the level of individual farmer, a farmer card would be introduced which would contain details of farmer identification; land holding – total; total fallow; different tree species existing and planted; surviving trees as found in annual surveys; time spent in maintenance and management operations; collection of intermediate products etc. On one side of the card, the timing of the main maintenance & management operations required for the plantation could be described.

- Creation of a database on TCPL farmers, land and tree resources linked with project MIS and GIS and available to other stakeholders such as TGS and wood-based industries

An expert would be engaged by PMU to develop a manual describing the process, procedures and tools for PME including the format of Farmer Card. The manual would be used to train the FMU staff, Resource Organization staff and FIG representatives on PME.

Based on annual monitoring exercise carried out by FIG members / SHGs and Project staff, the survival incentives to be distributed to each farmer would be determined.

Box 11 SUGGESTED INDICATORS OF SUCCESS OF TCPL

- Survival percentage for different species under different models and with different category of farmers
- Diversity of species planted (species wise area coverage)
- % of small and marginal farmers covered under TCPL
- % of area owned by small and marginal farmers covered under TCPL
- Increase in tree cover
- Increase in income from sale of tree products
- Savings on purchase of fuel and fodder

Box 12 SURVIVAL INCENTIVE MECHANISM

- All categories of farmers would be eligible for subsidy and survival incentives. However, this policy can be reviewed and the large and medium farmers could be taken out of survival incentive mechanism. Instead, increased incentive could be provided to marginal, small and semi-medium farmers.
- The total survival incentive would be paid in three phases – 20% (Re 1) after 1st year; 40% (Rs. 2) after 2nd year and 40% (Rs. 2) after 3rd year.
- Farmer would be eligible for survival incentive only if minimum desired survival is achieved – 75% in 1st year; 70% in 2nd year and 60% for 3rd year.
- Maximum survival incentive amount to be Rs. 2500 per Ha. Survival incentive for casuarinas at the rate of Rs. 0.25 per plant and for other species at the rate of Rs. 5 per plant.
- Survival incentive for short rotation crop (Casuarina) to be provided at the time of second planting

### *2.1.7 Cluster Exit Strategy -- Facilitating support institutions and mechanisms for sustainability*

For farmers to adopt farm forestry as an integral part of the farming system, it is essential that the farmers are able to: 1) market the trees planted on their land profitably and without much trouble – part of which they can re-invest for planting; 2) access quality planting material or raise their own seedlings; 3) make an informed choice based on market conditions; 4) employ learnt skills to plant, maintain and manage the plantations.

Access to wood market and market information is an important concern, particularly for small and marginal category of farmers who do not enjoy the economy of scale. Past experience shows that the problem is more acute for farmers in the semi-arid regions, where the market tends to be more exploitative.

The TCPL programme makes some critical assumptions related to sustainability. They are:

1. Farmers, particularly the small and marginal farmers, would be able to sell the trees and tree-products profitably.

2. Farmers would continue to have access to quality planting material and technical support as well as finances (if required) for re-planting.
3. Farmers would get the permission for harvesting and sale of those tree species which still require TT permit (Teak, Red Sanders, etc.) without any problem.

**Proposed Activities**

| | |
|---|---|
| 2.1.7.1 | Designing and establishing Wood Market Information System |
| 2.1.7.2 | Linking FIGs with wood-based & NWFP based industries |
| 2.1.7.3 | Organising common meetings of FIG members at Taluk / Range level |
| 2.1.7.4 | Facilitating formation and strengthening of TG(C)S |
| 2.1.7.5 | Training & exposure for TG(C)S representatives / farmers / SHG members |

***Designing Wood Market Information System (WMIS)***

The PMU would engage an expert to design and test a system for collecting, collating and disseminating information related to wood market to farmers. The wood market study proposed under research sub-component would help define the scope and framework for such a system.

***Linking FIGs with wood-based & NWFP based industries***

The process of farmer-industry meetings would start even before plantations are created as this would help farmers to better understand the industry requirements. Follow-up meetings between farmers and industries could focus on sale / procurement agreements. District and taluka level meetings of TCPL farmers would be organised from time to time. 150 such meetings are envisaged at the rate of one meeting per year per district spread over five years. In order to facilitate the process, PMU would prepare 'Model Agreements' for various tree species / products and directed at different industries.

***Facilitating Formation and Strengthening of Tree Growers (Cooperative) Societies***

Farmers, especially small and marginal and those in semi-arid (subsistence farming) regions, face numerous difficulties in getting access to market and in marketing their produce. Low per capita production makes it difficult for them to negotiate and obtain better prices for their produce. Industries also prefer to deal with agencies that can ensure supply of wood in lumpsum, rather than dealing with individual farmers which increases their transaction cost.

Cluster approach adopted for selection of project villages and formation of FIGs at village-level provide the necessary conditions for emergence of farmer institutions at different levels (cluster / block / taluk / range / district) depending upon the felt need. At higher levels, these groups can take a formal shape to deal with various issues effectively. There are three options to formalize – under TM Societies Registration Act 1975; Co-operatives Act and Companies Act. Out of these, registration as society or a co-operative society are considered feasible options for farmers. Before deciding the formal institutional form, advantages and limitations associated with both the options need to be analysed and explained to farmers.

25 district level Tree Grower Societies (TGS) have been constituted in 25 districts by an NGO called Society for Social Forestry Research and Development (SSFRD) – an agency created in 1989 during the social forestry phase – during last five-six years. See **Annexure 7.7** for details on existing TGS. They are already closely linked to the Extension Wing of the forest department, and provide useful role in extension. It is proposed to institutionally strengthen the existing TGS and facilitate the formation of new TGS or Tree Growers Co-operative Societies – as the need may be – at district or lower levels (block / taluk / cluster). Resource organizations such as SSFRD and local NGOs would play an important role in facilitating the process.

Cluster, block/taluk and district level meetings of FIGs would be organised to facilitate interaction among the farmers on the issue of tree cultivation. The meetings would include themes related to sharing of experience and innovations; industry and bank linkages; need and scope for block/taluk level society. 200 cluster / taluk/block level meetings are proposed to facilitate this process.

Representatives of the TG(C)S would be provided exposure and training on topics such as management of TG(C)S; maintaining record of members and the plantations available with them; marketing of trees; accessing institutional finance for farm forestry; wood market and marketing arrangement etc.

### 7.4.2 Research on Production Forestry/ Agro-forestry/ Farm Forestry

#### (1) Approach

This sub-component is focused on conducting various types of research to contribute to the objective of increasing the natural resource base. Research activities are planned with respect to improving production in areas outside forest as well as inside the forest. The overall approach adopted for identifying the research activities is to build upon the past research and introduce new research based on emerging ideas and needs in forestry sector.

Interventions are focused on building understanding related to production forestry and agro-forestry in different agro-climatic zones. A further intervention will be to design dissemination and extension strategies for disseminating the research findings.

#### (2) Rationale

Research could play a crucial role in enhancing the natural resource base. In order to increase the supply of wood and non-wood products from natural forests as well as areas outside forest, new techniques need to be identified and standardized for creation, management, harvesting and utilization of the forestry resources. In general, research in forestry sector has had a bias on production of timber and introduction of exotics. Relatively fewer research have been conducted on technical and management aspects of agro-forestry and Non-Wood Forest Products (NWFPs). Research on agro-forestry is essential to create an effective technical and extension support mechanism for promotion of tree cultivation on private land. Similarly, there is a need to understand the procedures involved in NWFP based management of natural forests and creating multi-storey forest resource in order to improve the resource base.

Research is also required to understand the context and dynamics related to agro-forestry and farm-forestry in order to be able to informed planning and extension for tree cultivation on farmland. The Project provides a major opportunity to undertake research on agro-forestry which, till now, has been a neglected area. It also provides opportunities to better understand the context for farm forestry through various studies.

**Table 7.2** summarized the features of the proposed research activities.

#### (3) Strategies

***2.2.1 Research on timber production***

Quality seeds, good planting material, and clones of desired qualities, high growth rate are essentials to raise good plantation timber. So seed production areas, seedlings/ *clonal* seed orchards, second generation seed orchards, *clonal* banks, hedge stool nurseries *clonal* evaluation trials in different localities for important timber species like *Teak, Kumil, Neem, Rosewood, Vagai* are necessary.

Experiment on effect of vegetation on local temperature and air in the vicinity of certain tree species and its effect on convectional rainfall. Soil carbon in various forest types and rhizospnere engineering studies would be conducted. This study will under take through a reputed research institution.

**Proposed Activities**

| | |
|---|---|
| 2.2.1.1 | Second generation and First generation seed orchards, seed stands Seed Production areas. |
| 2.2.1.2 | Hedge stool nursery for clones of species taken |
| 2.2.1.3 | Clonal evaluation trials and progeny trials |
| 2.2.1.4 | Production of clonal plants |

### *2.2.2 Research on fuel wood production*

Fuel wood is used by people in villages and by urban poor. The producer gas obtained from fuel wood can be used to generate power. The Research wing has carried out research in past to identify suitable species for use in gasifies. Based on those findings, it is proposed to create energy plantations of suitable species in private farm lands. The research would be carried out in areas where gasifies are increasingly being used to generate power.

### *2.2.3 Research on Agro Forestry*

Evaluation of different crops as inter crops, effect of irrigation on tree species and agricultural crop, growth rate of tree species, genetic combing for ideal tree species and cultural package for NTFP species will be tested by the research wing. While the following short rotation trees will be taken up for block planting, long rotation species and NTFP species will be tested for their efficacy in block as well as bunds. Shade on the field tolerant crop varieties will be assessed. The object of the experiment will be to get maximum return to the farmer through appropriate combination of agri-silviculture.

***Short Rotation Species*:** *Casuarina equisetifolia; C. Junghuniana; Eucalyptus tereticornis*

***Long rotation Species*:** *Tectona Grandis; Dalbergian latifolia; Peterocarpus marsupium; Ailathus excelsa; Melia dubia; Dalbergia sissoo; Adina cordifolia; Bambusa bamboos; Dendrocalamus strictus; Albizzia lebbeck; Azadirachta indica*

***NTFP Species*:** *Derris indica; Sapindus emarginatus; Bassia latifolia Terminalia chebula; Emblica officinalis*

Agricultural crops may be pulses, oil seeds, paddy, vegetable and other cereals. Experiments may be laid as on farm and off form trials. The data collected from these experiments would be used for bio-mass production and carbon trading.

**Proposed Activities**

| | |
|---|---|
| 2.2.3.1 | Evaluation of agriculture crops as inter crop - effect of irrigation on tree species and agri crop, growth rate of tree species, Genetic Combing of Agro Forestry tree species, cultural package for NTFP Species. |
| 2.2.3.2 | Multiplication of clones through micro and macro propagation |
| 2.2.3.3 | Fruit yield table for NTFP species in Agro Forestry |
| 2.2.3.4 | Post harvest technology and timber testing and treatment for various immature timbers grown under Agro Forestry. |

***Consolidating old research findings on agro-forestry for extension***

A compendium of various tree-species suitable for farms with suggested agricultural crops as intercrops based on old research would be prepared for irrigated and dry-land farming conditions for all the seven agro-climatic zones. The compendium would also provide the planting model options and their management requirements. This compendium would be used to inform the farmers to make appropriate choices for their land with respect to their adoption of agro-forestry models.

### *2.2.4 Research on bamboo*

Bamboo is a multi purpose species. There are about 126 Species of Bamboo available in India of which 19 are found in Tamil Nadu. The most abundant species are *Bambusa bamboos and Dendrocalamus strictus*. Now *thornless bamboos* have been introduced and on farm trials have been conducted. Species such as *Bambusa nutans, Bambusa vulgaris, Bambusa balcoa* have been propagated. New research needs would be identified in relation to bamboo as intercrop and its association with different agricultural crops.

**Proposed Activities**

| | |
|---|---|
| 2.2.4.1 | On farm trials and off farm trials of various bamboo species including introduction of bamboo species, reeds, canes in various forest types |
| 2.2.4.2 | Standardization of protocol medium in tissue culture lab |
| 2.2.4.3 | Standardisation of rooting technique for Macropropagation |
| 2.2.4.4 | Bamboo as reinforcement material - Partially replacing steel |
| 2.2.4.5 | Multiplication of 10 Bamboo varieties. |

### *2.2.5 Research on bio-fertilizers*

Bio-fertilizers like *phosphobacteria, Azotobactor, Rhizobiums* and *VAM, Vermicasting* are being produced in the laboratory of Modern nursery division at Dharmapuri. Isolation of particular strain of bacteria has to be done for different tree species in the laboratory. The upgradation of lab is necessary. Scientist are to be appointed for continuity of work and further research. During 2004-05, 114 tonnes of Bio fertilizers was produced. VAM was also produced to the tune of 61 tonnes. It also produces Bio-control Agents *Trichoderma viridi* and Pseudomonas, *flurencens* besides 426 tonnes of *Vermi* casting.

As further improvement, strains of bio-fertilizers have been identified with respect to different tree crops. Now attempts are being made to isolate the strains associated with plus trees of several tree species like *Derris indica, Tamarindus indica, Bambusa bamboos, Terminalia chebula, Sapindus emarginatus* etc.,

**Proposed Activities**

| | |
|---|---|
| 2.2.5.1 | Isolation of Phosphobacteria, Rhizobium and VAM |
| 2.2.5.2 | Establishment of Sandal seedlings with inoculation of Bio-fertilizers |

### *2.2.6 Research of Afforestation of problems sites*

Saline-alkaline soils, areas with boulders, areas with underlying sheet rocks and with shallow soil depth or simply sheet rock are difficult sites for tree growing. Such conditions prevail in many parts of the state. Trials will be conducted to bring these sites under some sort of trees growth. The bouldery site is having the problem of poor retention of moisture, shallow soil, fire etc.

Planting on dumped soil, at place where underlying rock is having veins or fissures would have chances of the root of seedlings going deep and helps in establishment of plant. Species suitable may be *Ficus retusa, Ficus religiosa, Ficus bengalensis, Ficus mysorensis, Gyrocarpus jacquinii* etc., Experiments on height of contour walls, width of saucer bounding, and drilling holes in rock fissures, type of contour wall with species variability will be carried out.

**Proposed Activities**

| | |
|---|---|
| 2.2.6.1 | Growing vegetation on sheet rock, tree growing on bouldary site with different SMC measures |

### *2.2.7 Research on wood market (Assessment of wood market characteristics in Tamil Nadu)*

Profitable marketing of farm forestry crop is key to its adoption as part of the farming strategy by farmers. Past experience has shown that unplanned extension of farm forestry focusing on some species has created supply glut leading to collapse in market price. A wood balance study was conducted in Tamil Nadu in the year 2008 to understand the demand-supply gap for fuelwood and timber in household, industrial and services sector. However, the study did not assess the present and future demand for wood by different industries – pulpwood, plywood & veneer, matchwood, etc. Such an understanding is critical to identify the coverage of area targeting different industries and species under TCPL.

The objectives of the study on wood market in Tamil Nadu would be to:

- **Understand the present and future market demand** – Assess the volume / quantity of wood required at present and in future by different categories of industries – pulpwood; veneer & plywood; construction & furniture; matchwood; pencil; biomass-based power generation etc.
- **Understand the different supply sources** – Assess the volume / quantity of wood required by various industries from government plantations; farm forestry; captive plantations and import from other states and countries; analyze the procurement system adopted by different industries procuring wood from farmers.
- **Understand the robustness of the wood demand** – Analyze the stability of the wood demand with respect different supply sources; trend towards use of wood substitutes and alternatives; new and emerging industrial uses of bio-mass etc.
- **Understand the wood market prices** -- Analyze the trend in market price for wood needed by different industries – farm gate / mill gate; analyze factors influencing the price for selected species.
- **Understand the characteristics of wood needed by industries** – Quality specifications specified for wood used by various industries

The market study would also help list various wood-based industries and their association, which could be useful in making informed choice on species and area coverage for IFP to cater to the needs of wood-based industries and developing strategies for facilitating farmer-industrial linkages. It would also help to design a Market Information System.

An expert (agency), experienced in market research would be hired by the PMU to undertake the study during the preparatory phase of the project.

### *2.2.8 Research on Prosopis juliflora (Study on ecological impact of Prosopis infestation on common and fallow land including commercial/consumptive use)*

Infestation of Prosopis julifora in natural forest as well as in areas outside fallow land is being treated

as a problem. Studies have been conducted on socio-economic aspects of Prosopis infestation in Tamilnadu. However, there is little understanding on the ecological implications of Prosopis infestation. Such a study could inform the public policy and the project strategy related to Prosopis juliflora.

It is proposed to conduct this study by hiring an expert agency in the preparatory phase of the project.

### *2.2.9 Research on Multi-tier forest management*

The productivity of regenerating natural forests can be enhanced by optimal utilization of the space through introduction of multi-tier forest management system. It is proposed that sites in different agro-climatic zones would be identified, preferably in areas under JFM.

**Proposed Activities**

| | |
|---|---|
| 2.2.9.1 | Introduction of under storey and middle storey crops in natural forest plots |
| 2.2.9.2 | Silviculture and management of the multi-tier forest |

### *2.2.10 Research on NTFP management*

The Non-wood forest produce (NWFP), originating from diverse sources ranging from large plants to micro flora consisting of heterogeneous products, constitute a critical lifeline for poor forest dwellers by providing them family sustenance and livelihood. But, due to ever increasing anthropogenic pressure, commercialization and globalization coupled with inappropriate harvesting regime and not so clear tenure rights, the NWFP resource base has degenerated, depleted and declined. Poor information base, disaggregated nature of activities, economic weakness and lack of collective bargaining power of the NWFP gatherers has resulted into institutional neglect by government agencies and NWFPs are given low priority with national planners, policy makers and forest managers.

Sustainable management of NWFP including MADP is an upcoming activity of the forest management. By and large timber has been the main focus of forest management and accordingly tools and techniques of classical forest management catered to this requirement. However many of the tools and techniques developed for timber are not applicable to NWFP and MADPs. Hence the necessity of evolving a sustainable NWFP development programme which could simultaneously address the twin issues of biodiversity conservation and poverty alleviation.

**Target Area**

One site under JFM per agro-climatic zone.

**Proposed Activities**

| | |
|---|---|
| 2.2.10.1 | Develop resource assessment methodologies |
| 2.2.10.2 | Establishing Non-destructive harvesting regime for different NTFPs |
| 2.2.10.3 | Grading, processing and value addition of different NTFPs |

As NWFPs are sourced, derived and extracted from different parts and types of plants, they have varying and complex requirement for their resource management, harvesting, post harvest treatments, processing and marketing. Some important parameters relating to sustainable management of NWFP are woven around three considerations:

1. When to harvest?

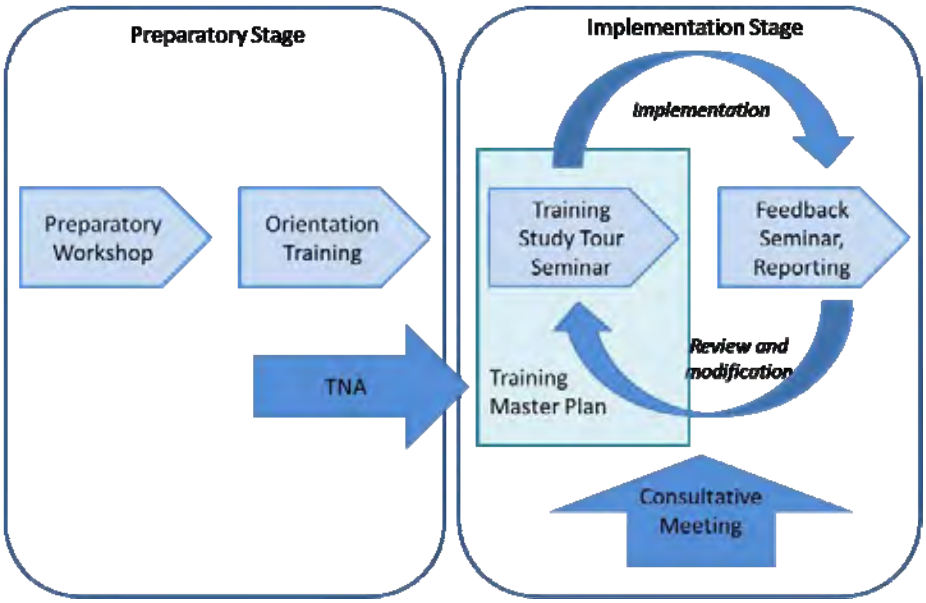
2. How to harvest?
3. How much to harvest?

## 7.5 Capacity Development

To develop the capacity of the staff for smooth implementation of the Project, a series of capacity development programmes such as training, workshops, study tours (field visits) and consultative meetings will be held during the project period. The aim of the capacity development is not to train a number of multi-task personnel but rather to foster "specialist" staff within the TNFD. Selected topics and lessons will be given to the identified persons considering their interests and assigned tasks in order to develop enough knowledge and skills. The PMU will maintain the personal information and training records of all the staff involved in the project implementation, and use these data for selection of the training candidates. The Project Management Consultant (PMC) will assist the PMU in following planning and executing the capacity development programme for the Project:

- Prepare an annual training schedule and training programmes/modules
- Develop a training manual, syllabus, and training materials
- Identify and select external resource persons/institutions to provide specialised inputs to the training
- Execute training programmes
- Conduct post-training evaluation and suggest improvements

The overall implementation process of the capacity development is illustrated below.




**Cycle of Capacity Development**

### 7.5.1 Training Needs Analysis (TNA)

The Survey Team developed tentative capacity development framework and training modules based on a brief technical knowledge and managerial skill analysis. For in-depth evaluation especially on technical knowledge and skills on biodiversity conservation of TNFD staff as required for the Project implementation and management, TNA will be undertaken through questionnaire interview to all levels of TNFD personnel, including faculty of the Tamil Nadu Forest Academy (TNFA) and Tamil

Nadu Forestry Training College (TNFTC), staff of Forestry Extension Centre, and men and women from the project villages. The TNA will be outsourced to a resource organization (experienced consultants/firm/organization) that has expertise on the subject matter. The PMU will select the service provider for the TNA through local competitive bidding.

To make more effective use of the Project period, orientation and other thematic training courses will be imparted based on the tentative capacity development framework. The TNA will identify the gap between required skills and knowledge for the Project and the existing skills and knowledge of the Project staff, which consequently lead to identifying the contents, modules, methodologies and curriculum for training. The findings from the TNA will be utilized for the enhancement and improvement of tentative capacity development framework and preparation of training master plan.

With the assistance from the service provider of TNA, the PMU will prepare a comprehensive training master plan which spells out the overall capacity development framework to be provided to staff members of TNFD and other stakeholders during the project period. The PMU will also prepare the annual training calendar and budget plan in line with the master plan. Said plan will be reviewed by PMU after the annual consultative meeting, while the annual training calendar and budget plan will be prepared for every financial year.

### 7.5.2 Knowledge and Skills Development

Training will be conducted by TNFA, TNFTC, and other government/private institutions/organizations. The selection of the training service provider will be basically done by PMU through local competitive bidding. Some of the training will be undertaken directly by TNFD through TNFA and TNFTC. The PMU will draw up the selection criteria, short-list of training service providers, and their terms of reference (TOR) specifying the roles and responsibilities of the training service provider. The PMU will select the most appropriate institution/organizations as the service provider for the Project based on the selection criteria.

While the TNA will be conducted by external experts/institutions and to be completed by the end of the first year, the capacity development program will start from the 1st year based on the tentative capacity development framework.

**Table 7.1** lists the proposed orientation and training activities.

**(1) Preparatory Workshop**

The PMU will organize preparatory workshops in the circle level. The workshops aim to grasp the level of understanding of TNFD staff and other stakeholders on topics related to the Project (biodiversity and TCPL), and their expectation to the orientation training. Participants to the workshops include senior officers and frontline staff of TNFD, ministerial staff, and potential resource organizations. The PMU will then develop strategies, training materials, and target-wise module for the orientation training.

**(2) Project Orientation**

Orientation training for staff members of PMU, DMUs and FMUs will be mainly imparted at the TNFA and TNFTC. Orientation will be organized by the rank of the target groups so as to develop deeper understanding of the roles and responsibilities of each group in the Project. As the space to accommodate number of trainees in the above institutes is limited, the participants to the orientation training will later organize in-house orientation at the Circle level to share the leanings with other staff members.

### (3) Basic training (thematic and managerial trainings)

Refresher training and managerial training for PMC, DMU, and FMU staff, including ministerial staff, will be organised by the PMC, and carried out by TNFA and TNFTC. Thematic training aims to provide specific skills and techniques, such as extension work and participatory approaches, mainly to the frontline staff. The thematic training will be outsourced to training institutes such as the Gandhi Gram Rural Institute.

### (4) Training on GIS and MIS

Considering the importance of the MIS and GIS in the implementation of the Project at various levels, training will be imparted in a structured manner. The MIS training consists of three levels of trainings, namely, paper-based MIS, software-based MIS, and MIS master's training (TOT) for smooth flow of information from micro level to macro level without any loss of information. Similarly, training on GPS and GIS will be undertaken to enhance collection of quality data and to increase the capacity of GIS data management at the division and circle level. **Annexure 7.8** provides more detailed proposals for GIS and MIS trainings.

### (5) Exposure Visits (Domestic)

The PMC will organize study tours to similar projects for selected Project staff, for the purpose of sharing experiences with the staff in other projects and encouraging cross-learning. Feedback sessions will be organized after the tours so that the learning from these tours can be shared with other Project staff. The tours will be planned and undertaken by PMU and concerned DMUs and forestry extension centres.

Study tours would be organized both at international and national levels to expose the participants to innovative initiatives and practices. The participants to the study tours shall be selected among the PMU/DMU/FMU staff involved in the project implementation related to the topics offered by the tour. The proposed study tours and their destinations, such as the 'Study Tour on Dugong in Australia and Orissa', are subject to change. The need-based study tours will be organized during the implementation. Participants to the study tours will submit tour reports and organize in-house feedback meetings at the PMU or circle level to share the learning with other TNFD staff.

### (6) Overseas Trainings and Study Tours

A total of 18 international trainings, such as biodiversity management, eco-tourism, GIS, participatory research, carbon sequestration, EIA, etc, will be organized during the Project period. These trainings aim to expose the participants to innovative practices and international standards. The participants to the overseas trainings shall be selected among the PMU/DMU staff involved in the decision/policy-making or project implementation related to the training topics. Feedback sessions will be organized after the training so that the learning from these tours can be shared with other Project staff.

Selected officers working in the Research Centre, Forestry Extension Centre, and TNFTC and TNFA will have opportunities to attend international training. The candidate will submit a training plan describing objectives, module, rationale, and budget for the training. After returning from the overseas training, the participants shall organize feedback seminars at the PMU level to share the learning and experience with other TNFD staff.

### (7) Training to VFCs, EDCs and Communities

Several trainings and exposure visits are planned for VFCs and EDCs members and communities under the three main components – Biodiversity Conservation, Increasing the Natural Resource Base, and REDD Plus Pilot Project. These training and exposure visits will be organized with the assistance

of resource organizations.

### 7.5.3 Workshops and Conference/ Seminars

The PMU will organize two national seminars and two international workshops in 2nd, 4th, 6th and 8th years. These seminars and workshops aim to share experiences and encourage cross-learning among participants. The seminars and workshops will invite forest officers and scientists from other states, including those implementing JICA projects, on the following themes; i) Biodiversity Conservation; ii) Trees Outside Forests; iii) Production Forestry; iv) Tribal Development; and v) Frontier Technologies in Forestry.

Selected officers working in PMU/DMU/FMU and Research Centre, Forestry Extension Centre, and Training College and Academy will have opportunities to attend international seminars and workshops on biodiversity conservation, forest management, and increasing green cover, and present their technical papers. Final paper shall be submitted to relevant journals for publication.

### 7.5.4 Review Meetings

Annual consultative meetings will be held at the state level and biannual consultative meetings at circle level. The meetings shall be organized in informal settings without formal ceremonies in order to encourage free and open discussions among participants. The main objectives of the meetings are to:

i) Exchange views, ideas, issues, and learning among staff and other stakeholders involved in the Project implementation,

ii) Identify technical, social and managerial issues/problems hampering proper implementation of the Project,

iii) Study best practices cases and lessons learned, and

iv) Provide feedback for incorporation into the annual action plan in order to address the issues and problems identified.

#### (1) Annual Consultative / Review meeting at the State Level

This annual meeting will be chaired by the Chief Project Director and attended by PMC staff, representatives from DMUs, forestry extension centres, project consultants, and resource organizations. The meetings will includes keynote speech by Project Director, presentation by all circles followed by questions and answers. After the annual review process is completed, the PMC will produce an Annual Review Report which will be circulated to Project staff, which will be submitted to the State Government, other relevant stakeholders, and JICA.

#### (2) Biannual Consultative / Review meeting at the Circle Level

The circle level consultative meetings will be organized and chaired by Chief Conservator of the respective circle. The meeting will be attended by DMU staff, representatives from FMU which are involved in the Project implementation, representatives from resource organizations, other relevant departments, and community-based organizations (EDCs, FIGs, SHGs). The year-end circle level consultative meetings will be followed by a state level meeting.

### 7.5.5 Enhanced Outreach and Environmental Education

#### (1) Website Creation

Two types of Project websites would be developed:

(i) a project website which features the background of the project, project organization, plan and progress, newsletters, image gallery, procurement information, featured links, comments, and contact; and

(ii) an ecotourism website which provides ecotourism information of the project, including features of each ecotourism site, access, and infrastructure available, snapshots of ecotourism sites, etc.

The websites would be developed in Tamil and English. The tasks for the website design, development and maintenance will be outsourced to a competent agency. National Informatics Centre (NIC), Government of India, is a good option, because due to its large infrastructure, it is capable of maintaining the website in a sustainable and cost-effective manner over a long period. The administrative access for editing and uploading will be with the PMU, which will be responsible for providing contents for the website.

**(2) Publicity Activities**

This activity will be conducted at the division level with a view to raise awareness amongst the general public about the importance of biodiversity conservation and tree planting in their daily lives, and to encourage them to conserve nature, forest and environment. The activities will include:

- Wall painting
- Conducting exhibition
- Setting up publicity boards

**(3) Awareness Generation**

The project will organize eco education to school children and teachers in the state to have them understand the importance of conserving terrestrial and marine biodiversity. Street plays and puppet shows will also be conducted on special occasions such as Environmental Day or Biodiversity Day.

**(4) Publications**

The PMU will publish and circulate newsletters biannually to provide stakeholders with news, work progress, photographs and insights. The newsletters will be prepared mainly in Tamil. The newsletters will be edited and designed by specialized publishers to achieve professional quality, and 2,000 copies (colour, A4 size) will be produced biannually. Pamphlets and posters on the overview of the project as well as issues such as biodiversity conservation, eco-development, ecotourism, TCPL, and REDD Plus will be prepared in Tamil for distribution to EDCs, community members and the general public to disseminate relevant information. Limited copies of project-related guidelines, manuals and annual reports will also be printed for circulation to JICA, relevant ministries and departments, and key stakeholders.

The project will procure handy and digital cameras for the PMU, DMU, FMU, and extension centres in order to document field activities, achievements and impacts of the project in digital formats. The PMU will outsource preparation of a project videography to professionals who will document the project activities and accomplishments in video.

## 7.6 Supporting Activities

### 7.6.1 Monitoring and Evaluation

#### (1) Monitoring & Evaluation

The Project is designed on the assumption that project interventions, in general will lead to conserve biodiversity together with ameliorating ecosystems and sustainably use these resources to facilitate alternate livelihoods, and to increase natural resource base outside recorded forest area.

The emphasis of the project M&E system will be to monitor and evaluate project activities in a timely manner in order to (i) track project activities progress, (ii) identify what is working well and what is not and help management during the course of implementation, (iii) evaluate the performance of activities and various institutions, and (iv) estimate project impacts and results on-the-ground. M&E will emphasize stakeholder participation and be designed to facilitate rapid identification of shortcomings and problem areas and facilitate mid-term corrections, where necessary, to project design and/or implementation arrangements to ensure that the project meets its goal and objectives. Systematic M&E will be carried out under the project to monitor performance of the project interventions, and to ensure that lessons learned are used throughout project implementation.

M&E being integral part of project management will require adequate resources, including budget, institutional capacity, clear institutional responsibilities, and reporting mechanisms. It will be important to build capacity and incentives to collect, use, maintain and analyze data for monitoring and evaluation. Since, M&E will require additional capacity, work and budget beyond the lifetime of the project it is important to TNFD develop phase-out strategy so that M&E plans can be resourced sustainably. (Refer **Annexure 7.9 M&E Plan** for further details)

#### (2) Operation and Effect Indicators

Indicators are basically measures of project progress towards realization of project goal and objectives. Therefore, the logical framework for working out the indicators is built primarily on the goal and objectives of the project, which includes improving biodiversity including ecosystems, tree cover outside forest areas and facilitates alternative livelihoods. The three project components considered are: biodiversity conservation; increasing the natural resource base; and capacity development. Pilot on REDD plus has not been considered under the result areas. Hence, the indicators also have to be logically organized in terms of these components. The proposed project results chain (indicators) is given in a table below

M&E plan considers four set of indicators viz., (1) Outcome indicators, (2) Effect indicators, (3) Operation indicators, and (4) Monitoring indicators and includes MIS and GIS initiatives proposed under the project and would be utilized to make assessment of project implementation and performance.

Four result areas have been identified that summarize key impact areas expected from project design and reflect interrelated and interdependent social, economic, and ecological elements of sustainability. Collectively, the result areas provide a monitoring and evaluation (M&E) framework for gauging project progress towards sustaining the multiple uses of its resources in perpetuity and for assessing contributions to social, ecologic, and economic systems in the project area. Desired conditions to be monitored would be logically organized in form of indicators under each result area.

**Outcome, Operation and Effect Indicators**

| **Overall Goal:** The project aims to conserve biodiversity and increase the natural resource base, thereby enhancing the State's ecological security and socio-economic well-being. | | | |
|---|---|---|---|
| **Outcome Indicators** | **Current (2010)** | **Expected (2019)** | **Target Area** |
| • % increase in family-income of target beneficiaries compared to non-beneficiaries from Eco-development ventures | 0% | >30% | 30 villages situated on the fringes of the following Protected Areas; 25 ecotourism sites; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • Increased grasslands area | x ha | >20% | Guindy National Park (2.8 $km^2$)and Vallanadu Blackbuck Sanctuary (16.4 $km^2$) |
| • Improved water retention capacities of water-bodies in natural areas | x days in June | >10% | 16 sites: 6 PAs and 10 RFs within Elephant Reserves |
| • Increase in cropping intensity | x% | >20% | Agriculture field adjoining forest areas |
| • Additional area under plough | x ha | >20% | Agriculture field adjoining forest areas |
| • Reduction in pressure on natural areas (measure change) | x% | >15% | 88 villages spread over the state of Tamil Nadu; 63 project villages covering sites abutting Protected Areas ; and 30 villages situated on the fringes of the following Protected Areas; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • Increase in family-income of target beneficiaries compared to non-beneficiaries from sale of tree products | 0% | >30% | 5,000 villages spread over 32 districts in the state |
| • Reduction in household expenses on fuel, fodder, etc. | 0% | >30% | 5,000 villages spread over 32 districts in the state; and 88 villages spread over the state of Tamil Nadu; 63 project villages covering sites abutting Protected Areas ; and 30 villages situated on the fringes of the following Protected Areas; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • % of household adopting alternate and efficient energy sources | 0% | >40% | ditto |
| **Operation Indicators** | **Current (2010)** | **Expected (2019)** | **Target Area** |
| **Component 1: *Biodiversity Conservation*** | | | |
| • Established Eco-development ventures | 0% | >90% | 30 villages situated on the fringes of the following Protected Areas; 25 ecotourism sites; and 33 villages that are located around Reserved Forests that are part of the Elephant Reserves |
| • Reduction in incidences of fire, poaching and encroachment | 0% | >90% | 16 protected areas for project interventions |
| • Reduction in incidences of wildlife destroying agricultural crops | 0% | >90% | 16 protected areas for project interventions |
| • Per cent of land cleared of invasive species | 0% | >90% | 14 sites: 4 PAs and 10 divisions in Elephants Reserves |
| • Proportion of turtle eggs hatched and hatchlings released to sea | | >0.70 | 8 districts in east coast (dugong and sea turtles) |
| • Bird species diversity and population sizes of migrant species at BSs | | increase | 11 Bird Sanctuaries |

| | | | |
|---|---|---|---|
| • Increase in blackbuck population in Vallanadu Sanctuary | >20% | >30% | Vallanadu Blackbuck Sanctuary (16.4 sq.km) |
| • Operational eco-tourism sites | 0% | >90% | 25 ecotourism sites; |
| • % of tribal population benefited by project | 0% | >30% | 33 tribal villages peripheral to RFs |
| **Component 2: *Increasing the Natural resource base*** | | | |
| • Increased tree cover outside recorded forest areas | 0% | >30% | 5,000 villages spread over 32 districts in the state |
| • Increased availability of fuel wood | 0% | >30% | ditto |
| • Survival percentage under different models over years by farmers category | 0% | >90% | ditto |
| • % of small and marginal farmers covered under TCPL | 0% | >90% | ditto |
| • % of area owned by small and marginal farmers covered under TCPL | 0% | >80% | ditto |
| • Number of tree planted by species and model | | >90% | ditto |
| • Number of SHGs/ FIG associated with tree plantation | | >90% | ditto |
| • Area planted by SHGs/ FIG associated under TCPL | | >90% | ditto |
| **Component 3: *Capacity Development*** *(including institutional and infrastructure capacity)* | | | |
| • Number of persons trained by skill and themes | 0% | >90% | PMU, project division and field unit staff; community, farmers, other stakeholders |
| • % of community institutions (EDC/ VFC) that could raise funds through conversion | 0% | >40% | VFC/ EDC implementing project |
| • % of Civil Works completed | 0% | 100% | Project areas |
| • Institutions established and strengthen with infrastructure | 0% | 100% | Project areas |

### (3) M&E Framework

As the project is being implemented in different forest divisions and on private lands interventions will be completed in a phased manner, the M&E system will enable the project to take any remedial action as project implementation proceeds. M&E system will have following eight key elements, and PMU would ensure to put the system in place.

1) Web-enabled Management Information System (MIS) – results to be integrated with GIS
2) Computerized Financial Management and Accounting System (FMAS)
3) Periodic Reviews and Assessments
4) Short Studies
5) Baseline and Socio-economic Impact Evaluation Surveys - M&E by external agency
6) Participatory M&E by community
7) Social Audits including Grievance Redressal Mechanism
8) Video and photo documentation

M&E will be undertaken in parallel by various entities. Various implementing units viz., forest divisions (Territorial and Wildlife, Social Forestry and Extension), circles, forest research and training institute, line departments, and the PMU will regularly monitor and report the physical and financial

inputs and outputs of project activities. PMU will coordinate with the PROJECT RANGEs and support organizations (NGOs, institutions etc.) through PROJECT DIVISIONs and Circles in monitoring the activities. The involvement of project beneficiaries will also be explored in monitoring and reporting activities at the local level. The CBOs members/ representatives will be trained to use simple tools to monitor project progress and impacts and discuss implications.

The responsibility to manage and analyze data generated during project implementation would be with M&E Cell established for project purposes. PMU will have in-place a web-enable monitoring information system (MIS) to consolidate and manage data received from the various implementation units/ agencies, and to collect its own data. The MIS software would have feature to integrate data with GIS to undertake spatial analysis. In addition, PMU will also develop computerized Financial Management and Accounting System (FMAS), and use it for efficient management of funds and generating statement of expenditures at all operational levels. Data will be used to update the indicators of the project to input into the monthly, quarterly, and annual progress reports. Use of GIS and other modern information tools will help collate, compare, analyze, and visualize the information.

### (4) Progress Monitoring

A system of undertaking periodic reviews and annual assessment would be one of the important elements of the proposed M&E system. The periodic reviews are suggested at all phases of the project implementation, viz., during planning, implementation, and operation and maintenance phases. PMU would review the project implementation **every month** utilizing reports generated through MIS and FMAS.

In addition, PMU would undertake **annual assessment** to be carried out using a set of parameters clearly identified well in advance. Concurrence on these parameters will be obtained from Governing Body prior to initiating this exercise.

The project will enlist the services of an independent external M&E agency for the duration of the project, to monitor the progress of project activities, and carry out periodic impact evaluations at various intervals (annually, mid-term, end of the project). The M&E agency will prepare and undertake a baseline survey with collaboration of the project units/ forest department, collect data on the key project indicators using agreed upon (with PMU) statistical sampling from project sites/ areas and districts under the project, and assist with documentation for project reporting and lessons learned. The Baseline for the project will be developed by PMU with inputs from surveys and analysis from the M&E agency. Baseline will also capture situations in control villages for making comparisons during evaluations exercise.

**Monitoring Plan**

| *Year* | *Yr.1* | *Yr.2* | *Yr.3* | *Yr.4* | *Yr.5* | *Yyr.6* | *Yr.7* | *Yr.8* |
|---|---|---|---|---|---|---|---|---|
| **Village Selection** | ● | | | | | | | |
| **By External M&E Agency** | | | | | | | | |
| **Baseline (Socio-economic) (before implementation is initiated)** | Baseline | | | | | | | |
| **Socio-economic Evaluation/ Assessment /1** | | | | Mid-term | | | | End-term |
| **By Consultants/ Institutions** | | | | | | | | |
| **Studies/ Short Studies** | ● | ● | ● | ● | ● | ● | ● | ● |
| **In-house** | | | | | | | | |
| **Periodic Reviews** | ❖ | ❖ | ❖ | ❖ | ❖ | ❖ | ❖ | ❖ |
| **Annual Performance Assessment (APA) – as a part of Periodic Reviews** | | ● | ● | | ● | ● | ● | |

| *Year* | *Yr.1* | *Yr.2* | *Yr.3* | *Yr.4* | *Yr.5* | *Yyr.6* | *Yr.7* | *Yr.8* |
|---|---|---|---|---|---|---|---|---|
| **Annual Project Status Report (PSR)** | ● | ● | ● | ● | ● | ● | ● | ● |
| **Project Completion Report (PCR) /2** | | | | | | | | ◆ |

/1 the actual timing for conducting mid-term and end-term would be guided by JICA
/2 To be coordinated by PMU with inputs from the reports submitted by other agencies involved in various studies and the M&E agency

### (5) Progress Reporting

PMU will furnish to the JICA quarterly progress reports and annual report at completion of fiscal year. PMU will develop templates for reporting during first six months of project commencement discussing in-house, and if necessary organize workshop to finalize reporting templates, and obtain concurrence from JICA. These reports will include: (a) up-to-date physical and financial expenditure data by components/ sub-components compared to annual and end-project targets; (b) updated indicators of project performance compared to annual and end-project targets; (c) successes and problems encountered during the reporting period, with suggested remedial actions, (d) observation and recommendations of external M&E agency, and; (e) socio-economic and environmental impacts of the project[17] .

In addition, the Annual Action Plan (AAP) will be prepared and submitted to JICA for information prior to the upcoming fiscal year, and will have synergy with overall project implementation schedule. PMU will establish a system of preparing demand responsive AAP to plan and implement intervention as per situations and capacities with implementation units. To generate a demand responsive AAP, PMU will prepare a timeline, provide necessary guidance and support, and regularly follow-up with lower units to compile annual plan. This process should get initiated at lowest operational level in the month of October and PMU should compile the AAP by February so that after obtaining necessary approvals budget is available from April onwards. Preparing demand responsive AAP would require capacity development of the project staff and institutions at each operational level.

Annual Project Status Report (PSR) for completed fiscal year, Annual Action Plan (for ensuing fiscal year) and Quarterly reports produced will be approved by Governing Body of the society. PMU will on regular basis communicate to JICA all Quarterly Reports, Annual PSRs and Annual Action Plans produced during the project implementation along with the minutes of the meeting of Governing Body that reviewed and approved the reports / plan.

The template of the reports will be designed to follow a clear, logical format with supporting graphics (charts and GIS maps). The reports will be submitted in hardcopy as well as in electronic form to facilitate further analysis and dissemination. The reports will also be accessible in the web-based project monitoring system. The reports will be discussed at the PMU on a monthly basis with key stakeholders and relevant agencies. Annual workshops will be held to discuss the monitoring observations at a higher administrative level in order to facilitate any adaptive management decisions required.

Independent of PMU the M&E agency hired to undertake baseline and impact evaluations will submit: (i) brief quarterly reports summarizing concurrent monitoring observations to the PMU; (ii) annual reports summarizing project M&E of preceding quarters, cross-cutting issues and recommendations, and updated project indicators; and (iii) three comprehensive reports – the baseline survey and the impact evaluations at mid-term and project completion.

In addition to such M&E reporting, the project proposes to have a Project Completion Results Report (PCRR) developed at project component level to facilitate faster transfer of lessons learned during

[17] Section (e) to be included in annual report only referring the Environment and Social Safeguard Plan under the project

implementation. The preparation of these component-wise PCRRs will be coordinated by PMU with inputs from the reports submitted by other agencies involved in various studies and the M&E agency. In addition, project will receive regular implementation support/ review missions from JICA, and the project will also receive a formal mid-term review at age of around 5 years (October/ November) from project commencement.

**Reporting Requirement and Schedule**

| Type of Report | Responsibility to generate Report | Periodicity of Report | Submission Level | Circulation/ User | Remarks |
|---|---|---|---|---|---|
| Monthly Progress and Performance Report (MPPR) | CBOs/ VFC | every Month (reporting for previous month) | Field Units | Divisional/ District Units/ Circle office | Including the progress (physical and finance), performance and functioning |
| | Support Organizations (e.g. NGOs) | every Month (reporting for previous month) | Field Units/ Divisional Units | Divisional/ District Units/ Circle office | Including the progress (physical and finance) and performance by SHGs/ FIGs, support to stakeholders and functioning |
| | Project Field Units | every Month (reporting for previous month) | Divisional Units | Divisional/ District Units/ Circle office/ PMU | Consolidating the progress (physical and finance) and performance by CBOs/ VFCs/ EDCs, NGOs and functioning |
| | Project Divisional Units | every Month (reporting for previous month) | Circle office/ PMU | PMU/ Circle Office | Consolidating the progress (physical and finance) and performance by CBOs/ VFCs/ EDCs, NGOs and functioning |
| | PMU | every Month (reporting for previous month) | PMU | PMU, TNFD, GoTN | Consolidating the progress (physical and finance) at all level of operation |
| Quarterly Progress and Performance Report (QPPR) | PMU | By 15th of July, October, January, April (reporting for previous quarter) | PMU | PMU (including GB), TNFD, GoTN, GOI, JICA | Consolidating the progress (physical and finance) for all stakeholders and performance for quarters Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar, and functioning |
| Annual Project Status Report (PSR) | PMU | By 25th of April (reporting for previous year) | PMU | PMU (including GB and EC), TNFD, GoTN, GOI, JICA | Consolidating the progress (physical and finance) and performance for entire year, and functioning |
| Annual Action Plan (AAP) | PMU | By 25th of March (reporting for following year) | PMU | PMU (including GB and EC), TNFD, GoTN, GOI, JICA | Planning activities as per Project implementation Plan, Plan for backlog/ delayed activities, and Strategy; this plan |

| Type of Report | Responsibility to generate Report | Periodicity of Report | Submission Level | Circulation/ User | Remarks |
|---|---|---|---|---|---|
| | | | | | would incorporate the annual plans of CBOs/ VFC etc. drawn out of the Micro-Plans |
| Statement of Expenditure (SOE) | Project Divisions | every Month (reporting for previous month) | PMU | PMU (including GB), TNFD, GoTN, GOI, JICA | Financial Reporting against the AAP consolidating expenses of Field Units and Divisional Unit |
| | PMU | every Month (reporting for previous month) | PMU | PMU (including GB), TNFD, GoTN, GOI, JICA | Financial Reporting against the AAP consolidating expenses of project divisions PMU |

### (6) GIS and Remote Sensing

GIS is a very effective tool that assists in planning and monitoring of resources. Due to high cost involved in setting up the infrastructure for GIS thus it is important to utilize this tool effectively to fully meet the objective and expectation that includes state level data creation, periodical updation, quantification and analysis rather than its utilization for few sample based studies only. In order to plug in the gaps in the state level database, that becomes bottle neck in utilization of GIS as an effective tool it is suggested that the following data layers shall be created/procured.

#### a) Basic Data layer creation

***Village boundary map*** – Survey of India provides village boundary database in vector form under Open Source Series Maps (OSM) category. The Geomatic Centre can procure the dataset for the entire state in order to facilitate village level assessment of forest within their jurisdiction as well as of tree cover outside forest land areas for better planning, assessment and management of resource. This data layer would also assist in extracting village level land use / cover, quantification of tree cover and comparative assessment and temporal analysis of land use/ cover dynamics.

***Forest Administrative boundary map*** – For any GIS based planning, geo-coded administrative boundary is a pre-requisite and forest department is not an exception to it. At TNFD, based on the information provided by TNFD officials, Range and Beat level boundaries are not digitized that makes it very difficult to understand the jurisdiction and administrative setup within TNFD. Thus, it is suggested that first and foremost TNFD should digitize their forest administrative boundaries at least till beat level (Division, Range and Beat).

#### b) Baseline Geo-coded Data Requirement of TNFD

***State level Land Cover/ Use Map*** – For periodical assessment of forest within jurisdiction of TNFD, Geomatic centre is procuring forest density map from FSI after an interval of every two years. The data covers only forest classes and reflects 2 year old situation, recently available data that was published by FSI in the year 2009 reflects situation of year 2007.

Apart from few site specific case studies, where GIS data is created and analysed, in general there is dearth of State level GIS database with the TNFD. It is suggested that state level data should be developed/procured at the initial stages of the project to ascertain the spatial

distribution of area under crop, current fallow (fallow <1 year), other fallow (fallow >1 & <5 year) and culturable waste (fallow >5 year) for analyzing the spatial distribution of fallow land and culturable waste land under TCPL component of the project. This would assist in identifying the suitable potential villages having concentration of land under other fallow and culturable waste categories. This would also assist in preparatory work and would reduce lots of time and effort in identifying the suitable target villages in comparison to simply relying on ground based survey techniques. For the year 2007, such satellite derived data is available with Institute of Remote Sensing (IRS) at Anna University, Chennai and NRSC, Hyderabad. The project can approach the agencies for the same. As an alternate the project can also procure temporal LISS-III satellite images of 2 seasons for 2 dates, i.e., 2007-08 and 2010-11 in order to reflect temporal variation and segregating the above mentioned fallow land categories.

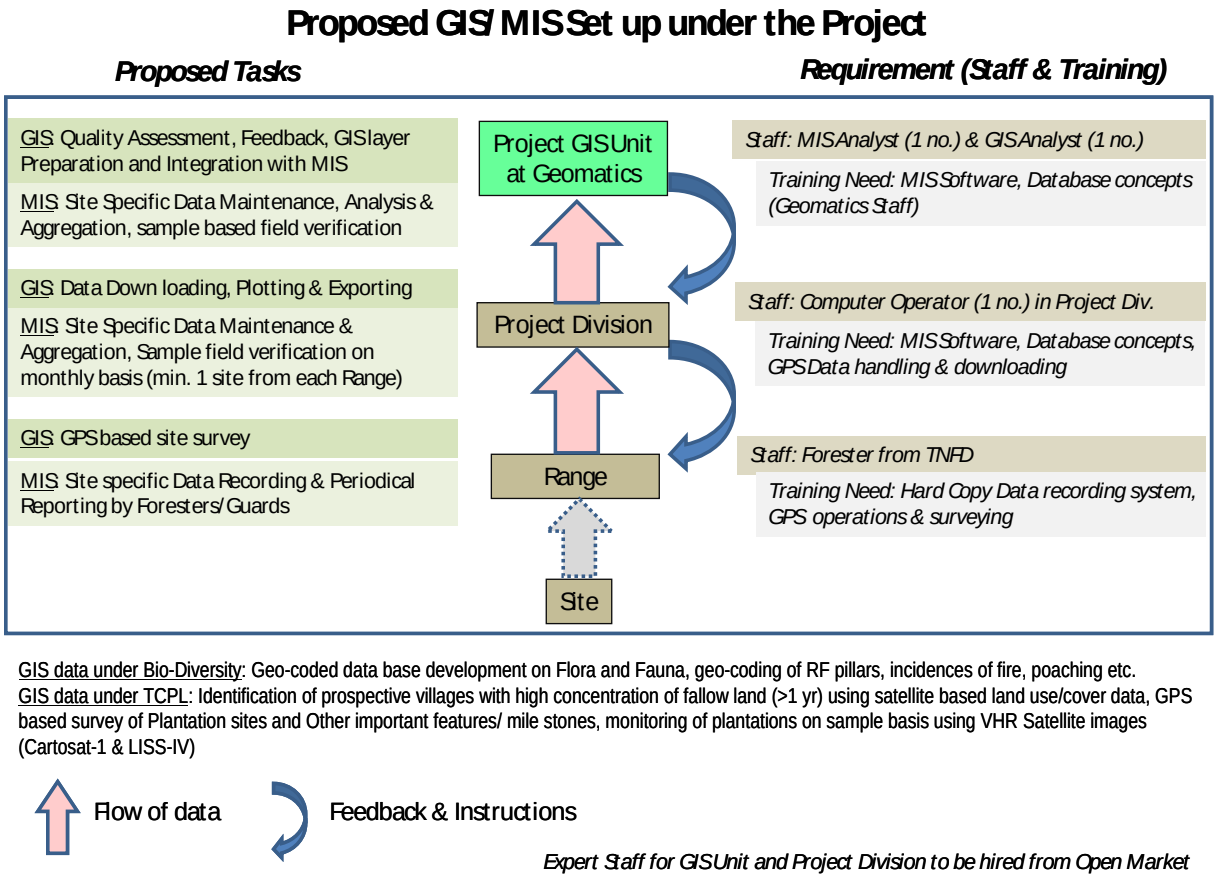
***Plantation areas*** **-** Under TCPL component all plantation sites/plots need to be surveyed at the time of plantation and GPS based geo-coded data need to be collected by the field staff (Forester/Guard). The type of data to be collected is given in table below:

| | Type of Plantation (TCPL) | GPS Data Type |
|---|---|---|
| 1 | Plot of land (as Block Plantation) | Polygon boundary |
| 2 | Canal side plantation | Line data |
| 3 | Bund plantation | Line data |

***Biodiversity***- In TNFD there is dearth of geo-spatial database about poaching instances, nos. of human-wildlife conflicts reported in the last 5 years, readily available with TNFD. Some of the administrative boundary information is available but detailed database need to be developed with respect to geo-coded information pertaining to flora and fauna through field based biodiversity survey, geo-coding of secondary information from on-going and past research, geo-coding of RF pillars, incidences of fire, poaching etc. There is dearth of location specific information with respect to endemic flora and fauna as well. This data needs to be collected from the various sources and a sound geo-spatial database shall be generated.

**c) Remote Sensing as means of monitoring tool**

The project interventions, mainly plantation activities under TCPL component should be monitored using horizontal photographs taken on ground during GPS based field survey along with vertical satellite images taken from space. It is suggested that Cartosat-1 (B&W with spatial resolution of 2.5 meters) along with LISS-IV (multispectral with 5.8 meter resolution) satellite images shall be used for sample based monitoring of blocks with maximum concentration of project sites (approximately 25% of the geographical area of the state). The black and white images would assist in visual identification of tree cover and whereas multispectral images would help in spectral interpretation and documentation of changes using NDVI technique. Also these Very High Resolution sample images would assist in creating training sites that would aid in classification and monitoring temporal changes on two date LISS-III satellite images for other project sites as well (areas falling outside the coverage of sample VHR satellite images procured).




## (7) Management Information System (MIS)

Management Information System is a very important tool for systematic and effective management of the activities and helps in periodical progress monitoring and timely & effective decision making. Under the TNSNRMP it is proposed to develop a project based MIS system covering activities and components under the project. The MIS need to be simple web-based application focusing on specific crucial information required for effective implementation and monitoring of activities.

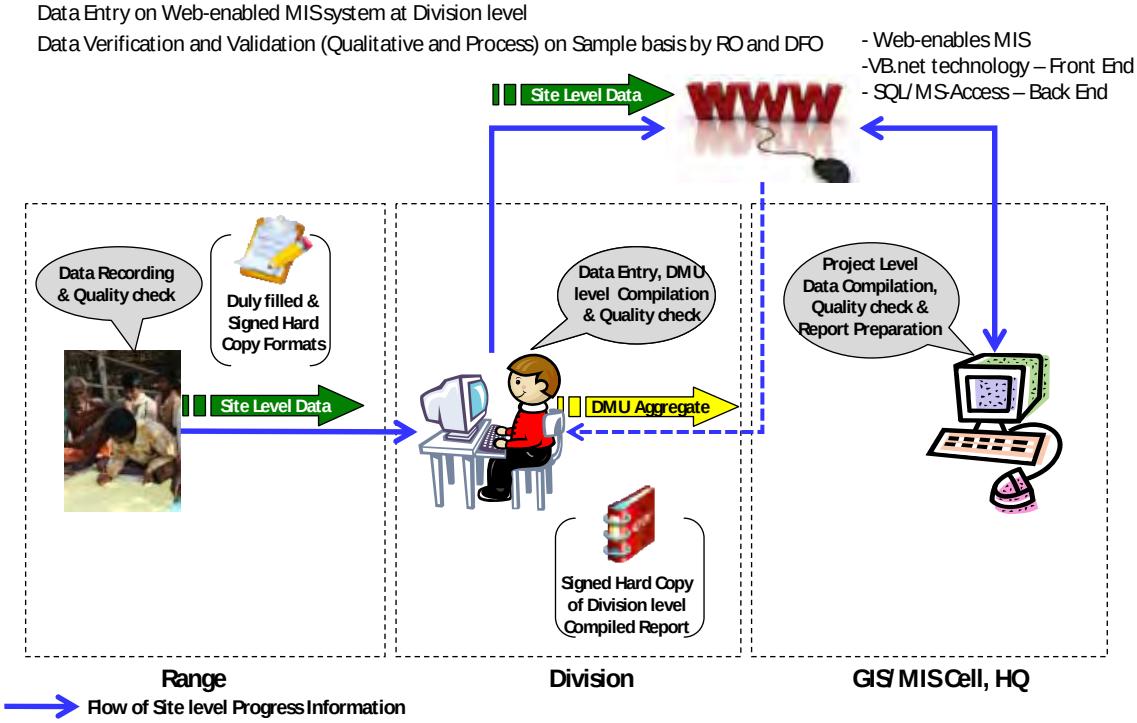
### a) Hard Copy Paper based MIS

**Data Recording Registers:** In the initial stages of the project itself, all VFCs/EDC (under Biodiversity component) and Forest Ranges or equivalent office (under TCPL) should be asked to maintain important documents/registers to record information with respect to the components and related activities e.g. Nursery Journal (with details like number of seedlings, polybags, casualty rate, man day generated etc.) and Plantation Journal (with details like species wise number of seedlings planted, area, details about the Land and owner, date of planting, height of seedlings at the time of planting, casualty rate, man day generated etc.). The formats and the information to be recorded need to be finalized in the initial stage of the project implementation. The data recording system need to be updated by respective forester on daily basis or in conjunction with the physical and financial progress.

**Data Reporting Formats:** Under paper based Project MIS, simple and effective MIS Reporting Formats need to be developed, field tested and introduced by end of first year of project implementation. Special care need to be taken up in designing the formats so as to include the 'key information' required from **Planning** and **monitoring** perspective to assess the '**quantity' of work, 'quality' of work and 'process adherence'** related details during implementation stage.

Proposed Architecture of MIS under the Project

- Data Recording in Hard Copy MIS Registers by Foresters at Site level
- Data Entry in Web Enabled MIS Software at Division level
- Data Compilation at Division & HQ level
- Monthly Data Reporting (Quantitative) by Foresters during Monthly Meetings at Division level
- Data Entry on Web-enabled MIS system at Division level
- Data Verification and Validation (Qualitative and Process) on Sample basis by RO and DFO




### b) Web based MIS Software

In line to the paper based data reporting formats, web based MIS software need to be developed and introduced for site specific periodical data entry at Division office. The design of the software interface need to be very simple and user friendly and to be designed keeping in mind the data reporting formats so that data entry should be convenient, faster and thereby minimizing the chances of typing errors. In the software there should be a provision of drop and down menu so as to reduce manual typing, logical checks, etc as an internal mechanism of quality checking. The MIS software development should be completed by mid of the second year of the project implementation to maximize its usage during crucial initial stages of the intervention in the field. The designed modules need to be thoroughly tested with the real field data during development stage among the field staff on sample basis.

The software should also have the following capabilities such as:

- ✓ Provision of data entry from anywhere by logging on through security password.
- ✓ Security levels with permission to access, view, data entry and edit.
- ✓ Printing of reports.
- ✓ Exporting reports in pdf and excel files.
- ✓ Provision of e-mail facility
- ✓ Uploading and downloading of sharable maps in jpg printable formats.
- ✓ Automatic data backup facility
- ✓ GPS data uploading facility

### (8) MIS-GIS Integration

All database records and information under MIS should be stored with respect to the unique identification code for each site. Similarly Geo-spatial entities under GIS shall also be maintained using unique site codes. Once any information is stored with respect to unique id, integration of such data at different level would be easy and real time.

## 7.6.2 Construction of Buildings

### (1) PMU Building

The TNFD is functioning in four floors of the existing 9-storey Panagal Building. The space of the existing building is not sufficient for accommodating the staff members and functions of PMU based on the estimated required manpower and facilities. Therefore, TNFD proposed to construct a new PMU building at Velacherry, adjacent to the JFMC training centre, Chennai. TNFD also proposed to few officers of TNFD will occupy parts of the new building to ensure smooth operation of the project. The total floor area of the proposed PMU office buildings will be 6,000 $m^2$. No land acquisition will be required for the construction. The detailed breakdown is given in **Annexure 7.10**.

### (2) Inspection Bungalow/ Forest Guest House

Five forest inspection bungalows are to be newly constructed in the entire state for monitoring and supervision of project activities. The list of proposed houses is as follows:

**Proposed Construction of Inspection Bungalows/ Forest Guest Houses**

| Sl. No. | Name of the Place | Range | Division | Circle |
|---|---|---|---|---|
| 1 | Hanumanthaputheri RF | Chengalpattu | Chengalpattu | Chennai |
| 2 | Paradarami | Gudiyatham | Vellore | Vellore |
| 3 | Jamnamarathur | Jamnamarathur | Tiruvannamalai | Vellore |
| 4 | Namakkal | Erode | Erode | Erode |
| 5 | Ayyalur | Ayyalur | Ayyalur | Dindigul |

### (3) Construction of Circle Offices

Two circle offices are to be constructed in the project as the two are old. Plinth area of each building will be 340 $m^2$. No land acquisition will be required for the extensions. The list of said offices is as follows:

**Proposed Construction of Circle Offices**

| Sl. No. | Name of the Place | Division | Circle |
|---|---|---|---|
| 1 | Vellore | Vellore | Vellore |
| 2 | Villupuram | Villupuram | Villupuram |

### (4) Construction of District Offices

Eight new district offices are to be constructed as part of the Project. The existing Divisional Forest Officer (DFO) buildings concerned will be either extended or newly constructed to secure an average area of 240 $m^2$ for each district. No land acquisition will be required for the extensions. The list of said offices is as follows:

**Proposed District Offices to be Constructed**

| Sl. No. | Name of the Place | Division | Circle |
|---|---|---|---|
| 1 | Vellore | Vellore | Vellore |
| 2 | Kottamalai | SF, Vellore | Vellore |
| 3 | IFF, Krishnagiri | IFF, Krishnagiri | Dharmapuri |
| 4 | Namakkal | Namakkal | Erode |
| 5 | Pudukottai | Pudukottai | Tiruchy |
| 6 | Forest Campus, MDU | SF, Madurai | Madurai |
| 7 | Thoothukudi | Thoothukudi | Tirunelveli |
| 8 | Virudhunagar | SF Virudhunagar | Viruthunagar |

### (5) Construction of Range Offices

Some of the existing range office buildings concerned will either be extended or newly constructed to secure 85 $m^2$ for each range office (58 range offices are included in the Project area). The breakdown of circle-wise range offices is as follows:

**Proposed Range Offices to be Constructed**

| Circle | Numbers |
|---|---|
| Chennai | 5 |
| Vellore | 13 |
| Dharmapuri | 1 |
| Salem | 3 |
| Erode | 4 |
| Coimbatore | 1 |
| Villupuram | 3 |
| Tiruchy | 17 |
| Dindigul | 1 |
| Madurai | 8 |
| Tirunelveli | 2 |
| **Total** | **58** |

### (6) Construction of Forest Extension Centres

Forest extension centres will engage in TCPL component of the project. Two numbers of forest extension centres at Tiruppur and Ariyalur districts are to be constructed as new centres in the districts. These two districts were not covered under TAP-I and TAP-II. The plinth area of each forest extension centre (newly constructed) is 234 $m^2$.

### (7) Construction of New Extension Centres

A total of 26 extension centres office buildings are to be constructed in the project areas. The plinth area of each extension centre will be 100 $m^2$. The list of proposed extension centres is as follows:

**Proposed New Extension Centres to be Constructed**

| Sl. No. | Location of the Centres | Name of District |
|---|---|---|
| 1 | Chinnathadampalayam | Karur |
| 2 | Chithali | Perambalur |
| 3 | Ulundurpet | Villupuram |
| 4 | Neyveli | Cuddalore |
| 5 | Chengalpattu | Kancheepuram |
| 6 | Nanmangalam | Chennai |

| Sl. No. | Location of the Centres | Name of District |
|---|---|---|
| 7 | Poondi | Thiruvallur |
| 8 | Pasumalai | Madurai |
| 9 | Vaigaidam | Theni |
| 10 | Dindigul | Dindigul |
| 11 | Thoppukkollai | Pudhukottai |
| 12 | Thanjavur | Thanjavur |
| 13 | Thiruchampalli | Nagapattinam |
| 14 | Ramnathapuram | Ramnathapuram |
| 15 | Tiruvarur | Tiruvarur |
| 16 | Sathankulam | Thoothukudi |
| 17 | Aralvoimozhi | Kanniyakumari |
| 18 | Srivilliputtur | Virudhunagar |
| 19 | Harur | Dharmapuri |
| 20 | Sidharkovil | Salem |
| 21 | Athanur | Namakkal |
| 22 | Arachalur | Erode |
| 23 | Thiruvannamalai | Thiruvannamalai |
| 24 | Pallikonda | Vellore |
| 25 | Mangarai | Coimbatore |
| 26 | Ooty | The Nilgiris |

### (8) Construction of Van (Parking) Sheds in Forest Extension Centres

Twelve van (parking) sheds in the forest extension centres are to be constructed as part of the Project. The plinth area of each shed will be 25 $m^2$. The list of said sheds is as follows:

**Proposed Location of Van Shed to be Constructed in Forest Extension Centres**

| Sl. No. | Location of the Centres | Name of the District |
|---|---|---|
| 1 | Ulundurpet | Villupuram |
| 2 | Neyveli | Cuddalore |
| 3 | Vaigaidam | Theni |
| 4 | Thanjavur | Thanjavur |
| 5 | Aralvoimozhi | Kanniyakumari |
| 6 | Thiruvannamalai | Thiruvannamalai |
| 7 | Pallikonda | Vellore |
| 8 | Mangarai | Coimbatore |
| 9 | Ooty | The Nilgiris |
| 10 | Tiruppur | Tiruppur |
| 11 | Ariyalur | Ariyalur |
| 12 | Arachalur | Erode |

### (9) Construction of Modern Interpretation Centre

A Modern Interpretation Centre is to be constructed in Nanmangalam of Kanchepuram District, as a venue for explaining to the farmers and visitors regarding different forest species tried in the area.

### (10) Construction of Interpretation House

There will be two interpretation houses to be built in the existing extension centres for the farmers and visitors. Said houses will be located either in Trichy, Coimbatore, Turunelveli, Madurai or Namakhal.

### (11) Anti-poaching Camp Building

At present, personnel stay in temporary makeshift camps and undertake combing operations. A permanent camp building for anti-poaching personnel will provide them shelter against inclement weather and improve their performance. Various facilities like solar electric power lighting, cooking arrangements and necessary basic infrastructure like water supply will be provided in such camps. This activity will help create 26 permanent anti-poaching camp buildings in seven protected areas. Only the large protected areas with problems on poaching and illicit activities like ganja cultivation, timber felling, etc., especially in the Western Ghats and Eastern Ghats, have been identified for this activity.

## 7.6.3 Augmentation of Office Facilities & Equipment

To implement and manage the Project effectively and efficiently, the following equipment and furniture will be provided for PMU, Circle offices, DMUs, FMUs and extension centres.

**Proposed Office Facilities and Equipment for Procurement (1)**

| | Quantity of equipment and furniture | | | | |
|---|---|---|---|---|---|
| | PMU (1) | Circle (12) | DMU (66) | FMU (202) | Extension Centre (32) |
| Desktop PC with software & accessories | 32 | 24 | 132 | 202 | 32 |
| Laptop PC with software & accessories | 10 | 24 | 66 | - | - |
| Printer (Laser) | 20 | 24 | 66 | - | - |
| Printer (Dot Matrix) | 22 | 24 | 66 | 202 | 32 |
| Tables, chairs | 72 | 60 | 132 | 202 | 32 |
| A4 size scanner | 2 | 12 | 66 | - | - |
| Copier / fax | 2 | 12 | 66 | 202 | 32 |
| UPS 1KVA | 32 | 24 | 132 | 202 | 32 |
| Handycam | 3 | 12 | 66 | - | - |
| Digital camera | 5 | 24 | 66 | 404 | 64 |
| Upgradation of hardware and software | LS | LS | LS | LS | LS |

**Proposed Office Facilities and Equipment for Procurement (2)**

| For Geomatic centre | | For all offices | |
|---|---|---|---|
| Equipment | Q'ty | Equipment | Q'ty |
| GIS window based work station including office software and accessories | 8 | Hand held GPS | 1,000 |
| Notepads (Lap top) including office software and accessories | 2 | Mobile GPS (Vehicle mounted) | 20 |
| GIS application software | See Annexure 8.4 | PDA | 200 |
| A4 size scanner | 1 | | |
| A3 size Laser jet printer (Color) | 1 | | |
| A0 size plotter | 1 | | |
| UPS 10KVA | 1 | | |
| Upgradation of hardware and software | LS | | |
| Acquisition of satellite images and FSI digital data for GIS analysis & interpretation | See Annexure 8.4 | | |

### 7.6.4 Strengthening Mobility

To execute field inspections, technical guidance and assistance, monitoring and other project-related activities such as training and study tour in a timely and efficient manner, the following vehicles and motorcycles will be provided to PMU, DMUs and FMUs:

**Proposed Vehicles for Procurement**

| Vehicles/ motorcycles | Q'ty |
|---|---|
| Staff car | 19 |
| Jeeps | 132 |
| Wildlife safari van | 24 |
| 35 seater bus | 3 |

### 7.6.5 E-Governance

#### (1) Video Conferencing through TNSWAN

Tamil Nadu State Government is planning to implement e-Governance in a big way and Forest Department is no exception. TNSWAN has been identified as one of the core e-Governance back bone infrastructure by National e- Governance Action Plan (NeGP) and Department of Information Technology (DIT), GOI has issued guidelines for setting up of State Wide Area Network and also extended partial financial support to the States. TN State WAN covers the State Secretariat & five Government complexes (Metro Centres) and seven Special Offices at Chennai. 30 District Collectorates, 73 revenue divisions, 206 Taluk offices and 385 block offices. ELCOT is the implementing agency of the project.

Tamil Nadu State Wide Area Network will link all the Government departments to provide Voice, Data and Video connectivity for improving the delivery of services to the citizens and for improving the response-time and transparency. Also under TNSWAN a Centralized Video Conferencing (VC) facility would be set up at the State Center and Point to point video conferencing at all other MAN Centers and all the 30 District Centers. Through TNSWAN, PMU at TNFD HQ can have video conferencing with lower offices as well. PMU officials at HQ/Chennai and Circle Office would be able to conduct Video Conferencing with officials from Division offices, where Range level officials need to visit the nearest POP Centre for a Video Conferencing. The facility does not require any infrastructure to be developed by TNFD at Range level as there are TNSWAN POPs at block level having all necessary facilities required for Video Conferencing. This mechanism would be cost effective and would also help in better monitoring and speedy communication without any establishment cost. Based on the information provided by the TNFD, TNFD HQ and Circle offices would be connected with the TNSWAN connectivity and already a request has been put across with ELCOT by TNFD. The required accessories such as TV monitor need to be installed at PMU, Circle office and Division offices.

#### (2) Internet Connectivity

Internet connectivity is one of a pre-requisite for speeding up communication system that will go a long way in improving efficiency by reducing time lag in communication with field offices up to Range level. All project Range offices need to be provided with one internet connection (could be Broadband/ wireless data card/ dial-up connection) for accessing the web-enabled MIS software and e-mailing facilities. All Project divisions also to be provided with Broadband connection till internet connectivity is provided under TNSWAN. It is to be noted that any Range office can be provided with secured access to the organizations network through VPN (Virtual Private Network) technology. A VPN is a network that uses a public telecommunication infrastructure (such as Internet) to provide remote offices or individual users with secure access to their organization's network up to Division level (herein through TNSWAN). It aims to avoid an expensive system of *owned or leased lines* that

can be used by only one organization. The goal of a VPN is to provide the organization with the same secure capabilities but at a much lower cost.

## 7.7 Organizational Setup for Project Implementation

### 7.7.1 Overview

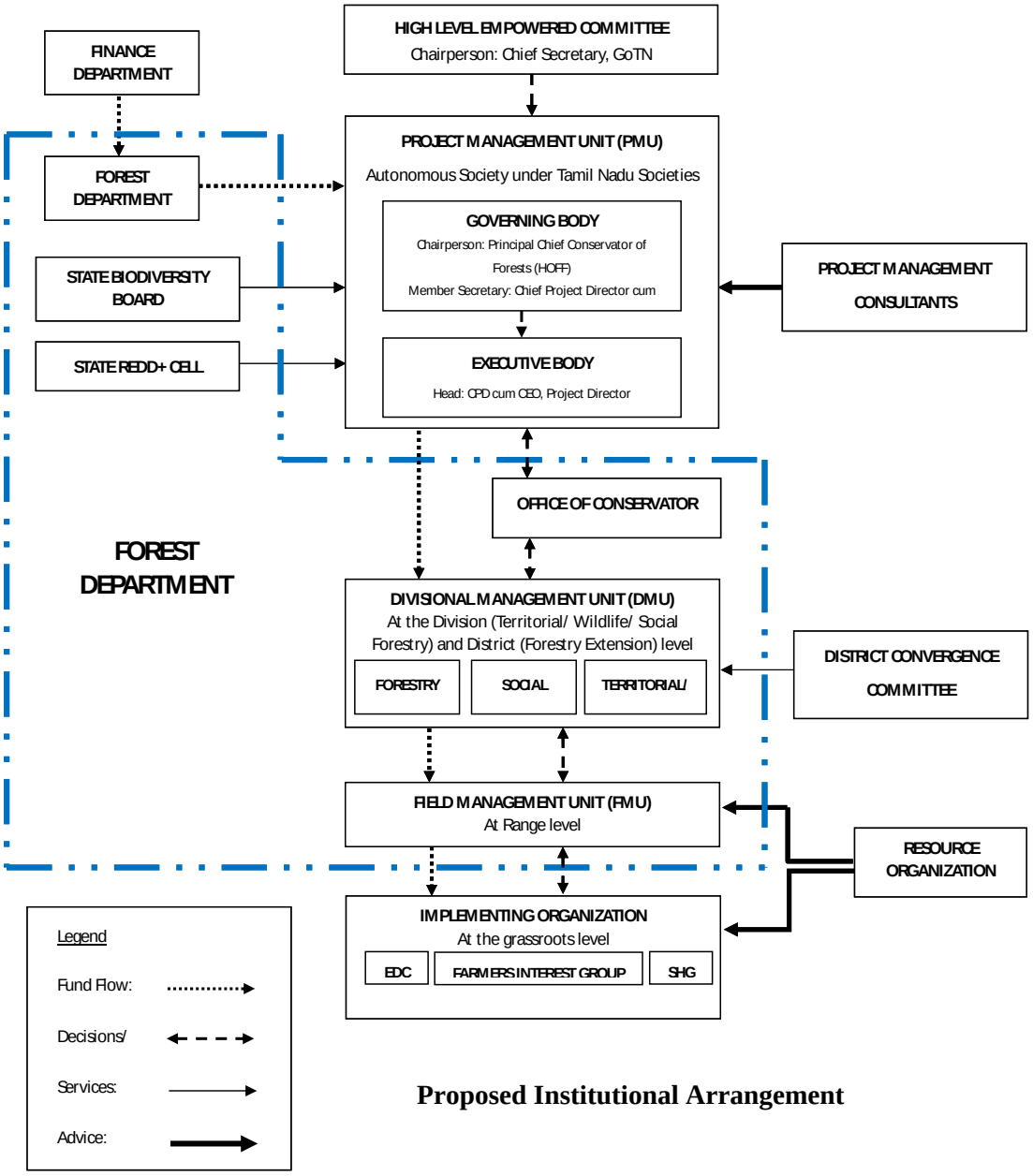
As recommended in Section 6.3, the Project will be implemented by the Tamil Nadu Forest Department through an autonomous Society called PMU registered under Tamil Nadu Societies Registration Act, 1975. Various offices of the TNFD at Circle, Division and Range levels will implement the project activities. The PMU will be in-charge of the overall managerial tasks of the Project. The PMU will collate and consolidate the expenditure statements from divisional and field offices, and prepare documentation for reimbursement claims to JICA. The offices of the Conservator of Forests (Territorial) will be brought into the ambit of the PMU for the implementation of the Project. It will facilitate the critical links between the divisional/ district level units with the PMU.

At the field level, the PMU will coordinate with the Circle, Division Management Units (DMUs) and Field Management Units (FMUs), which will operate within the jurisdiction of the TNFD.

**Management Set-up for the Project**

| TYPE | No. of Unit | Status |
|---|---|---|
| **PMU** | 1 | Registered Autonomous Society |
| **DMU** | 66 | Part of Office of DFO/ Wildlife Warden/ DlFO and other special units viz. Research, Extension, TNFA |
| **FMU** | 202 | Part of Office of RO |

The figure below shows the detailed institutional arrangement envisaged for the implementation of the Project.




**Proposed Institutional Arrangement**

The PMU will be created as an autonomous body registered as a society through a state resolution (Extra Ordinary Gazette Notification) with its memorandum of association and bylaws stipulating the following:

i) Name of Society
ii) Location and area of operation
iii) Aims and objectives of the society
iv) List of membership of the society (general body)
v) List of members of the governing body
vi) Executive officers, other officers and their functions
vii) Funds of the society

viii) Audit of accounts

The PMU will have an operation manual, which will prescribe financial, administrative, management and policy instructions for the smooth implementation of the Project. This manual will convey the internal policy of the PMU subject to approval of the High Level Empowered Committee, in order to be impartial with regards to the existing departmental administration rules and regulations. The TNFD and the PMU will enter into an agreement to designate the project management responsibilities to the PMU.

### 7.7.2 Key Managerial Features of Institutional Arrangement

There are a number of key managerial features in order to make the institutional arrangement effective and to function within the framework of the government systems.

**(1) Accounting Procedures**

In this institutional design, the funds from the TNFD will be given as grants to the PMU, who will then provide the funds to DMUs. It is important to use a unified accounting procedure for all levels, i.e., PMU, DMUs and FMUs. The DMU will follow the Forest Accounting Rules of Government of Tamil Nadu, and thus, it is suggested that the PMU should follow the Forest Accounting Rules for accounting purposes.

The funds from the PMU will be remitted to a designated schedule bank account at respective DMUs in the form of bank cheque or bank draft.

**(2) Auditing**

Auditing will be carried out by the Auditor General (AG) because the grant to the PMU is extended from the consolidated fund of GOI. According to the Society Registration Act, a society should be subject to an annual audit by a chartered accountant and/or AG.

**(3) Compliance with General Financial Rules (GFR) and General Rules of Business (GRB)**

In order to ensure compliance with GFR and GRB of Government of Tamil Nadu, the PMU will get on deputation a Chief Account Officer/ Account Officer from Treasuries and Accounts Department. He will assist PMU in financial management and liaison with Finance Department.

**(4) Link with the State Government**

The PMU will designate either a Project Director or any officer from the PMU as Special Secretary of TNFD to constantly coordinate with the state government.

**(5) Structural Integrity**

The PMU will only be created for the implementation of the Project, as there is no intention of creating a dual administrative structure within the forestry sector in Tamil Nadu. The existing tasks and authorities of TNFD will remain intact regardless of the creation of the PMU. For instance, in case the function of the PMU ceases, the assets and infrastructure of the PMU created under the Project will be transferred to TNFD through provisions in its bylaws. This will ensure TNFD of the organizational integrity of PMU.

### 7.7.3 Institutional Setup for Project Implementation

#### (1) High Level Empowered Committee (HLEC)

HLEC will be created within the state government as the highest decision-making body for the Project. It will meet at least bi-annually or more often, if the situation demands. The composition HLEC is as follows:

**Composition of the High Level Empowered Committee (HLEC)**

| Position | Designated Personnel |
|---|---|
| **Chairperson** | Chief Secretary, Government of Tamil Nadu |
| **Member** | Principal Secretary, Forests & Environment |
| **Member** | Principal Secretary, Finance |
| **Member** | Principal Secretary, Planning & Development |
| **Member** | Principal Secretary, Revenue |
| **Member** | Principal Secretary, Rural Development & Panchayat Raj |
| **Member** | Principal Secretary, Tribal Welfare |
| **Member** | Principal Chief Conservator of Forests (HOFF) |
| **Member** | PCCF (Wildlife), Chief Wildlife Warden |
| **Member Secretary** | Chief Project Director cum Chief Executive Officer, TNBCGP |

The operation manual of PMU will be approved by HLEC. It will also approve the annual plan of action and budget for the implementation of the Project. It will from time to time or whenever necessary issue directions to the Project for the smooth implementation and will pursue matters related to government policy.

It will accord administrative sanctions of all individual schemes, and proposals amounting to a maximum of Rs. 200 million each for item contained in the total estimate.

#### (2) Project Management Unit (PMU)

The PMU will take full charge in terms of administration and management for the implementation of the Project. For the purpose of implementing the Project, PMU will be created as an autonomous society. The Governing Body and Executive Body will be created as a requirement of the Society Registration Act. The Governing Body will be the highest decision-making institution within the society. The composition of the Governing Body is shown in the table below:

**Composition of the Governing Body**

| Position | Designated Personnel |
|---|---|
| Chairperson | Principal Chief Conservator of Forests (HOFF) |
| Member | PCCF (Wildlife), Chief Wildlife Warden |
| Member | APCCF (Afforestation) |
| Member | APCCF (Administration) |
| Member | APCCF (Planning & Budgetary) |
| Member | APCCF (Research) |
| Member | APCCF (Social Forestry & Extension) |
| Member | APCCF (Forest Conservation Act) |
| Member | APCCF (Working Plan) |
| Member Secretary | Chief Project Director cum Chief Executive Officer, TNBCGP |

The **Governing Body** will be the highest decision making body within PMU which provides necessary administrative and policy directions being endorsed and validated by HLEC to the

Executive Body and DMU and FMU for smooth implementation of the Project activities. It will examine and endorse Annual Plan of Action, Budget etc., that being prepared by the Executive Body and forward it to HLEC for final approval. Governing Body reserves the rights to sanction the expenditure to a limit as will be mentioned in the By-laws.

The Governing Body will meet on a regular basis or as the need arises. It will review the functions of the society regularly and prepare proposals for the HLEC, as necessary, for the smooth implementation of the Project.

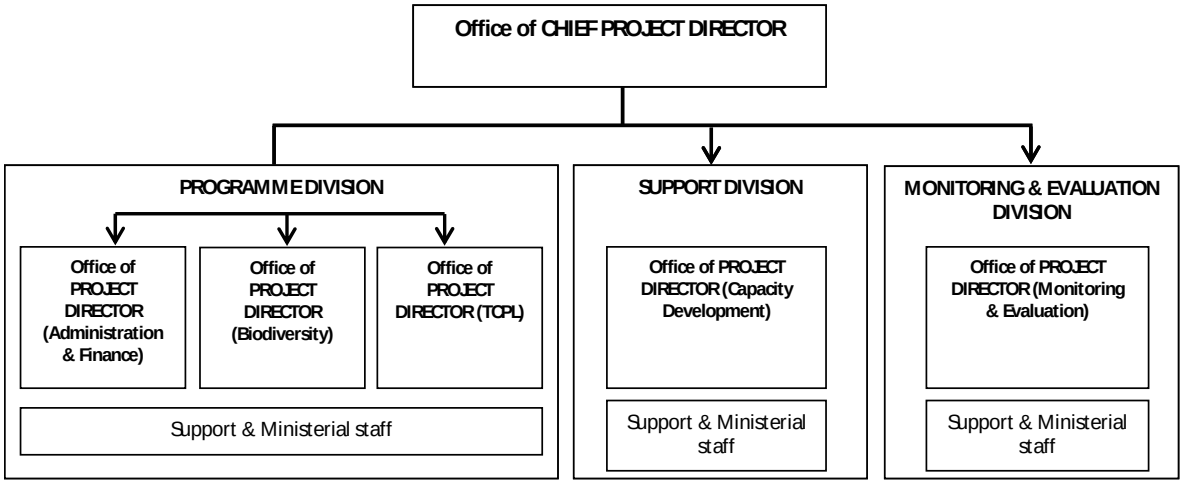
The **Executive Body** - the members of the office of the Chief Project Director shown below- will constitute the Executive Body. It is responsible for the implementation of the activities. It will plan, implement and monitor the progress of the implementation through DMU and FMU. It will continuously report the status of the implementation to the Governing Body and also assist Governing Body to report to HLEC. The Executive Body will draw the administrative and financial powers required to execute the Project from the Operation Manual being prepared for the Project execution.

**Composition of the Executive Body**

| Staff Member | Designated Personnel |
|---|---|
| Chief Project Director | Additional Principal Chief Conservator of Forests (APCCF) |
| Project Director (Administration & Finance) | CCF |
| Project Director (Biodiversity) | CCF |
| Project Director (TCPL) | CCF |
| Project Director (Capacity Development) | CCF |
| Project Director (Monitoring & Evaluation) | CCF |
| Finance Controller | State Finance Services |
| Member Secretary | Chief Project Director cum Chief Executive Officer, TNBCGP |

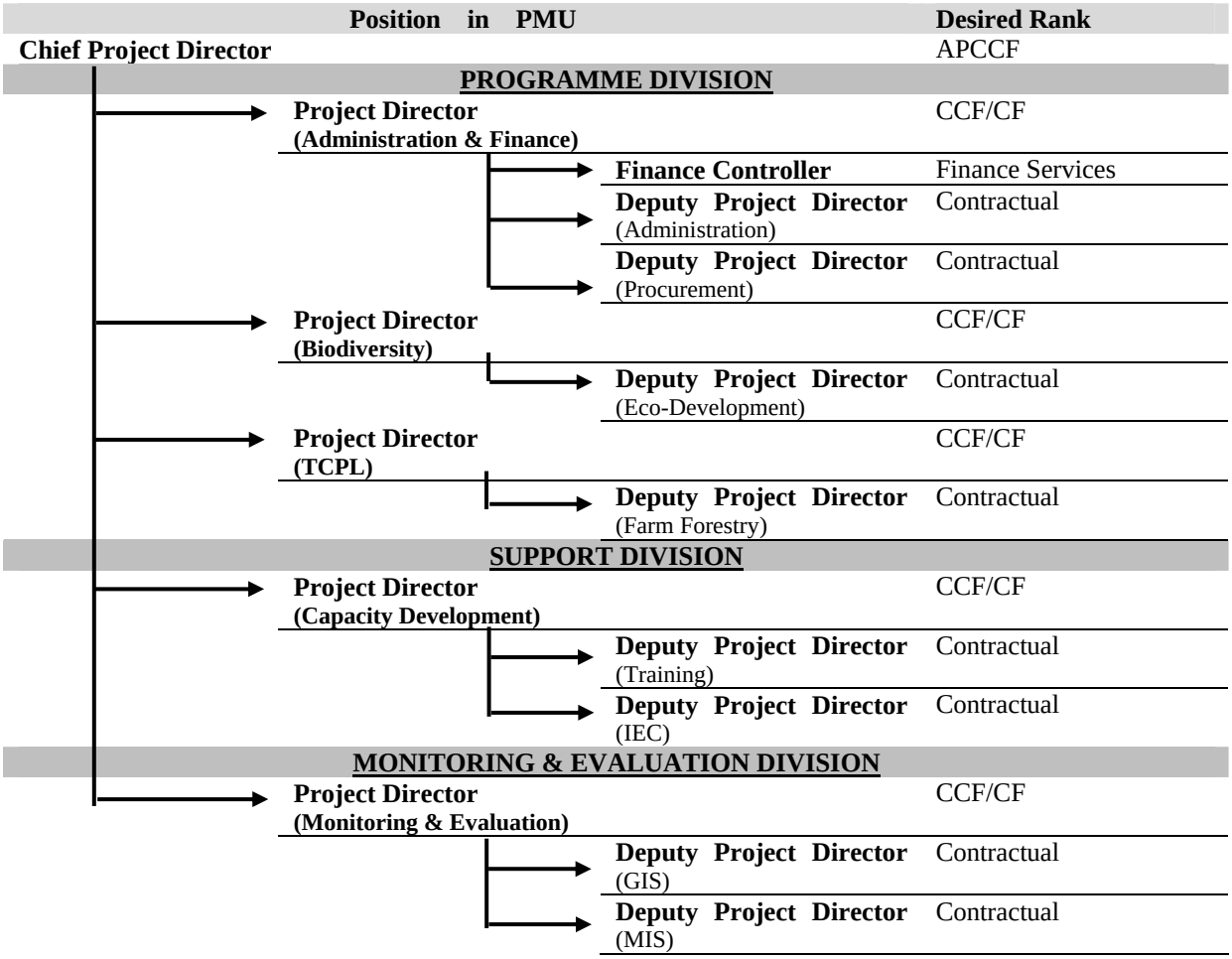
The **General Body of the Society** will consist of members of the Governing Body, Executive Body and Conservators of Forests from all the identified circles where the Project activities will be undertaken, as well as divisional/ district level Nodal Officers such as DMU Officer from all the divisions included in the Project. The General Body will meet once a year during the annual review meeting of the Project.

The structure of the PMU will be as follows. **Table 7.3** shows the responsibilities of the key staff.




**PMU Structure**

The detailed ***ORGANOGRAM*** of the PMU will be as follows:




The support and ministerial staff distribution in the PMU is as follows:

**Support and Ministerial Staff in the PMU**

| Staff Position | Number | Description |
|---|---|---|
| **OFFICE OF CPD** | | |
| Superintendent | 1 | |
| Accountant | 3 | |
| Computer Operator | 2 | |
| Steno Typist | 2 | |
| Office/ Personal Assistant | 1 | |
| **PROGRAMME DIVISION** | | |
| Superintendent | 3 | 1/ each Project Director |
| Computer Operator | 9 | 1/ each Project Director & Deputy Project Director |
| Steno Typist | 9 | 1/ each Project Director & Deputy Project Director |
| Office/ Personal Assistant | 9 | 1/ each Project Director & Deputy Project Director |
| **SUPPORT DIVISION** | | |
| Superintendent | 1 | 1/ each Project Director |
| Computer Operator | 3 | 1/ each Project Director & Deputy Project Director |

| Staff Position | Number | Description |
|---|---|---|
| Steno Typist | 3 | 1/ each Project Director & Deputy Project Director |
| Office/ Personal Assistant | 3 | |
| **MONITORING & EVALUATION DIVISION** | | |
| Superintendent | 1 | 1/ each Project Director |
| Computer Operator | 3 | 1/ each Project Director & Deputy Project Director |
| Steno Typist | 3 | 1/ each Project Director & Deputy Project Director |
| Office/ Personal Assistant | 3 | 1/ each Project Director & Deputy Project Director |

The total strength of support and ministerial staff at the PMU is shown below.

| Sr. no | Position | Total number |
|---|---|---|
| 1 | Superintendent | 6 |
| 2 | Computer Operator | 17 |
| 3 | Steno Typist | 17 |
| 4 | Office/ Personal Assistant | 16 |
| | **TOTAL** | **56** |

### (3) GIS/MIS Cell, Geomatic Centre

At GIS/MIS Cell of the PMU, at Geomatics Centre, one GIS/Remote Sensing Analyst with a minimum qualification of Masters degree in Forestry, Geography, Natural Resources Management or similar field from a reputed institution along with M.Tech/ Post Graduate Diploma in Remote Sensing and GIS with a minimum of 3 years of hands on experience in GIS & RS position, need to be appointed from open marked.

For MIS related tasks one MIS Analyst with a minimum qualification of MCA/M.Tech in software engineering having minimum of 3 years of hands-on experience in software development, data base designing, compilation, reporting and management, shall be appointed from open market. The candidate should be well versed with RDBMS, SQL, .net technologies etc.

The GIS & MIS Analyst would undertake/assist the management, monitoring, verification and validation, report generation and analysis of GIS and MIS data received from the field. The technician would also coordinate with Division, Range to ensure proper project specific GIS/MIS database management.

### (4) Office of Conservator of Forests

Twelve circles have been chosen for the implementation of the Project. The field conservators of forests of these identified circles will be the field directors who will provide critical administrative and managerial support to the divisional levels during the implementation. These field directors will function together with the PMU and DMU, and provide necessary administrative sanctions and directions to field operations as it happens in normal forestry works. All directions, instructions and information from PMU will pass through the offices of the field directors.

The Conservator of Forests will perform as Field Director in an additional capacity and will have the following support and ministerial staff dedicated for the implementation of the Project.

| Position | | | Desired Rank | Number |
|---|---|---|---|---|
| **Field Director** | | | CF | 1 |
| → | **Deputy Field Director** (Administration & Finance) | | Contractual | 1 |
| | | Computer Operator | Departmental/ Contractual | 1 |
| | | Steno Typist | Departmental/ Contractual | 1 |
| | | Office/ Personal Assistant | Departmental/ Contractual | 1 |

### (5) Divisional Management Unit (DMU)

A total of 66 divisions have been selected for the implementation of the Project. Out of which, 58 divisions are under the operational purview of 12 field conservators. six divisions belonging to AAZP, Kalakad Mundanthurai Tiger Reserve (KMTR), Mudumalai Tiger Reserve (MTR), and Anamalai Tiger Reserve (ATR) report to officials in the rank of Chief Conservators of Forest (CCF), and the remaining three are TNFA, FTC and Genetics Division, Coimbatore. The District Forestry Extension Officer (of ACF rank) of the identified 31 districts report directly to CCF (extension) based in the headquarters.

DMUs will receive project funds from the PMU for the implementation of the project and disburse it to Project implementers such as FMUs, and field level implementing units such as EDCs, SHGs, and FIGs. The DMUs will supervise the activities of those Project implementers and assist the PMU in planning, fund management, work progress monitoring and documentation at the field level. DMU will report to PMU through the field directors of the Office of Conservator of Forests. The current system of reporting from divisions to conservator of forests includes territorial, wild life and social forestry divisions. Therefore, the proposed system of reporting through the field director is in line with TNFD's current practice.

In case of AAZP, KMTR, MTR and ATR, the concerned heads will report to PMU directly. Moreover, in order to activate this reporting route a Government Order (GO) needs to be issued by the Office of the PCCF (HOFF) before implementation starts.

The DMU will be created within the office of DFO/Wildlife Warden. In other words, the DMU is not an extension unit or subordinate office of PMU and also not registered as an autonomous society. It is thus a devoted project management office within the TNFD at the division level.

The DFO/Wildlife Warden will concurrently head the DMU (as DMU Officer) on a part-time basis, and will be assisted by two Assistant DMU Officers (ADOs) at the rank of ACF or equivalent persons, who will be recruited from the open market through placement agencies/service providers, in case the department fails to deputize its own staff. The ADOs in the case of ACF will be released from regular duty charges as an ACF and dedicate its work to the Project implementation on a full-time basis.

The DMU officers will also be assisted by a finance officer who will be either deputized by the Finance Department or recruited from the open market, with the support of an accountant.

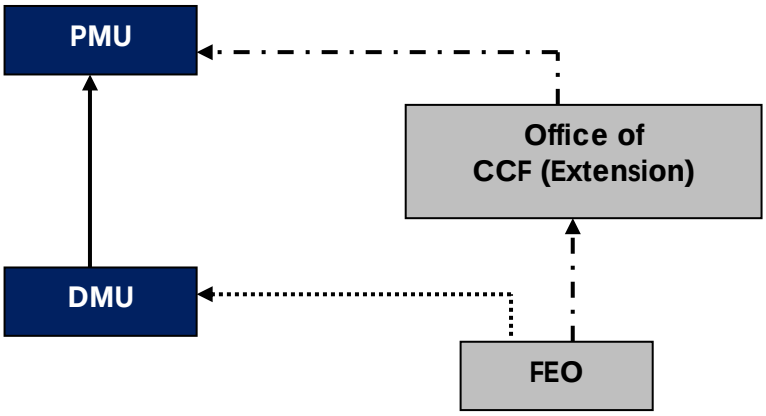
| Unit | Staff Member | Desired Rank |
|---|---|---|
| **Office of DMU Officer** | DMU Officer | DFO/ Wildlife Warden/ DlFO |
| **Administration & Finance** | Finance Officer | TNFS/ equivalent |
| | Accountant | Contractual |
| **Planning & Implementation** | Assistant DMU Officer | ACF/ Contractual |
| **Monitoring & Evaluation** | Assistant DMU Officer | ACF/ Contractual |

It is recommended that Computer Operator with a minimum qualification of MCA/Bachelors degree in science with Diploma in Computer Science need to be appointed on contract basis in Project Divisions. The major tasks includes operation and management of project database, data entry on web based application, GPS based survey data maintenance, assistance to Division staff in e-communication, coordination with field staff in getting timely monthly reports during monthly meetings at Division, as well as training staff of Division office on computer usage and operations.

The strength of 'support and ministerial' staff at each DMU level would be as follows:

| | Position | Total Number |
|---|---|---|
| 1 | Computer Operator | 1 |
| 2 | Steno Typist | 1 |
| 3 | Office/ Personal Assistant | 2 |
| | **TOTAL** | **4** |

The portion of the work component related to TCPL being implemented by the forestry extension centre in the identified districts will maintain the following flow in terms of reporting and monitoring.




**Reporting and Monitoring Flow**

The district forestry extension officer will share the monitoring inputs to the respective DMU and will also forward the information to the regular line of command i.e., to the office of CCF (Extension). It is advisable that CCF (Extension) forward the Project implementation information directly to PMU. A GO needs to be issued by the office of the PCCF (HOFF) in this regard to formalize this chain of information flow.

### (6) District Convergence Committee

A convergence committee will be created at the district level to provide technical and administrative support to the Project. It will act as the hub for supporting various Project interventions and assist in inter-sectoral linkage. The DMU will develop a comprehensive 'Convergence Plan', which will be part of the micro-plan that will be developed for the implementation of the Project. The committee will meet preferably once a month and will consist of the following members:

**Composition of the District Convergence Committee**

| District Collector cum Magistrate | Chairperson |
|---|---|
| PD, DRDA | Member |
| District Agriculture Officer | Member |
| District Horticulture office | Member |
| District Fisheries Officer | Member |
| District Animal Husbandry Officer | Member |

| District Collector cum Magistrate | Chairperson |
|---|---|
| Representative of leading NGO | Member |
| DMU Officer | Member Secretary |

Alternatively, the existing District Level JFM Committee could be utilized for the purposes.

### (7) Field Management Unit (FMU)

The distribution of ranges in the identified divisions where the Project will be implemented is as follows:

| Sr. No | Identified Circles | Total No. of Territorial Ranges |
|---|---|---|
| 1 | Chennai | 9 |
| 2 | Vellore | 22 |
| 3 | Villupuram | 13 |
| 4 | Tiruchirapalli | 19 |
| 5 | Madurai | 14 |
| 6 | Dindigul | 16 |
| 7 | Virudhunagar | 12 |
| 8 | Tirunelveli | 15 |
| 9 | Salem | 8 |
| 10 | Dharmapuri | 15 |
| 11 | Coimbatore | 24 |
| 12 | Erode | 14 |
| 13 | AAZP | 2 |
| 14 | KMTR | 7 |
| 15 | MTR | 6 |
| 16 | ATR | 6 |
| | **TOTAL** | **202** |

The FMU will be created within the office of the RO to take charge of Project implementation at the range level. The FMU will have two general functions: i) technical support to Project implementers at the village level, namely EDCs and SHGs, and ii) field execution of project components viz. biodiversity conservation and TCPL.

The FMU will receive Project funds from the DMU and execute the works. It will make the specific site development plans, hire adequate laborers, prepare necessary materials, undertake the works and document the physical and financial progress.

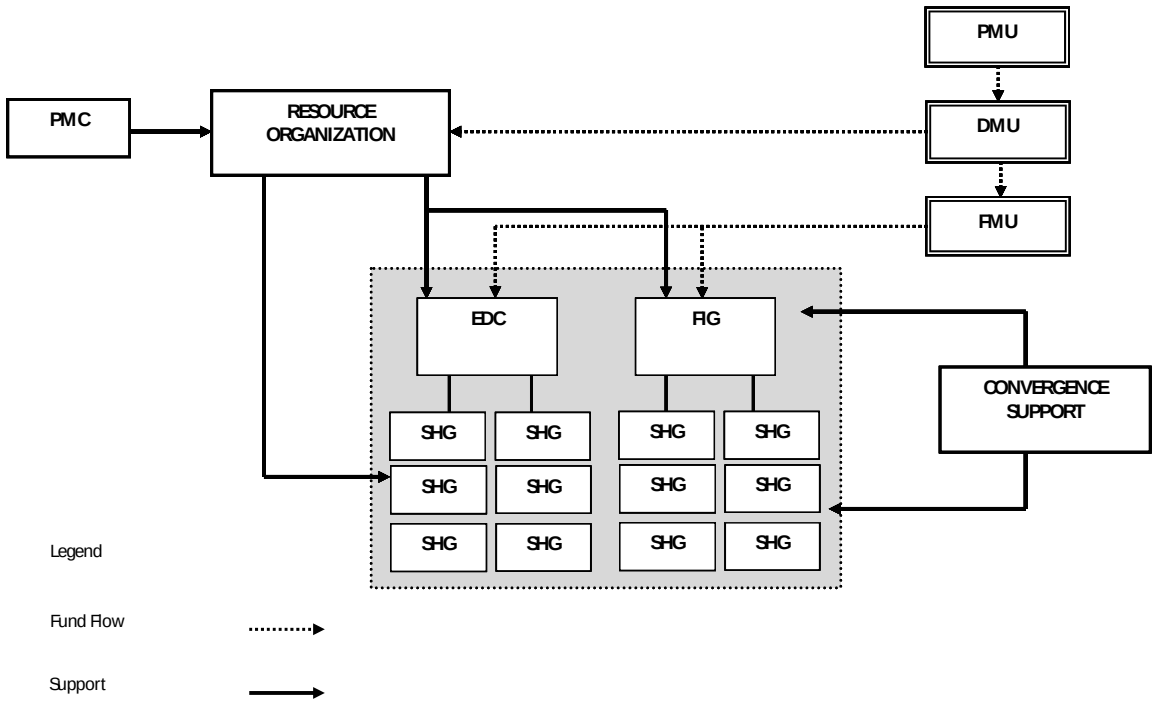
The RO will be the concurrent head of FMU (FMU Officer) on a part-time basis to be assisted by one Assistant FMU Officer (AFO) at the rank of forester or equivalent person to be recruited from the open market through placement agencies/service providers. When AFOs are forest officers, they will be released from their regular duty charges to concentrate full-time on the Project implementation.

| Staff Position | Desired Rank | Number |
|---|---|---|
| FMU Officer | Range Officer | 1 |
| Assistant FMU Officer (AFO) | Forester/ contractual | 1 |
| **SUPPORT & MINISTERIAL STAFF** | | |
| Computer Operator | Contractual | 1 |
| Utility Person | Contractual | 1 |

It is recommended that Computer Operator with a minimum qualification of Bachelors degree in Science with Diploma in Computer Science need to be appointed on contract basis. The major tasks includes assistance in office communication, assistance in providing support in timely recording of

work progress in data recording registers and timely filling of reporting formats under the project as well as training staff of Range office on computer usage and operations.

The FMU will implement the work components with a range of grassroots organizations such as EDCs, SHGs and FIGs (it will be created especially for the implementation of the TCPL component).




## 7.8 Support/ Technical Service Provider

### 7.8.1 Project Management Consultant

Management consulting services will be available to PMU for the smooth implementation of the Project.

The scope of the Consulting Services would be as follows**;**

(a) Assist PMU in formulating a comprehensive plan of operation for the implementation of the Project;

(b) Assist PMU in the preparation of guidelines and manuals relevant to the project;

(c) Assist PMU and DMUs in organizing various trainings for the project staff and stakeholders;

(d) Assist PMU in procuring NGOs, consultants, various resource organizations, construction contractors and other contractors that may be needed;

(e) Assist PMU in establishing an efficient and reliable system for monitoring and evaluation and in operating such systems for progress monitoring and impact assessment;

(f) Assist PMU in annual planning and budgeting;

(g) Provide technical assistance to PMU, DMUs, FMUs and various contractors and NGOs in the execution of their works such as survey, assessment, monitoring, capacity development, community organizing, and micro-planning;

(h) Review, analyze and recommend improvements in existing policies and guidelines relevant to

the project;

(i) Assist PMU in designing the course module and identification of institutions/places for international training/ study tours;

(j) Develop capacity, knowledge, and skills of PMU staff and field officers who play key roles in project activities through technical and managerial assistance; and

(k) Assist PMU in organizing seminars and workshops.

**Required Experts and Man-Months**

| Experts | MM |
|---|---|
| 1. Team Leader (International) | 13 |
| 2. Biodiversity Expert | 38 |
| 3. Community Development Expert | 38 |
| 4. Monitoring & Evaluation Expert | 22 |
| 5. GIS/MIS Expert | 20 |
| 6. REDD+ Expert | 18 |
| 7. Training Coordinator | 14 |
| **Sub-total** | **163** |
| **Supporting Staff** | **MM** |
| 1. Administrative Officer/Accountant | 52 |
| 2. Utilityman | 52 |
| **Sub-total** | 104 |

Specific tasks of experts are given in **Annexure 7.11**.

### 7.8.2 Resource Organizations

The project will require the services of various resource organizations: NGOs, research and academic institutions, and consultants. NGOs will be hired to provide community organization support to EDCs, SHGs and FIGs. These NGOs will be working with the community-based groups for a longer period of time, at least for the first three years. Services of technically competent NGOs, research and academic institutions, and consultants in biology and other technical fields will be procured to implement surveys, assessment, action plan preparation and monitoring works to be done by PMU and DMUs.

Besides this, local experts on 'as needed' basis will be hired to work with FMU and the communities.

## 7.9 Procurement and Implementation Methods

Project activities can be divided into the following three categories:

a) Works conducted directly by PMU, DMUs, FMUs, and extension centres

b) Works conducted by people's organisations (POs) such as EDCs, VFCs, and SHGs

c) Works conducted by resource organisations, including NGOs, consulting firm, research institutes, universities and other contracted organisations/individuals

In general, implementation methods for the above three categories can be summarised as follows:

| Implementer (Type of work) | Implementation method |
|---|---|
| a) Departmental works | Mainly by direct undertaking (partially on a contractual basis, direct contract and by price quotation) |
| b) Works by POs | Contractual basis through MOU |
| c) Works by resource organizations and others | Contractual basis |

Departmental work would be implemented by the PMU, DMUs and FMUs on a direct undertaking work basis or a contractual basis. Recruitment of members of local communities and project related POs, such as labourers or any other capacities for departmental works, is encouraged.

Procurement of equipment and goods will be outsourced to Electronics Corporation of Tamil Nadu (ELCOT). It is a fully-owned undertaking of the Government of Tamil Nadu, registered under the Indian Companies Act (1956). ELCOT is the nodal agency for Information and Communication Technology projects for the Government of Tamil Nadu. ELCOT is also an optional procurement agency (G.O.Ms.No.58 of FINANCE (BPE) DEPARTMENT Dated: 16.2.1999, Letter No.624/MIE.2/99-2, dated 21.10.1999) for the procurement of computer hardware and software for government departments/organisations/boards.

For the construction of buildings, these will be implemented by TNFD through the following options:

**Option 1:** If the budget is within Rs. 500,000, it is implemented departmentally, by the TNFD

**Option 2:** If the budget for construction of buildings is between Rs.500,000 and Rs. 3,000,000, then the works will be undertaken by open tendering/bidding procedure as per Government of Tamil Nadu.

**Option 3:** If the budget for construction of buildings is more than Rs.3,000,000, it will be implemented by the PWD department, Government of Tamil Nadu. PWD will undertake the work through open tendering or bidding procedure.

In principle, POs will implement all Project-related activities on the basis of a memorandum of understanding (MOU) or other forms of agreement/contract with the DMUs through which the accountability of the works would be entrusted to POs.

For the procurement of category c) stated above, the PMU will call for expressions of interest or request for proposal by advertisement in the local newspapers of the state as well as the division. A free and fair process of resource organisation selection will be done. A selection/appraisal committee will be formed by members of the PMU and development/rural management sectors/academics etc. Criteria for selection of resource organisations will be established, which will include experience, organisational staff and strengths.

The PMC will be selected through international competitive bidding in accordance with JICA's guidelines. A detailed implementation method for each of the Project component is described in **Table 7.4**.

## 7.10 Implementation Schedule of the Project

Detailed implementation schedule of the Project is shown in **Figure 7.2** attached. Loan validity period is assumed to be ten years, while the project implementation period is 8.5 years.

Prior to the loan agreement (L/A) coming into effect, TNFD would start the creation of the empowered committee and the PMU, and identification of key personnel for the Project implementation.

# CHAPTER 8 PROJECT COST

## 8.1 Conditions and Assumption

The Project cost was estimated based on the following conditions:

a) The Project cost for the Project period of eight years is estimated based on July 2010 constant prices or the relevant fixed rate for FY 2010 in Indian Rupees (Rs).

b) The daily wage for normal (unskilled) labour was estimated at Rs. 100 which was Tamil Nadu State's latest legal minimum daily wage (as of August 2010).

The quantity of each component, sub-component and activities to be included in the Project were estimated based on experiences from similar works in Tamil Nadu, particularly those implemented by TNFD.

c) Unit cost for each sub-component and activity were estimated on the basis of the detailed cost breakdown for each unit cost. Some costs were adopted from cost norms (schedule of rates) of TNFD, rates used for similar activities, and price quotations.

d) The cost for work implemented by EDCs/VFCs/SHGs includes an administration cost.

e) The cost for work contracted out to resource organizations includes service tax (10.3% of the total cost for concerned works).

f) The following exchange rates were applied for the cost estimation of the Project:

Rs. 1.0 = JPY 1.88, USD1.0 = Rs. 46.6, USD1.0 = JPY 87.7

g) Price escalation for local and foreign currency components is estimated at 3.2% and 1.2% per annum, respectively.

h) Physical contingency of 10% was applied.

i) Breakdown of unit cost is given in **Annexure 8.1 to 8.9.**

## 8.2 Cost Estimate

### (1) Direct Cost

The direct cost of the Project consists of costs for all components, namely biodiversity conservation, increasing the natural resource base, and supporting activities. The total cost of all these components is estimated at Rs. 5,600 million.

### (2) Administration Cost (Project Management Cost)

Administration costs consist of the following: i) personnel cost of PMU, circle offices, DMUs, FMUs and extension centres; and ii) running and maintenance costs necessary for operation and maintenance of offices, such as allowance and travel expenses, fuel and maintenance of vehicles, utility charges, maintenance of offices, office supplies, and other miscellaneous expenditures. The total administration cost is estimated at Rs. 1,601 million as the base cost.

### (3) Price Contingency

Price contingency is the amount of price escalation during the Project period, which is applied separately for local and foreign currency portions for all cost components. Price contingency is estimated at Rs. 780 million.

### (4) Physical Contingency

Physical contingency of 10% is applied to all costs for the various project components. Physical contingency is estimated at Rs. 639 million.

### (5) Project Management Consultant

The unit costs for consultancy services were derived from the market price corresponding to expected appropriate qualifications. The total estimated cost of consultancy services is tabulated below.

**Cost of Consultancy Services**

| Currency | Item | Cost (Rs. million) |
|---|---|---|
| Foreign currency portion | Base cost (w/o tax) | 22.6 |
| | Price contingency | 1.1 |
| | Physical contingency | 2.4 |
| | Service tax | 2.7 |
| | Sub-total | 28.9 |
| Local currency portion | Base cost (w/o tax) | 67.7 |
| | Price contingency | 6.4 |
| | Physical contingency | 7.4 |
| | Service tax | 8.4 |
| | Sub-total | 89.8 |
| Total | | 118.7 |

Source: JICA Preparatory Survey Team (2010)

### (6) Taxes and Duties

Value added tax for costs of all materials, consumables and services, service tax, and service charge of ELCOT are calculated in the cost estimation.

### (7) Total Project Cost

The total Project cost is estimated at Rs. 6,751 million. The summary of the Project cost breakdown is shown in the following table. The details are presented in **Table 8.1** and **Annexure 8.11.**

**Summary of Project Cost**

| Component | Cost (Rs. Million) |
|---|---|
| **1. Biodiversity Conservation** | **1,054** |
| 1.1 Habitat restoration, enhancement and management | 423 |
| 1.2 Resource protection | 299 |
| 1.3 Mitigate human-wildlife conflict | 215 |
| 1.4 Ecologically sustainable development | 117 |
| **2. Increasing the Natural Resource Base** | **1,854** |
| 2.1 Tree Cultivation on Private Land | 1,784 |
| 2.2 Research on production forestry/ agro-forestry/ farm forestry | 70 |
| **3. Supporting Activities** | **2,334** |
| 3.1 Capacity Development | 137 |

| Component | Cost (Rs. Million) |
|---|---|
| 3.2 Monitoring & Evaluation | 34 |
| 3.3 Construction of Buildings | 321 |
| 3.4 Augmentation of Office Facilities & Equipment | 124 |
| 3.5 Strengthening Mobility | 117 |
| 3.6 Project Management | 1,601 |
| **4. Sub-total (1+2+3)** | **5,241** |
| 5. Price Contingency | 788 |
| **6. Sub-total (4+5)** | **6,029** |
| 7. Physical contingency | 603 |
| **8. Sub-total (6+7)** | **6,632** |
| 9. Consulting Services | 119 |
| **10. Grand Total (8+9)** | **6,751** |

Source: JICA Preparatory Survey Team (2010)

## 8.3 Currency Component

The Project cost was divided into foreign and local currency components, with the assumptions that all goods and services are available locally, and international consultancy services will be procured overseas. Hence, foreign currency components cover the cost for the Project consultant only, while all other costs are estimated as local currency components. The currency components of the Project cost are summarized as follows.

**Summary of Currency Components for the Project Cost**

| Component | Local C. (Rs. million) | Foreign C. (Rs. million) |
|---|---|---|
| **1. Biodiversity Conservation** | **1,054** | **-** |
| 1.1 Habitat restoration, enhancement and management | 423 | |
| 1.2 Resource protection | 299 | |
| 1.3 Mitigate human-wildlife conflict | 215 | |
| 1.4 Ecologically sustainable development | 117 | |
| **2. Increasing the Natural Resource Base** | **1,854** | **-** |
| 2.1 Tree Cultivation on Private Land | 1,784 | |
| 2.2 Research on production forestry/ agro-forestry/ farm forestry | 70 | |
| **3. Supporting Activities** | **2,334** | **-** |
| 3.1 Capacity Development | 137 | |
| 3.2 Monitoring & Evaluation | 34 | |
| 3.3 Construction of Buildings | 321 | |
| 3.4 Augmentation of Office Facilities & Equipment | 124 | |
| 3.5 Strengthening Mobility | 117 | |
| 3.6 Project Management | 1,601 | |
| **4. Sub-total (1+2+3)** | **5,241** | **-** |
| 5. Price Contingency | 788 | - |
| **6. Sub-total (4+5)** | **6,029** | **-** |
| 7. Physical contingency | 603 | **-** |
| **8. Sub-total (6+7)** | **6,632** | **-** |
| 9. Consulting Services | 90 | **29** |
| **10. Grand Total (8+9)** | **6,722** | **29** |

Source: JICA Preparatory Survey Team (2010)

## 8.4 Financial Plan

Administration costs, and taxes and duties related to the Project activities will not be covered by the JICA loan based on JICA's funding policy. As a result, the total cost to be borne by GOI is estimated

at Rs. 1,897 million, while the total cost to be covered by the JICA loan is estimated at Rs. 4,853 million (JPY 9,124 million). Breakdown of the financial plan is presented in **Table 8.1** and its summary is given below.

**Summary of Fund Requirement**

| Component | Loan (Rs. million) | GOI (Rs. million) | Total (Rs. million) |
|---|---|---|---|
| **1. Biodiversity Conservation** | **1,029** | **25** | **1,054** |
| 1.1 Habitat restoration, enhancement and management | 416 | 7 | 423 |
| 1.2 Resource protection | 287 | 12 | 299 |
| 1.3 Mitigate human-wildlife conflict | 212 | 3 | 215 |
| 1.4 Ecologically sustainable development | 114 | 3 | 117 |
| **2. Increasing the Natural Resource Base** | **1,843** | **10** | **1,854** |
| 2.1 Tree Cultivation on Private Land | 1,774 | 10 | 1,784 |
| 2.2 Research on production forestry/ agro-forestry/ farm forestry | 70 | - | 70 |
| **3. Supporting Activities** | **945** | **1,389** | **2,334** |
| 3.1 Capacity Development | 137 | 0 | 137 |
| 3.2 Monitoring & Evaluation | 32 | 2 | 34 |
| 3.3 Construction of Buildings | 314 | 7 | 321 |
| 3.4 Augmentation of Office Facilities & Equipment | 114 | 11 | 125 |
| 3.5 Strengthening Mobility | 107 | 10 | 117 |
| 3.6 Project Management | 242 | 1,359 | 1,601 |
| **4. Sub-total (1+2+3)** | 3,818 | 1,424 | 5,241 |
| 5. Price Contingency | 497 | 291 | 788 |
| **6. Sub-total (4+5)** | 4,314 | 1,715 | 6,029 |
| 7. Physical contingency | 431 | 171 | 603 |
| **8. Sub-total (6+7)** | **4,746** | **1,886** | **6,632** |
| 9. Consulting Services | 108 | 11 | 119 |
| **10. Grand Total (8+9)** | **4,853** | **1,897** | **6.751** |

Source: JICA Preparatory Survey Team (2010)

# CHAPTER 9 PROJECT EVALUATION

## 9.1 Economic Analysis

### 9.1.1 Basic Assumption for Economic Analysis

The cost-benefit analysis was conducted under the following basic conditions and assumptions.

a) The economic life of the project is assumed to be 40 years since this type of environmental project takes a longer time to deliver return than that of ordinary infrastructure development projects.

b) The project costs in the project period are estimated based on July 2010 constant prices in Indian Rupees.

c) All of the financial cost of the project except for a part of the consulting service cost is local currency portion. The local currency portion is converted into economic cost by applying a standard conversion factor at 0.9.

d) The farm gate prices of forest products are assumed to be equivalent to the economic price with no distortion in prices.

e) The price contingencies, taxes and other kinds of transfer payments are excluded from the estimated financial costs in order to estimate the economic costs.

f) For the calculation of the net present value a discount rate of 10% is applied based on the economic opportunity cost of capital in India.

g) Exchange Rates: Rs.1.00 = 1.88 Yen; USD 1.00 = 87.7 Yen; USD 1.00 = Rs.46.6 as of August 2010.

h) Price Escalation Rate: 1.8% per annum. for foreign currency and 3.2% per annum. for local currency.

i) Physical contingency Rate: 5%

### 9.1.2 Economic Cost of the Project

#### (1) Capital cost

The economic cost of the project is estimated based on the conditions mentioned above. The financial cost and estimated economic cost are summarized in the table below. Breakdown of the estimated economic costs of the project components are given in **Table 9.1** and summarized below**:**

**Financial and Economic Project Cost (Rs. million)**

| Component | Financial Cost | Economic Cost |
|---|---|---|
| **1. Biodiversity Conservation** | **1,054** | **926** |
| 1.1 Habitat restoration, enhancement and management | 423 | 374 |
| 1.2 Resource protection | 299 | 258 |
| 1.3 Mitigate human-wildlife conflict | 215 | 191 |
| 1.4 Ecologically sustainable development | 117 | 102 |
| **2. Increasing the Natural Resource Base** | **1,854** | **1,659** |
| 2.1 Tree Cultivation on Private Land | 1,784 | 1,596 |
| 2.2 Research on production forestry/ agro-forestry/ farm forestry | 70 | 63 |

| Component | Financial Cost | Economic Cost |
|---|---|---|
| **3. Supporting Activities** | **2,334** | **2,074** |
| 3.1 Capacity Development | 137 | 123 |
| 3.2 Monitoring & Evaluation | 34 | 29 |
| 3.3 Construction of Buildings | 321 | 282 |
| 3.4 Augmentation of Office Facilities & Equipment | 124 | 102 |
| 3.5 Strengthening Mobility | 117 | 96 |
| 3.6 Project Management | 1,601 | 1,441 |
| **4. Sub-total (1+2+3)** | **5,241** | **4,659** |
| 5. Price Contingency | 788 | - |
| **6. Sub-total (4+5)** | **6,029** | **4,659** |
| 7. Physical contingency | 603 | 466 |
| **8. Sub-total (6+7)** | **6,632** | **5,125** |
| 9. Consulting Services | 119 | 92 |
| **10. Grand Total (8+9)** | **6,751** | **5,217** |

Source: JICA Preparatory Survey Team (2010)

### (2) O&M Cost

In addition to the capital costs stated above, the O&M costs are estimated at 1% of the capital economic cost (direct cost). It is assumed that the O&M cost would cover replacement cost of equipment, furniture and vehicle and the major portion will emerge after the completion of the project in Year 8.

## 9.1.3 Anticipated Economic Benefits

It is expected that the implementation of the project will bring economic benefits as outlined below:

| Components | Sub-component | Expected benefits |
|---|---|---|
| 1. Biodiversity conservation | 1.1 Habitat restoration, enhancement and management | ♦ Restoration, conservation and enhancement of biodiversity<br>♦ Augmentation of ground water due to construction of water holes and check dams |
| | 1.2 Resource protection | ♦ Reduction of damages on forest, human and wildlife by fire, spread of contagious diseases, and poaching. |
| | 1.3 Mitigate human-wildlife conflict | ♦ Reduction of damages on crops, human and wildlife |
| | 1.4 Ecologically sustainable development | ♦ **Income and employment generation through IGAs, eco-enterprises and ecotourism**<br>♦ Improvement of livelihood through provision/rehabilitation of roads, water supply, school, etc. |
| 2. Increasing the natural resource base | 2.1 TCPL | ♦ **Timber and fuelwood production**<br>♦ **Carbon sequestration (mitigation of climate change effects)** |
| | 2.2 Research on production forestry/ agro-forestry/ farm forestry | ♦ Improvement of income from forestry activities in the future |
| 3. Supporting Activities | 3.1 Capacity development | ♦ No direct benefit derived from the activities. But it will directly and indirectly contribute for generating the benefits above. |

Note: Tangible benefits are highlighted by **bold and underlined characters**.

Many of the expected benefits except for those underlined above are intangible or difficult to estimate

due to lack of detailed data for estimation at this stage of the project. Estimation of tangible benefits is explained as follow:

### (1) Rough Estimation of Benefits from IGA and Ecotourism

Little is documented concerning the economic benefits of income generating activities (IGA) in Tamil Nadu, particularly with respect to ecotourism for which most of the relevant information lies within the private sector and is not readily accessible. Some anecdotal information is summarised below:

- The mean annual income increased by Rs. 1,800 over a period of three consecutive years in two TAP villages in Chengalpattu/Kanchipuram District, which has scheduled caste households, when women were allowed to plant and collect fodder grass or *Phoenix* to make brooms.
- Regularisation of *Phyllanthus* (gooseberry) collection in Sathyamangalam, through the formation of Village Forest Councils (VFCs), has generated an annual income of Rs. 28,000-30,000 per council over a period of five years.
- Allowing people to collect *Phoenix* to make brooms in Erode Division, again through VFCs, has increased average annual household income by Rs. 2,800.
- Coastal restoration interventions in the Catholic Diocese of Pondicherry and Cuddalore has increased average annual household income by about Rs. 5,400. In the same set of villages, activities such as nursery raising has provided women with an income of about Rs. 400 per month

Elsewhere in India, ecotourism has been hugely successful in Periyar Tiger Reserve, Kerala, where some 40,000 villagers from 5,540 families have benefited from a wide range of income-generating ecotourism activities (e.g. rafting, home-stays, guided treks, overnight stays in the jungle) during the period 1998-2005[1]. Village members of the bamboo-rafting programme earn a monthly wage of Rs 3,500; women working as trackers/guides have an assured income of Rs. 5,000 per month; and households providing home-stays have increased their annual income by Rs. 35,000.

Ecotourism is emerging in Orissa, notably in Satkosia Tiger Reserve where an eco-camp has been running for several years on the sand banks of the Mahanadi River during the winter season. Here, an EDC having been supported by Orissa Forestry Sector Development Project (funded by JICA) started a new eco-camp with 9 tents. Maximum capacity of the eco-camp is 18 adults and 9 children (27 in total). The record maintained by OFSDP field level expert provides information on the profit of ecotourism activities.

**Data on Eco-camp Operation (2008/09)**

| | Tents Available | Tents Booked | Gross Revenue (Rs.) | | | |
|---|---|---|---|---|---|---|
| | | | From Tents | From Boats | From Food | Total |
| Nov '08 | 261 | 128 | 129,200 | 6,000 | 11,633 | 146,833 |
| Dec '08 | 279 | 221 | 232,600 | 17,000 | 29,232 | 278,832 |
| Jan '09 | 279 | 175 | 193,600 | 16,050 | 9,375 | 219,025 |
| Feb '09 | 252 | 111 | 124,000 | 8,700 | 5,451 | 138,151 |
| March '09 | 279 | 67 | 71,600 | 500 | 2,468 | 74,568 |
| April '09 | 270 | 10 | 11,000 | 0 | 0 | 11,000 |
| **Total** | **1,620** | **712** | **762,000** | **48,250** | **58,159** | **868,409** |

Source: Orissa Forestry Sector Development Project/Satkosia Wildlife Division

[1] S.P. Thampi (2005). Ecotourism in Kerala: Lesson from the Eco-development Project in Periyar Tiger Reserve. Ecoclub.com E-Paper Series 13.

The eco-camp operated for six months only due to weather condition. According to the information from Orissa Project, 35% of the revenue from tents goes for repair and maintenance. Meanwhile, the repair and maintenance cost of boats and material cost of food are assumed to be 50%. Hence, the net annual profit from the eco-camp was estimated at Rs. 548,505 (Rs. 495,300 from tents, Rs. 24,125 from boats, and Rs. 29,080 from food).

Considering the above information, the expected benefits from IGA and ecotourism were roughly estimated based on following assumptions:

a) The average annual income of household participating in IGA increase by Rs. 3,000/year

b) Net annual profit of ecotourism activities at an ecotourism site is Rs. 548,505/year

**Rough Estimation of Annual Net Income from IGA**

| | | No. of target villages | Average No. of participating households per village *1 | Average annual household income increased by the activity supported by the Project (Rs.) | Expected annual benefit (Rs.1,000) |
|---|---|---|---|---|---|
| 1.4.3 | Eco-development activities in villages abutting PAs | 30 | 80 | 3,000 | 7,200 |
| 1.4.4 | Ecologically sustainable Development in villages peripheral to RFs | 33 | 80 | 3,000 | 7,920 |
| | | | | Total | 15,120 |

Note: No. of households per village ranges from 40 to 200. It is assumed that on average 90 households per village will participate in income generating activities.

**Rough Estimation Annual Net Income from Ecotourism**

| | | No. of target villages | Annual average net profit of ecotourism activities per village (Rs.) | Expected annual benefit (Rs. 1,000) |
|---|---|---|---|---|
| 1.4.5 | Community-based ecotourism | 25 | 548,505 | 13,713 |

## (2) Benefits of timber and fuelwood production by TCPL

The benefits are estimated based on the following assumptions:

a) Casuarina, Teak, Ailanthus excelsa, and Melia dubia are selected as representative species for calculation of economic benefit of TCPL. According to available data of on-going TCPL in two districts below, Casuarina and Teak are dominant species of TCPL. Ailanthus excelsa, and Melia dubia are also popular species being selected by farmers for TCPL in other areas of the state.

| Species | No. of seedlings planted | | | | Planted Area # | |
|---|---|---|---|---|---|---|
| | Vellore | Tiruvannamalai | Total | % | (ha) | % |
| **Casuarina** | 142,500 | 157,500 | 300,000 | **51%** | 30 | **5%** |
| **Teak** | 63,824 | 69,920 | 133,744 | **21%** | 267 | **44%** |
| Rosewood | 35,837 | 14,465 | 50,302 | 9% | 101 | 17% |
| **Alianthus excelsa** | 505 | 8,000 | 8,505 | **1%** | 17 | **3%** |
| Vengai | 14,400 | 7,375 | 21,775 | 4% | 44 | 7% |
| Kumi | 21,808 | 21,745 | 43,553 | 7% | 87 | 14% |
| Redsandal | 10,326 | 19,295 | 29,621 | 5% | 59 | 10% |
| Total | 289,200 | 298,300 | 587,500 | 100% | 605 | 100% |

Source: Raw data of TCPL accomplishment in the two districts for year 2009/10 (obtained from TNFD)
#: Planted area was estimated based on planting density of 500 seedlings/ha for all species except for Casuarina (10,000 seedlings/ha).

b) Following estimated planting areas of each species are used for benefit calculation:

| | | |
|---|---|---|
| Casuarina: | 3,000 ha | (30,000,000 seedlings) |
| Teak: | 40,000 ha | (20,000,000 seedlings) |
| Ailanthus excelsa | 26,000 ha | (26,000,000 seedlings) |
| Melia dubia: | 40,000 ha | (24,000,000 seedlings) |
| Total | 109,000 ha | (100,000,000 seedlings) |

c) It is assumed that farmers would keep replanting Casuarina after harvesting over the project period (40 years). They would bear all the investment cost including the cost of seedlings, planting, maintenance, and harvesting except for the cost seedlings and planting for 1st rotation.

d) Casuarina will be harvested at 5th years after planting. The productivity is estimated at 80 ton/ha of polywood and 20 ton/ha of fuelwood per hectare based on information obtained from farmers in the field.

e) Teak would be harvested at 20 years after planting in 10% of the planted areas and at 30 years in the remaining 90% of the planted areas. MAI (mean annual increment) of Teak is estimated at 3.0 $m^3$, which is a pessimistic scenario of an available study.[2] About 70% of the products is taken as timber and the remaining as fuelwood. No replanting is planned after harvesting.

f) Ailanthus excelsa would be harvested at 10 years after planting. MAI is estimated at 5.0 $m^3$. About 70% of the products is taken as timber and the remaining as fuelwood. No replanting is planned after harvesting.

g) Melia dubia would be harvested at 15 years after planting. MAI is estimated at 5.0 $m^3$. About 70% of the products is taken as timber and the remaining as fuelwood. No replanting is planned after harvesting.

**Tables 9.2, 9.4, 9.6, and 9.7** provide the economic cost and benefit flow of each tree species.

### (3) Carbon sequestration (REDD plus benefits)

The proposed TCPL activity is a business as usual activity and there is no additionality to it as mentioned below. Therefore TCPL will not meet the criteria for registering as an AR-CDM project.

[2] J.B. Ball, D. Pandey, and S. Hirai, Global Overview of Teak Plantations: Paper presented to the regional seminar – Site, Technology and Productivity of Teak Plantations, Cheang Mai, Thailand, 26-29 January 1990. The paper shows a pessimistic scenario with MAI of 3$m^3$/ha/yr, a realistic scenario of 5$m^3$/ha/yr, and an optimistic scenario of 8$m^3$/ha/yr.

- In case of TCPL plantations, tree growing appears as a profitable venture because similar plantation are raised by farmers in nearby areas on their own (without any inventive by the government) for selling wood in the market.

- There appears to be no investment, technological or social barriers, because as per the project proposal submitted to JICA, the department would be planting the farmers seed with seedling and would be providing incentives to the farmers based on surviving seedlings.

However, the TCPL activities could be eligible for REDD plus since the scope was broadened to include "enhancement of forest carbon stock" through afforestation/reforestation. Though the modalities and methodologies for REDD plus have not established/ approved, the benefits - net anthropogenic GHG removals by sinks - were estimated using simplified methodologies approved by UNFCCC for AR-CDM projects.

In case of AR-CDM, UNFCCC requires project proponents to estimate GHG removal by sinks conservatively. The principle would be the same for REDD plus and thus the lower productivity - MAI - of Casuarina than that used for estimation of benefit of timber and fuelwood was used for estimating the net anthropogenic GHG removals by sinks, viz. 13$m^3$/ha/year which was used in registered small-scale AR-CDM project in Tamil Nadu. As for Teak and other species, the MAI used for benefit estimation was used for estimating the net anthropogenic GHG removals by sinks because the figures are conservative enough.

**Table 9.8** gives detailed calculation of REDD plus benefits. To estimate the monetary value of the benefit, the opportunity cost per ton $CO_2$e (US$ 3.0) and estimated implementation and transaction cost of REDD activities per ton $CO_2$e (US$ 1.0) were used.[3]

### 9.1.4 Cost Benefit Analysis

The net present value (NPV) and economic internal rate of return (EIRR) are calculated to validate the economic feasibility of the project:

**Table 9.9** shows the projected cash flow of the estimated economic project costs and benefits of the project. The NPV at the 10% discount rate and EIRR are estimated at Rs. 2,045 million and 11.6 %, respectively. They are rather low because many of the project benefits are intangible in nature or difficult to estimate due to lack of data and clear quantitative targets of project activities.

**Results of Economic Analysis**

| Items | Result |
|---|---|
| Net present value (at discount rate of 10%) | Rs. 2,045 million |
| EIRR | 11.6% |

Source: JICA Preparatory Survey Team (2010)

### 9.1.5 Sensitivity Analysis

Sensitivity analyses are carried out to examine the viability of the project under enforceable negative changes in costs and benefits, namely, i) 10% increase in cost, ii) 20% increase in cost, iii) 10% decrease in benefit, iv) 20% decrease in benefit, and their combinations. The results of the calculation are given in Annexes, and summarized as follows:

[3] The data is derived from "The Financial Costs of REDD: Evidence from Brazil and Indonesia," IUCN, 2009.

**Sensitivity Analyses by EIRR**

| | | Change in Benefit | | |
|---|---|---|---|---|
| | | **0% (Base case)** | **- 10 %** | **-20 %** |
| **Change in cost** | **0% (Base case)** | 11.6 % | 11.2 % | 10.9 % |
| | **+10 %** | 11.3 % | 10.9 % | 10.4 % |
| | **+20 %** | 10.9 % | 10.6 % | 10.1 % |

Source: JICA Preparatory Survey Team (2010)

**Sensitivity Analyses by NPV (Rs. Million)**

| | | Change in Benefit | | |
|---|---|---|---|---|
| | | **0% (Base case)** | **- 10 %** | **-20 %** |
| **Change in cost** | **0% (Base case)** | 2,045 | 1,467 | 890 |
| | **+10 %** | 1,672 | 1,094 | 517 |
| | **+20 %** | 1,299 | 721 | 143 |

Source: JICA Preparatory Survey Team (2010)

## 9.2 Financial Analysis

In principle, general financial analysis aims to assess profitability of the business/ project/ cash flow. But such analysis does not fit well with the project for which detailed plans and scale of project activities would be formulated in a participatory manner and/or through detailed surveys or assessment at the initial stage of project implementation. In addition, profitability of the project activities aiming at biodiversity conservation and restoration of ecosystem and capacity development of stakeholders is always difficult to assess due to lack of reliable data.

Despite of lack of reliable data, financial analysis of TCPL was analyzed for popular species, Casuarina and Teak, to assume if it is financially attractive and affordable to small and marginal farmers and the sustainability.

**Tables 9.3 and 9.5** show the result of financial analysis per hectare of Casuarina and Teak under the on-going TCPL, respectively.

**Financial analysis of Casuarina Plantation per hectare (Rs. 1,000/ha)**

| | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Total | FIRR |
|---|---|---|---|---|---|---|---|---|
| Cost | TNFD | 70 | 0 | 0 | 0 | 2 | 72 | |
| | Farmers (A) | 13 | 10 | 7 | 2 | 0 | 32 | |
| | Total | 83 | 10 | 7 | 2 | 2 | 104 | |
| Benefit | (B) | 0 | 0 | 0 | 0 | 160 | 160 | |
| Benefit - Cost | | -83 | -10 | -7 | -2 | 158 | 56 | 12% |
| Benefit - Cost (B-A) | | -13 | -10 | -7 | -2 | - | 128 | |

Refer to Table 9.3.

The financial investment cost per hectare of Casuarina is Rs. 104,000, of which 69% is supported by the project and the remaining (31%) by farmers. The profit in five years (Rs.56,000/ha) may not be very attractive in comparison with the net benefit of paddy cultivation (Rs. 30,000 – 50,000/ha/crop) and sugarcane (Rs. 37,500 – 75,000/ha/crop). This is partly due to higher cost of production as the planting is done by TNFD. Nevertheless, farmers prefer Casuarina cultivation due to the following reasons:

a) Casuarina requires much less irrigation than paddy or sugarcane & irrigation cost is going up due to declining water table

b) Marketing risks for Casuarina is less than sugarcane as the latter is perishable.

c) Casuarina requires much less labour and the labour requirement is concentrated in first year.

d) Increasing incidence of pest attack in paddy and sugarcane, which increases cost both in terms of pesticide and supervision.

e) Casuarina provides opportunity to farmers to look for alternate employment / income sources.

The analysis shows that farmer could actually get higher net profit (Rs. 128,000) with financial support under TCPL scheme. The higher net gain in short gestation period would encourage farmers to step into tree cultivation.

**Financial analysis of Teak Plantation per hectare (Rs. 1,000/ha)**

| | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Y5~19 | Y- 20 | Y-30 | Total | FIRR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cost | TNFD | 6.5 | 0 | 2.2 | 0 | 2 | - | - | - | 9 | |
| | Farmers | 6.6 | 3 | 2 | 2 | 1 | 1 | 12.8 | 169 | 220 | |
| | Total | 13 | 3 | 4.2 | 2 | 1 | 1 | 12.8 | 169 | 229 | |
| Benefit | | - | - | - | - | - | - | 331 | 4,698 | 5,029 | |
| B-C | | -13 | -3 | -4.2 | -2 | -1 | -1 | 318 | 4,529 | 4,800 | 21% |

Refer to Table 9.5.

On the other hand, Teak is medium rotation period of 20-30 years. Though the gestation period of Teak is longer than Casuarina, it is profitable and one of the most popular tree species being planted under TCPL.

## 9.3 Environmental and Economic Contribution by TCPL

Anticipated environmental and economic contribution of TCPL in terms of increased green cover, carbon sequestration and wood supply were roughly analyzed under the same assumptions used for benefit calculation.

For wood supply, the project, through TCPL, would supply 0.38 million $m^3$ of timber, equivalent to 24% of the deficit in 2008. Meanwhile, the expected supply of fuelwood by TCPL under the project would be negligible (0.16 million $m^3$/year or merely 1% of annual deficit) compared with the deficit shown below:

**Comparison of Wood Supply from the Project with Current Deficit**

| | Planted Area (ha) | MAI (m3/ha/year) | Annual supply *1 (1000$m^3$/year) | | Annual Deficit *2 (1000$m^3$/year) | |
|---|---|---|---|---|---|---|
| | | | Timber | Fuelwood | Timber | Fuelwood |
| Casuarina | 3,000 | 13 | 27.3 | 11.7 | | |
| Teak | 40,000 | 3 | 84.0 | 36.0 | | |
| Ailanthus excelsa | 26,000 | 5 | 91.0 | 39.0 | | |
| Milea dubia | 40,000 | 5 | 140.0 | 60.0 | | |
| Total | 122,000 | - | 342.3 | 146.7 | 1,560 | 12,490 |

*1: Of the annual increment (MAI), 70% is taken as timber and the rest as fuelwood.
*2: Total supply from import and other sources in 2008 is taken as "deficit". Source: "Wood Balance Study – Tamil Nadu," June 2009, Madras School of Economics, Chennai

With regard to forest cover, the project would increase it between 110,000ha and 120,000 ha, more or less 1.0% of the total geographical area in Tamil Nadu. As for GHG emission reduction, the project will reduce 0.36 million tons of $CO_2$ equivalent annually by TCPL. This is about 0.02% of the net

GHG emission from India in 2007 (1,727.7 million tons of $CO_2$ equivallent).[5]

## 9.4 Review of Environmental and Social Considerations

This section describes applicable guidelines, policies and laws at national and international levels, which ensure a certain level of quality in the infrastructure projects for ensuring sustainable development. The objective is to ensure that the project will not lead to major ecological or other losses to the country and the people that could nullify otherwise immediately available project benefits. The various regulations that apply to the Project are provided in this section.

### 9.4.1 Applicable Regulations of the Government of India

The primary responsibility of the administration and implementation of GOI's policy with respect to environmental management, conservation, ecologically sustainable development, and pollution control rests with the Ministry of Environment and Forests (MoEF).

A list of all the most important applicable GOI regulations is summarized below:

**Summary of Applicable Regulations**

| Applicable Regulations | Year | Objective | Applicability |
|---|---|---|---|
| Environment (Protection) Act | 1986 | To protect and improve overall environment | Protect environment in general |
| Environment Impact Assessment (EIA) Notification | 1994 | To meet requirements of Environmental Impact Assessment | Direct |
| Water (Prevention and Control of Pollution) | 1974 | To control water pollution by controlling emission and water pollutants according to prescribed standards | Control of water pollution |
| Tamil Nadu Forest Act | 1882 | For protection and management of forest in the State of Tamil Nadu | Forest |
| Forest (Conservation) Act | 1980 | To conserve forests and to regulate the utilization of forests for non-forestry purposes | Forest |
| The Wildlife (Protection) Act | 1972 | To provide for the protection of wild animals, birds plants and for matters connected therewith | Wildlife |
| Ancient Monuments and Archaeological sites & Remains Act | 1958 | To conserve cultural and historical remains found in India | Archaeological remains |
| Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act | 2006 | To recognize the rights of the forest dwelling Scheduled Tribes and other traditional forest dwellers | Scheduled Tribes and forest dwellers |
| Noise Pollution (Regulation and Control) Rules, 2000 | 2001 | To regulate and control noise pollution | Control of noise pollution |
| Public Liability Insurance Act | 1991 | To assess hazardous materials and accidents hazards | Health and safety |
| Biological Diversity Act | 2002 | To conserve biological diversity, ensure sustainable use of its components and achieve fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith | Biodiversity |

[5] India: Green Gas Emissions 2007 (Executive Summary), MoEF, 2010.

| Applicable Regulations | Year | Objective | Applicability |
|---|---|---|---|
| EIA Notification | 2006 | To assess environmental impact assessment of major development projects | Environmental clearance |
| International environmental treaties to which India is a party, such as Convention on Biological Diversity, Ramsar Convention on Wetlands, Bonn Convention on Migratory Species, UN Framework Comvention on Climate Change | | To ensure International cooperation and domestic commitments in biodiversity conservation, greenhouse gas emission, etc. | Environmental protection |

Source: www.envfor.nic.in

### (1) Environment Protection Act, 1986

The Environment Protection Act 1986 is an umbrella act which provides for the protection and improvement of the environment, and for matters connected therewith. This act authorizes the central government to intervene directly in order to protect the environment and also allows public interest litigation for the same purpose. In terms of responsibilities, this Act and its associated rules require obtaining environmental clearances for specific types of new/expansion projects addressed under EIA notification. Environmental clearance is not applicable for the Project.

### (2) EIA Notification in India

The EIA Notification in India is GOI's guidelines for EIA governing all development interventions that takes place within the boundaries of India. EIA notification was issued by Ministry of Environment and Forests (MoEF) in 1994 and later amended in 2002. The purpose of this was to impose restrictions and prohibitions on the expansion and modernization of any activity or new projects as specified in Schedule 1 in any part of India unless environmental clearance has been accorded by the central or state government in accordance with the procedure specified in the notification. The EIA notification was revised and notified on September 14, 2006 in order to make the EIA process more transparent and effective. This supersedes the notification issued in 1994.

There are two categories of projects via, category A and category B. Category A will be cleared by MoEF at the central level (Expert Appraisal Committee or EAC constituted by MoEF). Meanwhile, category B project will be cleared by the State Environmental Impact Assessment Authority (SEIAA) constituted by MoEF at the state level. If there is no state level authority constituted, all categories of projects included in Schedule 1 would be dealt at the central level.

The objectives of the notification are as follows:

- To formulate a transparent, decentralized and efficient regulatory mechanism;
- To incorporate necessary environmental safeguards at planning stage;
- To involve stakeholders in the public consultation process; and
- To identify developmental projects based on impact potential instead of investment criteria.

The differences between EIA Notifications 1994 and 2006 are as follows:

- Public consultation structured; to be conducted by SPCB and presided by DM (within 45 days) with the proceedings to be videographed; or by MoEF as the case may be to intervene if public hearing not held in time

- Time limits with consequences at each stage
- SEIAA and State Expert Appraised Committee (SEAC) at the state level, and EAC at the central level

According to the latest EIA notification, activities in the project do not appear in the list of Schedule 1 and as such are exempted from the environmental clearance.

### (3) Forest Conservation Act, 1980

The Forest Conservation Act, 1980 provides for the conservation of forests and regulates diversions of forestlands for non-forestry purposes. When any projects fall within forestlands, prior clearance is required from relevant authorities under said act. State governments cannot de-reserve any forestland or authorize its use for any non-forest purposes without prior approval from the central government.

Rules, guidelines and acts which are related to forestry are listed below.

**Laws Relevant to Forestry**

| Area/Sector | Type | Level of Control |
|---|---|---|
| Forestry/Forest Conservation | Acts<br>- Forest Conservation Act, 1980, as amended in 1988 | Government of India and all state government |
| | Rules<br>- Forest Conservation Rules, 2003 as amended in 2004 | Government of India and all state government |
| | Guidelines<br>- No.5-5/86-FC, [25/11/1994] – Guidelines for diversion of forest lands for non-forest purpose under the Forest Conservation Act, 1980<br>- No.11-9/1998-FC [04/05/2001] – Guidelines for national park and wildlife sanctuaries.<br>- S.O.525 (E) [23/04/2003] – Constitution of CAMPA order for managing the compensatory afforestation funds.<br>- F.No.5-1/1998-FC [17/09/2003] – Guidelines for collection of net present value<br>- F.No.2-1/2003-FC [20/10/2003] – Guidelines for stepping up of development project in tribal area<br>- F.No.2-1/2003-FC [20/10/2003] – Modification of existing guidelines<br>- No.8-84/2002-FC [14/05/2004] – Guidelines for project utilizing wind energy<br>- No.2-1/2003-FC [07/06/2004] – Revised guidelines for tusser cultivation<br>- Various orders of the Honorable Supreme Court of India in W.P.(C).No.202/95. | Government of India and all state government |
| Forestry/Forest Conservation | Acts<br>- Tamil Nadu Forest Act, 1882 | State of Tamil Nadu |
| | Rules<br>- The Tamil Nadu Sandalwood Transit Rules, 1967 (to regulate the transit of sandalwood)<br>- The Tamil Nadu Timber Transit Rules, 1968 (to regulate timber movement)<br>- Tamil Nadu Sandalwood Possessions Rules, 1975 (to regulate sandalwood possession)<br>- The Tamil Nadu Maintenance of Accounts in Respect of Scheduled Timber for Industrial or Commercial Purposes Rules, 1988 (to regulate the possession of scheduled timber) | State of Tamil Nadu |

Source: www.envfor.nic.in and TNFD

### (4) Biological Diversity Act, 2002

In order to provide for the conservation of biological diversity, sustainable use of its components and fair and equitable sharing of benefits arising out of the use of biological resources and knowledge, the United Nations Convention on Biological Diversity was formulated in 1992. As a party to the said convention, India enacted the Biological Diversity Act in 2002 which came into force on February 5, 2003. The rules and orders issued under the said act are given below.

**Laws on Biodiversity**

| Area/Sector | Type | Level of Control |
|---|---|---|
| Biodiversity | Biological Diversity Act, 2002<br>- No. 18 of 2003, [05/02/2003] – The Biological Diversity Act, 2002<br>- S.O.753 (E), [01/07/2004] – Coming into force of sections of the Biodiversity Act, 2002<br>- S.O.497 (E), [15/04/2004] – Appointment of non-official members on NBA from October 1, 2003<br>- S.O.1147 (E) – Bringing into force sections 1 and 2; section 8 to 17; section 48,54,59,62,63,64 and 65 w.e.f. October 1, 2003 | Government of India and all state governments |
| | Rules<br>- G..S.R.261 (E), [15/04/2004] – Biological Diversity Rules, 2004 | Government of India and all state governments |

Source: www.envfor.nic.in

### (5) Wildlife Protection Act, 1972

The first comprehensive legislation related to the protection of wild animals, birds, plants and for matters connected therewith or incidental thereto with a view to ensuring the ecological and environmental security of the country, was passed by the parliament and it was given assented by the president on September 9, 1972. This came to be known as the Wildlife Protection Act, 1972. This law has given special importance to the protection of specified plants, control/prohibition of trade or commerce in wild animals, animal articles and trophies, hunting of animals, and declaration of sanctuaries, national parks and closed areas etc. The rules and orders issued under the act are given below.

**Laws on Wildlife**

| Area/Sector | Type | Level of Control |
|---|---|---|
| Wildlife | Acts<br>- The Wildlife Protection Act, 1972 (amended in 1982, 1986, 1991, 1993 and 2002) | Government of India and all state governments |
| | Rules<br>- S.O.1092 (E), [22/09/2003] – The National Board for Wildlife Rules, 2003<br>- S.O.445 (E), [18/04/2003] – The Declaration of Wildlife Stock Rules, 2003<br>- G.S.R.350 (E), [18/04/1995] – The Wildlife (specified Plant Stock Declaration) Central Rules, 1995<br>- G.S.R.349 (E), [18/04/1995] – The Wildlife (specified Plant – Conditions for Possession by Licensee) Rules, 1995<br>- G.S.R.348 (E), [18/04/1995] – The Wildlife (Protection) Rules, 1995<br>- Recognition of Zoo Rules, 1992 | Government of India and all state governments |

| | | |
|---|---|---|
| | - G.S.R.328 (E), [13/04/1983] – The Wildlife (Protection) Licensing (Additional matters for Consideration) Rules, 1983<br>- G.S.R.29 (E), [25/01/1973] – The Wildlife (Stock Declaration) Central Rules, 1973<br>- G.S.R.198 (E), [09/04/1973] – The Wildlife (Transaction and Taxidermy) Rules, 1973 | |
| | Wildlife Guidelines<br>Guidelines for Appointment of Honorary Wildlife Wardens | Government of India and all state governments |

Source: www.envfor.nic.in

**(6) Noise Pollution Regulation and Control Rules, 2000**

As a result of considering the deleterious and psychological effect of the noise pollution on human well being, MoEF has drawn up the Noise Pollution Regulation and Control Rules, 2000, which have come to force on February 14, 2000. According to the provisions of the Rules notified, a person could make a complaint to the designated authority in the event that actual noise levels exceed the ambient noise standards by 10 db (A) or more as compared to the standards prescribed in the schedule of the rules. The designated authority will take action against violators in accordance with the provisions of these rules or other laws in force.

**(7) Water Prevention and Control of Pollution Act, 1974**

The Water Prevention and Control of Pollution Act, 1974 resulted in the establishment of the Central and state level pollution control boards. The responsibilities of which include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of certain facilities.

### 9.4.2 Applicable Policies and Strategies

**(1) National Environmental Policies**

The National Environmental Policy (NEP) 2006 is a response to national commitment to clean environment mandated in the Indian Constitution and is intended to incorporate environmental concerns in all development activities. NEP recognizes environmental degradation as a major causal factor in enhancing and perpetuating poverty particularly among the rural poor. One of the key objectives of NEP is to integrate environmental concerns into policies, plans, programs and projects for economic and social development. This policy has evolved from the recognition that only such development is sustainable, which respects environmental and ecological constraints. In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

**(2) National Zoo Policy, 1998**

The National Zoo Policy, 1998 aims at giving proper direction and thrust to the management of zoos, by mustering cooperation and participation of all the concerned. This policy also provides strategy in achieving the objectives of the policy, and also details of animal housing, upkeep of animal collection,, health care, research and training, breeding program for species, education and outreach activity, extension activities and amenities to visitors, etc.

**(3) National Forest policies**

In 1952, the former Ministry of Food and Agriculture of GOI enunciated a national forest policy which is to be followed for the management of state forest in the country. However, forests in the country have seriously depleted over the years. The need to review the situation and to evolve a new

strategy for forest conservation in the future has become imperative. In view of this, the national forest policy was revised in 1988. The principal aim of the new forest policy is to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which is vital for sustenance of all life forms, human, animal and plant. The derivation of direct economic impact must be subordinated to this principal aim. The policy envisions the enhancement of forest coverage to 33% of the total geographical area of India.

**(4) JBIC Guidelines for Confirmation of Environmental and Social Considerations**

On April 1, 2002, JBIC established "Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations" as unified guidelines of two environmental guidelines applied to international financial operation and overseas economic cooperation operations respectively. The guideline have been implemented on October 1, 2003.

Said guidelines give guiding principles related to environmental consideration by JBIC in its appraisal of a project. It also provides for environmental matters to be considered and the preparation stages of a project. Projects have been categorized into three basic categories, A, B, and C, depending on the extent of involvement of significant environmental and social issues similar to other funding agencies such as the World Bank and ADB.

In accordance with JBIC guidelines, projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or ordinances of the government for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such designated areas). Projects are also not to impose significant adverse impact on designated conservation areas.

JBIC guidelines focus on the participation of stakeholders as local community inhabitants who will be affected by the Project. They require the project executor to solicit stakeholders' participation from the project planning stage. The checklist to be confirmed by JBIC now includes social considerations pertaining to resettlement, indigenous people and women. Also, a provision on information disclosure is more strengthened than in the previous guidelines. JBIC is required to make public such items as the category classification of the Project prior to loan approval.

Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate for the country and locality in which the project is planned. For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan. Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor and ethnic minorities, all of whom are susceptible to environmental and social impact as well have little access to the decision-making process within society.

Involuntary resettlement and loss of livelihood are to be avoided whenever feasible as all vital alternatives are to be explored. When it is proved unfeasible after such examination, effective measures in order to minimize impact and to compensate for losses must be agreed upon with the affected people.

People to be resettled involuntarily as well as people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents, etc. in timely manner. The project proponents, etc. must make efforts to enable the affected people improve their standard of living, income opportunities and production levels, or at least restore their status to pre-project levels.

Appropriate participation by the affected people and their communities must be promoted in planning, implementation and monitoring of involuntary resettlement plans and against the loss of their means

of livelihood.

The present study integrated the basic concerns on environmental and social considerations in accordance with JBIC guidelines.

### 9.4.3 Environmental and Socio-economic Impacts of the Project

#### (1) Scoping

Scoping of the environmental and social effects of the Project was conducted by the JICA Survey Team in order to obtain an initial identification of main potential impacts of the Project. The scoping was conducted with reference to the relevant laws and regulations in India and JBIC Guidelines for Confirmation of Environmental and Social Considerations.

The scoping results on the environmental and social impacts of the proposed Project are summarized as follows. A total of 14 impact items that may cause negative and positive impacts as a result of the Project were identified.

**Summary of Scoping Results on Environmental & Social Impacts of the Project**

| Impacts / Phase | Land Acquisition and Involuntary Resettlement | Local Economy such as Employment & Livelihood | Land Use &Utilization of Local Resources | Social Institutions such as Social Infrastructure | Existing Social Infrastructures & Services | The Poor, Indigenous & Ethnic Pople | Misdistribution of Benefit & Damage | Local Conflict of Interest | Water Usage or Water Rights | Sanitation | Cultural heritage | Hazards, Infectious diseases such as HIV/AIDS etc. | Topography & Geographical Features | Soil Erosion | Groundwater | Hydrological Situation | Coastal Zone | Fauna, Flora & Biodiversity | Meteorology | Landscape | Global Warming | Air Pollution | Water Pollution | Soil Contamination | Waste | Noise and Vibration | Ground Subsidence | Offensive Odor | Bottom Sediment | Accidents |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Social | | | | | | | | | | | | Environmental | | | | | | | | | | | | | | | | | |
| Planning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Implementation Phase | | C+ | C+ | | | C+/− | C− | | | | | | | C− | C− | | B+ | B+ | C+ | C+/− | B+ | | C− | | C− | | | | | C− |

A+/-: Significant positive/negative impact is expected. B+/-: Some positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown (further examination is needed) Blank: No negative impact is expected.
Source: JICA Survey Team

The evaluation of the items which are envisaged to cause negative and positive impacts must be conducted. It was preliminary conducted in the following section with literature and field reconnaissance results. The evaluation must be continued with monitored results in order to revise the Project activities.

#### (2) Preliminary Environmental and Social Examinations

Preliminary environmental and social examinations were conducted in order to avoid critical negative impacts by the Project and ensure its sustainability. The examination identified negative and positive impacts caused by the activities of the Project. If negative impacts are identified on an activity, mitigation measures and alternative plans are considered. The result regarding some negative impacts is summarised below and a more detailed result is described in **Table 9.10**.

**Biodiversity Conservation**

Some activities may come with abnormal phenomenon such as proliferation of weeds. The negative impacts are able to be controlled with proper mitigation measures such as simultaneous planting and in some cases establishing water holes. Construction of infrastructure in particular for ecotourism may cause negative impacts. The construction site, materials for facilities, and treatment of wastewater and solid wastes must be carefully designed. However, ecotourism will contribute to income generation for local people and conservation of natural resources. Thus being so, positive impact outweighs

negative impact if adequate planning and implementation such as limiting construction and observation site, construction in harmony with the environment in consideration of colour, material, and size of infrastructure is to be done.

**Increasing Nature Resource Base**

The differentiated incentive mechanism for the poor and better-off farmers must be adopted. The activity doesn't include land acquisition and resettlement, and negative impacts are smaller than positive impacts.

**REDD Plus Pilot Project**

The construction of a renewable energy generation facility may cause negative impact such as noise and waste. However, renewable energy is sustainable and eco-friendly energy and its magnitude of impact is lower than the other forms of energy. The negative impact is minimal if the design is considered carefully from the viewpoint of environmental and social aspects.

**Supporting Activities**

The construction of buildings in and on the peripheral of PAs and RFs may cause negative impact. However, if the sizes of the buildings are small and if the locations of the buildings are carefully selected by taking ecological condition into consideration, the negative impact is to be minimal.

Since the Project aims to conserve the environmental and social conditions in Tamil Nadu through biodiversity conservation and afforestation, critical and negative impacts were not detected. Most of the activities contribute to environmental and social improvement, and the Project is evaluated as acceptable in terms of environmental and social considerations.

### (3) Monitoring Plan

Environmental and social monitoring of the Project must be conducted throughout the preparation and implementation period. TNFD will be responsible in monitoring of the project works, and will be required to prepare a detailed monitoring plan. Arrangements for such monitoring must be included in the monitoring plan of project activities. The results of monitoring must be regularly reported to relevant organizations and used to review project activities.

The JBIC Guidelines for Confirmation of Environmental and Social Considerations (April 2002) state that items requiring monitoring shall be decided according to the sector and nature of the Project, with reference to the following list of items:

1. Permits and approvals, explanations: Response to matters indicated by authorities
2. Anti-pollution measures: Air quality, water quality, waste, noise and vibration, and odors
3. Natural environment: Ecosystems-Impact on valuable species, countermeasures, etc
4. Social environment: Resettlement and lifestyle and livelihood

The detailed monitoring plan should define the locations, parameters and frequency of monitoring. Sampling should generally be at monthly intervals, but 'spot' sampling should also be undertaken whenever non-compliance is apparent, or when a complaint is received from a member of the public.

Based on scoping results, the outline of the monitoring plan is suggested as shown below. The table describes a provisional and minimum monitoring plan. The outline needs to be modified, expanded and finalised by TNFD.

**Proposed Outline of the Monitoring Plan (Provisional)**

| Impact item | Monitoring | Frequency | Section in charge |
|---|---|---|---|
| Misdistribution of benefit | Regular inspection to local people in compliance with mitigation measures with respect to TCPL. | Monthly | PMU |
| Fauna, Flora and Biodiversity | Field survey at the fixed sampling stations, and hearing to local people. | Yearly | PMU |
| Soil erosion | Regular inspection in compliance with mitigation measures with respect to excavation, spoil disposal, treatment and revegetation of land. | Monthly | PMU |
| Water pollution | Regular inspection at the surface water near ecotourism site with respect to biological and chemical parameters (pH, SS, BOD, DO, coliform, etc.). | Monthly | PMU |
| Waste | Regular inspection near ecotourism site. | Monthly | PMU |
| Accidents | Regular inspection on all activities. | Weekly | PMU |

Source: JICA Survey Team

### (4) Environmental Checklist

The environmental checklist of the JBIC Guidelines for Confirmation of Environmental and Social Considerations (April 2002) is the form in confirming environmental and social considerations. The preparation of the checklist is requested in this survey and attached in this report as **Annexure 9.1**.

# CHAPTER 10 PROJECT RISKS & IMPORTANT ASSUMPTION

For the effective and smooth implementation of the project, the following external conditions and requirements, which have significant impacts on project implementation, must be met.

a. There should be no delay in fund disbursement during the implementation.

b. There should be no delay in approval and any decision making process by the State Government and TNFD with regard to the project.

c. There should be no change in policies and strategies in biodiversity conservation and forest development of the Government of India.

d. There should be no social conflicts or disputes taking place in the target area / villages.

The following external conditions and requirements must also be met in order for the envisaged project outcomes to achieve desired and expected effects and impacts.

a. No large-scale and destructive natural disaster in the target area, such as severe droughts or strong cyclones will take place.

b. The prices of wood chips and timber will not drop drastically.

c. Employment conditions in rural areas in the regions/target provinces will not be changed drastically.

d. The macro economy of the country will be stable and favourable to attract public attention for biodiversity conservation and ecotourism.