Tamil Nadu Forest Department
The State of Tamil Nadu
Republic of India

Preparatory Study on Tamil Nadu Biodiversity Conservation and Greening Project – Phase II
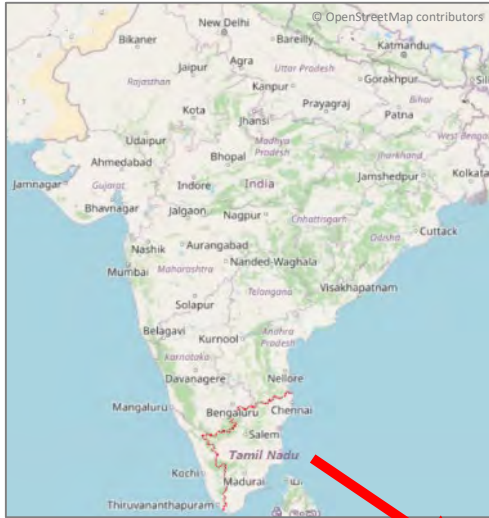
Final Report

Advanced Version

March 2022

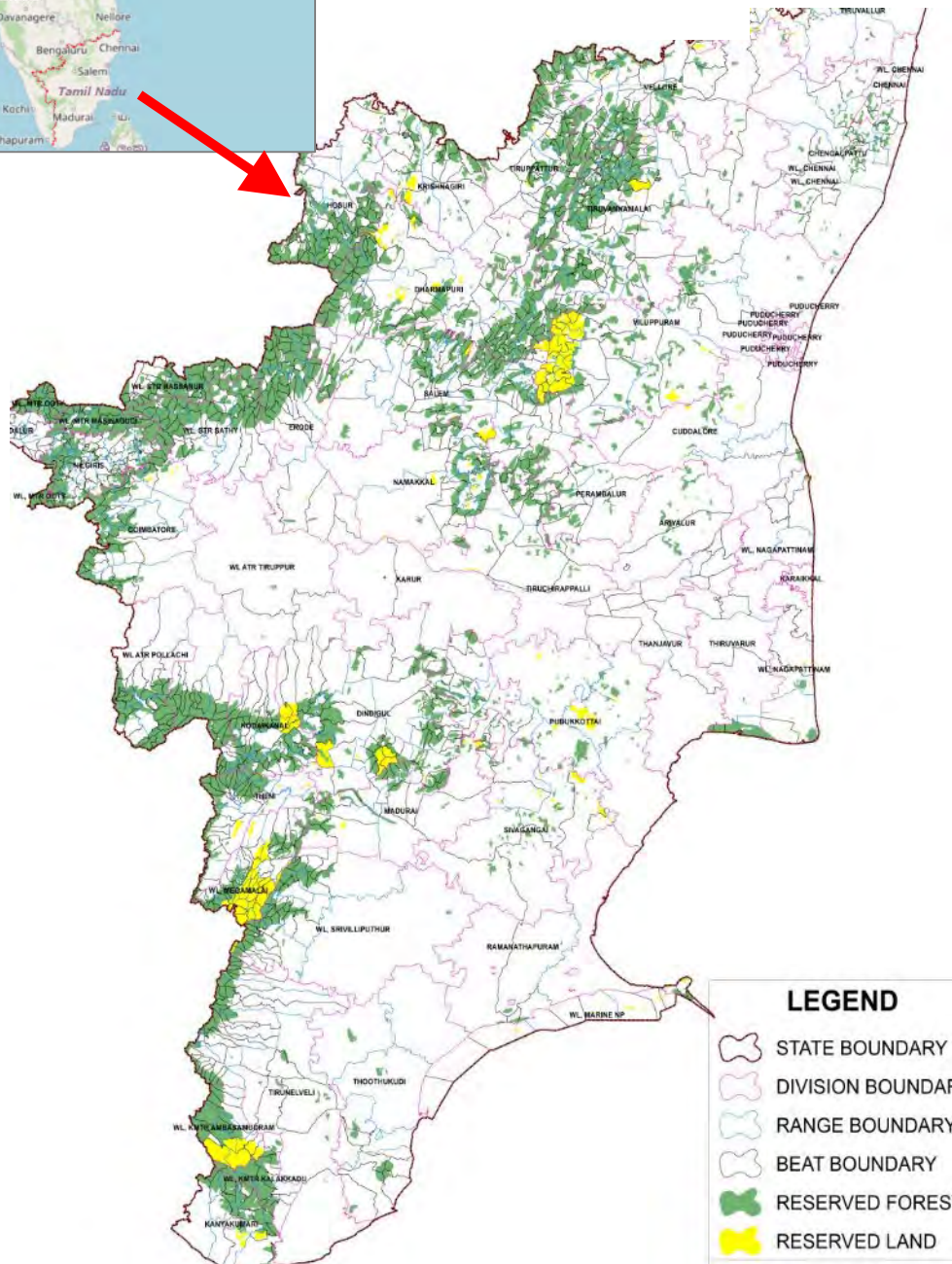**Japan International Cooperation Agency (JICA)**

Kokusai Kogyo Co., Ltd.

Currency Conversion Rate
USD1 = ¥115.262000; INR 1.0 = ¥1.538570
(JICA conversion rate for February 2022)
Source: https://www.jica.go.jp/announce/manual/form/consul_g/ku57pq00000kzv7m-att/rate_2021.pdf
USD = US Dollar、 ¥ = Japanese Yen、 INR = Indian Rupee

Location Map

Tamil Nadu, India

LEGEND

- STATE BOUNDARY
- DIVISION BOUNDAR[Y]
- RANGE BOUNDARY
- BEAT BOUNDARY
- RESERVED FORES[T]
- RESERVED LAND
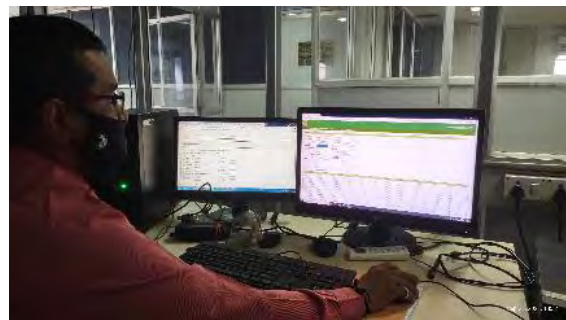
Photographs of the Survey

Appearance of
TBGP Office Building in Chennai

MIS Centre in the TNFD

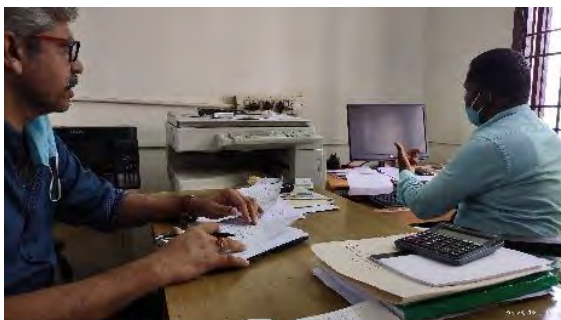Conditions of the Geomatics Centre

Demonstration of TNFMIS
by the Technician in Charge

Progress Report Meeting
at the TBGP meeting hall

Appearance of State Forest Research Institute
(SFRI)

Interview with SFRI Researcher
by Local Consultant

Appearance
of Tiruvallur District Forest Office (DFO)

Interview with the Officer
in the Tiruvallur DFO Office

Appearance of the Guesthouse
in the Tiruvallur DFO Office

Plantation Site

Nursery

Appearance of the Range Office

Appearance of Training Facility
in the Forest Extension Centre (FEC)

Interview with the Range Officers
by Local Consultant

Sales Counter
for Non-Timber Forest Products (NTFP)

Interview
with an Owner of the Sales Counter

Appearance of the FEC Office

Room Inside of the FEC Office

Materials for Awareness Raising
Stored in the FEC Office

Nursery in the FEC of Vellore District

Conditions of
Tree Cultivation in Private Lands (TCPL)

Conditions of TCPL
(Banana Plantation as Intercrops of Teak)

Plantation of Redsander

Medicinal Botanical Garden
in the Gene Pool Garden

Nursery
in the Gene Pool Garden

Interpretation Centre
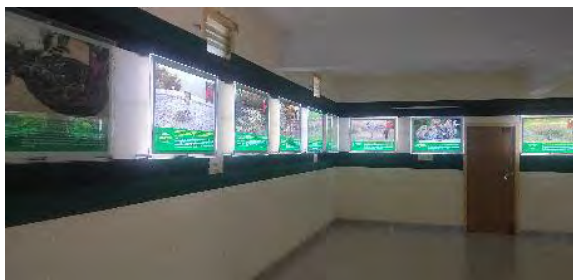in the Aiyur Ecotourism Site

Interview with an EDC Staff
in the Aiyur Ecotourism Site

Entrance if the Agayagangai Aruvi-Kolli Hills
Ecotourism Site

Interpretation Centre in the Agayagangai
Aruvi-Kolli Hills Ecotourism Site

Interpretation Centre in the Amirthi (Goddaru)
Waterfalls Ecotourism Site

Meeting with JFM Members
of the Past Forestry Project

Executive Summary

This Executive Summary gives an overview of the "Preparatory Study on Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project" (hereafter "the Study") and an overview of the "Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project" (hereafter "TBGCP").[1]

1 Study Overview

This section presents an overview of the Study, involving the (1) background; (2) objectives; (3) survey period; and (4) report structure, including brief summaries of each chapter from Chapter 2 to Chapter 9 of the final report.

1.1 Background

The state of Tamil Nadu is located in the southern part of India. It has a long and narrow shape with a width of about 670 km from north to south and about 200 km from east to west (380 km at its longest in the central part of the state). Tamil Nadu has a total area of about 130,000 km^2, with characteristics that vary depending on region. Forests and grasslands (such as elephant habitats) with significant biodiversity are found in the western part of the state. On the eastern side, a coastline of more than 1,076 km extends from north to south.[2] Mangroves and wetlands, which are important for biodiversity, widely distributed in this area. In the northern part of the state, where the large city of Chennai is located, industry, commerce and agriculture are flourishing because of moderate rainfall compared with the rest of the state. Also, many timber production areas of important tree species, such as teak, sandalwood, and rosewood, are distributed. In addition, Chennai suffered severe damage from a flood that killed more than 300 people in 2015.[3] This disaster was due to unplanned urban expansion, itself due to rapid urban expansion. In the southern part of the state, precipitation is relatively low and there is increasing aridity. As a result, many abandoned cultivated lands are found in this region. In the central part of the state, there is much important biodiversity and many forests are distributed.

The Tamil Nadu Forest Department (hereinafter "TNFD"), which is the implementing agency of the TBGCP, has implemented three yen-loan projects: the "Tamil Nadu Afforestation Project (1)" (hereinafter "TAP 1") (1997-2005); "Tamil Nadu Afforestation Project (2)" (hereinafter "TAP 2") (2005-2013); and "Tamil Nadu Biodiversity Conservation and Greening Project" (2011-in progress) (hereinafter "TBGP"). In order to improve the forest coverage rate in particular, the first two projects focused on improving the density of degraded and degrading reserved forests by gap planting, whereas the TBGP focused on tree planting activities outside of forest areas. In addition to these activities, the extermination of exotic plants, provision of alternative livelihoods, awareness activities, and improvement of community-based nature reserve management were also implemented. The TBGP improved the forest coverage rate through the afforestation of about 143,000 ha. However, the biodiversity of the state is still at risk due to recent rapid population growth and economic development, the increased proximity of areas of human activity and wildlife habitats as a result of urbanisation, and the excessive consumption of forest resources by the residents around the forest. Climate change and its impacts have caused a severe strain on many of the wild ecosystems in the state, threatening their existence as well as endangering the ecosystem services that flow from such ecosystems. Moreover, certain critical habitats like corals, sea grass beds, and mangroves have not

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[1] The title of the project was renamed in the middle of this study from "Tamil Nadu Biodiversity Conservation and Greening Project (Phase 2)", which is a title of this study as shown on the title of this report, to "Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project".

[2] Ministry of Environment, Forest, and Climate Change, Environmental Information System.

[3] https://www.bbc.com/news/av/world-asia-india-35129556.

received due attention. Under these circumstances, the conservation of biodiversity is urgently needed.

As mentioned above, the area of Tamil Nadu covers an extremely large area. The natural and socio-economic conditions in the state greatly vary depending on the region. Though the TBGP focused on the improvement of forest coverage rate through afforestation, especially on lands outside of the forest areas throughout the state, in places with the greatest need of conservation activities, such as areas in the central part of the state, relevant activities remained limited. Therefore, in the TBGCP, the methods and results demonstrated in the TBGP will be verified, utilised, and strengthened. In addition, ecosystem services that were not undertaken in the TBGP will be strengthened in the TBGCP, focusing on the conservation of areas with particularly important biodiversity and forests, such as the Eastern Ghats area, which was not included as a target in the TBGP. At the same time, to achieve social and economic development around those conservation areas, it is important to develop and implement activities for the "improvement of animal and plant habitats", the "forestry promotion", and the "strengthening of organisational structure" in the TBGCP.

1.2   Objectives

The purposes of the Study are to gather and analyse the information necessary for the review of the TBGCP as a Japan yen-loan project — which include the validity of TBGCP, project components, project cost, implementation schedule, implementation system, operation and maintenance system, procurement/construction method, environmental and social considerations, economic/financial analysis, and operation and effect indicators — and to make an appropriate proposal for the implementation of the TBGCP.

1.3   Study Period

The Study was conducted for twelve months, starting in April 2021 and continuing until March 2022. The Study involved both field surveys by local consultants and a subcontracting work in India and domestic work in Japan.

1.4   Report Structure

This report is structured in the following order: (1) Overview of the Tamil Nadu State (Chapter 2); (2) Forest and Forest Management (Chapter 3); (3) Biodiversity (Chapter 4); (4) Forest Products (Chapter 5); (5) Livelihood Improvement and Ecotourism (Chapter 6); (6) Institutional Arrangement (Chapter 7); (7) the Review of the DPR (Chapter 8); (8) Issues Identified from the Preparatory Study to Date and the DPR (Chapter 9); and (9) the Proposed Project Outline and the Scope of Work. Figure 1 shows the overall structure of the final report.
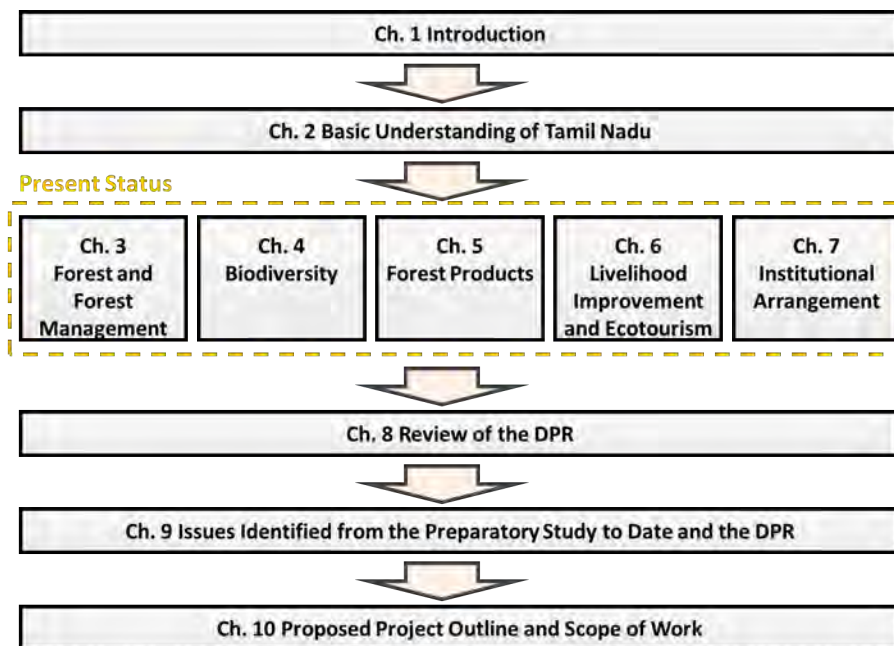
Figure 1: Overall Structure of the Final Report

In the following section, the main ideas of the chapters from Chapter 2 to Chapter 9 are briefly summarised.

Chapter 2 shows the outline of the Project area, Tamil Nadu, including its location, administrative systems, socio-economic situations, and natural conditions, along with the introduction of the development plans, programmes, and projects in the state of Tamil Nadu. To begin, Tamil Nadu lies in the southernmost part of the Indian subcontinent, and its physiography is naturally classified into four zones, namely Western Ghats, Eastern Ghats, Plateaus, and Coastal and Inland Plains. The hill region, consisting of Western Ghats and Eastern Ghats, is much more complex compared to other areas. The climate of Tamil Nadu is basically tropical. Due to its proximity to the sea, the summer is less hot and winter is less cold. The normal annual rainfall is 958.4 mm. About 50% of the total annual average rainfall is received during the northeast monsoon, while about 31% is received during the southwest monsoon and the balance in other seasons. Regarding the land use, the Net Cropped Area occupies a largest proportion of 35.16% (4.582 million ha), followed by Land Put to Non-Agricultural Use and Forest, with proportions of 19.9% (2.202 million). The predominant soils of Tamil Nadu are red loam, laterite, and black, alluvial, and saline soils. Moreover, Tamil Nadu has been facing various natural disasters with, in recent years, the threat of such natural disasters as earthquakes, floods, coastal tsunamis and hilly landslides having increased. In particular, flooding in urban areas is the most concerning problem.

For the socioeconomic characteristics of the state, the population of Tamil Nadu in 2011 is 72.147 million, while the total number of households is 23.1 million. In the state, there are 36 Scheduled Tribes (ST) and the share of ST in the state population is only 1.1%. The Tribal Sub-Plan (TSP) has been implemented in Tamil Nadu since the year 1976-77. The following six groups out of 36 — Toda, Kota, Kurumbas, Irular, Paniyan, and Kattunayakan — are designated as 'Particularly Vulnerable Tribal Groups (PVTG)'. There are 10 ITDP (Integrated Tribal Development Programme) tribal pockets in seven districts. At the same time, Tamil Nadu has succeeded in economic development recently and the percentage of population below the poverty line is 12%, the 11th smallest in India. However, some districts such as Ariyalur, Virudhunagar, Ramanathapuram, Perambalur, and Dharmapuri still show a high level of poverty. Regarding gender, the state of Tamil Nadu has formed a Gender Budget Cell and has included a Gender Budget Statement in the state budget since 2017-18, while implementing various schemes and acts for the welfare of girls. The gender gap in literacy

rate is 12.95, one of lowest states in India. However, the sex ratio at birth (females per 1,000 males), one of the main indicators of Sustainable Development Goal (SDG) 5, has not improved much, from 898 in 2018 to 908 in 2020. This is far below the national target of 950.

India took a leading role in implementing the agenda, preparing the first SDG India Index in 2018 with a set of 62 indicators covering 39 targets and 13 goals. Under the third version of SDG India Index (Index 3.0), prepared in 2021, there is a set of 115 indicators covering 60 targets and 16 goals. The Indian government ranks states/union territories (UTs) based on their performance. Tamil Nadu received the score of 74 in Index 3.0, improving from a score of 67 in Index 2.0, and taking the second position among states, following Kerala.

In Chapter 3, the characteristics of forests in Tamil Nadu were reviewed with reference to various existing materials. In particular, information that will become the basis of subsequent chapters, such as forest classification in the state, forest coverage change, forest management methods (including JFM and working plans) and related laws and regulations, and forest administration were organised.

Chapter 4 introduces the status of biodiversity in Tamil Nadu. First, while Tamil Nadu has a wide variety of species, these species have been endangered. The state has five national parks, 29 wildlife sanctuaries, and two sanctuaries, which occupy 4.97% of the state's entire area. In particular, the Nilgiri Biosphere Reserve is one of the hotspots for biodiversity. Tamil Nadu ranks the first among the Indian states in terms of angiosperm diversity, with 5,745 taxa identified. Of these 5,745 taxa, 212 are native species found only in Tamil Nadu, 86% of which are found in the Western Ghats and adjacent areas. On the other hand, Tamil Nadu is home to 595 species of freshwater animals, 2,247 species of marine animals and 1,898 species of terrestrial animals, of which 126 species of fish, 56 species of amphibians, 77 species of reptiles, 32 species of birds, and 40 species of mammals are listed on the IUCN Red List of Threatened Species. In addition, 36 amphibians, 63 reptiles, 17 birds, and 24 mammals have been reported as endemic species. Thus, many species in Tamil Nadu are endangered, partly due to the spread of invasive alien species covering a range of nearly 3,000 km^2. Therefore, in 2002, the central government established the National Biodiversity Authority (NBA)[4] under the Biological Diversity Act (2002), and the Tamil Nadu Biodiversity Board (TNBB)[5] was also established by the state government.

Second, in Tamil Nadu, damage caused by conflicts between humans and wild animals has become a major problem. Between 2013 and 2018, 8,087 human and wild animal conflicts were reported in the state, of which 7,383 were cases of crop damage and 47 were cases of human injury or death. Wild elephants are mainly involved in this problem. It is estimated that there are about 1,700 elephants in Tamil Nadu, and conflicts between humans and elephants occurred due to forest fragmentation as a result of economic development, especially livestock grazing and changes in habitat land use around the forest. In areas where damage was caused frequently, various measures, such as providing training programmes, forming countermeasure teams, and installing ditches, have been taken to protect the residents of villages that are vulnerable to elephants and other wildlife. The reduction of these kinds of damage is required and this effort is more critical than the complete elimination of conflicts. In order for humans and wild animals to coexist, it is important to set objective indicators and goals and implement population management and zoning.

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[4] In addition to the NBA, local communities have established the Biodiversity Management Committee (BMC) with the aim of promoting biodiversity conservation and sustainable use by local residents and institutions in potentially rich areas. The NBA needs to consult with responsible BMCs before making a decision, and as of 2021, 13,604 BMCs exist in Tamil Nadu.

[5] The TNBB advises the state government on issues related to biodiversity conservation and consults with locals, NGOs, and other relevant agencies before making decisions in order to investigate and propose a plan for the establishment of a biodiversity heritage site (BHS). After the investigation, the TNBB declares the establishment of a BHS. This process is defined in the guidelines published by the NBA.

Third, in Tamil Nadu, invasive alien species such as lantana and mesquite have caused enormous damage, and efforts to control future damage are required. Lantana (*Lantana camara*) is a means of livelihood for the inhabitants of local communities, as stems of lantana can be processed to make furniture, while causing enormous damage to the natural environment in the state. Mesquite (*Prosopis juliflora*) is also an invasive alien species causing damage in Tamil Nadu, and approximately 2,000 hectares of mesquite have been weeded so far. As future tasks, it is necessary to verify the effectiveness of existing herbicidal methods and conduct a survey so that weeding methods suitable for different environmental conditions can be adopted. Also, the prediction of mesquite expansion is one of the future challenges faced. Mesquite grow thickly, and by taking the advantage of its characteristics, it is possible to predict its future expansion — identifying the distribution of mesquite from satellite images and understanding the natural environmental conditions that control the growth of mesquite, such as water and soil.

Fourth, the conservation and management of coastal ecosystems is an important issue in Tamil Nadu. Not only was this recognised as an important issue in the 2018 Tamil Nadu Forest Policy, but the TBGP also implemented many relevant activities. For instance, the capacity of local stakeholders was strengthened through workshops and trainings, monitoring and information sharing systems were developed, and effective plans to address the issues were formulated. In particular, the protection of dugongs (e.g. understanding about the number and distribution of individuals, conservation of seaweed beds, and raising awareness of residents), conservation of sea turtles (e.g. strengthening of the capacity and awareness of related stakeholders and provision of turtle extermination equipment), aquaculture of seaweed (e.g. development of aquaculture technology), and mangrove plantation were regarded as important issues in the future, and the formulation of effective plans for implementing these activities is an urgent task.

Chapter 5 describes how to classify or organise forest resource areas in Tamil Nadu. First, the concept of the TBGP's Tree Cultivation on Private Land (TCPL) and the concept of land classification (zoning) for tree plantations in the urban and peri-urban forestry of the Project is explained. Specifically, the TBGP and the Project's biodiversity conservation, supply chain development, and afforestation activities for forest resource development are classified into forest areas and areas outside of the forest areas based on land management methods and the legal classification of land category. In addition, the entire forest area of Tamil Nadu was classified based on land ownership, management system, commercial use, management organisation or system, planted tree species, and forest product types. Therefore, forest areas in Tamil Nadu, especially as a resource area for supply chain development, can be summarised as follows.

- In forest areas managed by the TNFD, logging for commercial use is not permitted in forest areas except forest areas operated by three public enterprises such as TAFCORN,[6] and it can be said that there is a high tendency to conserve forests from the perspective of state forest policy.
- Forest resources for commercial use, such as timber, rely on trees produced outside the forest area, except for forest areas managed by three public enterprises, including TAFCORN.

In addition, this chapter shows activities such as the amount of TCPL planted and the species of trees planted in the TBGP. After explaining three public enterprises such as TAFCORN, a conceptual cross section diagram shows the relationship between urban and peri-urban forestry, which will be implemented in the Project, and the target forest areas where trees near biodiversity habitats and ecodevelopment activity areas can be used, and the target tree zones in cities and their neighbouring areas.

Chapter 6 presents a review of critical aspects related to ecotourism and ecodevelopment activities. For ecotourism, legal and policy frameworks both at the central- and state-level are first revisited and

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[6] An abbreviation for Tamil Nadu Forest Plantation Corporation Limited.

summarised. The results of the present-situations analysis of tourism and ecotourism in Tamil Nadu State suggested a great potential for the development of the ecotourism sector. In addition, the ecotourism-related activities carried out under the TBGP Phase 1 were also reviewed from the perspective of target sites, processes, and achievements. Twenty-five (25) ecotourism sites developed are outlined in terms of location, site features, and attractions/activities, including achievements such as infrastructural development and equipment provisions.

Meanwhile, ecodevelopment activities are reviewed on their evolution and initiatives at the central-level, followed by a review of the ecodevelopment-related initiatives under the TBGP. The review is organised in terms of the target sites, processes, and achievements. A total of 63 villages have been supported in a participatory manner, with various ways of support such as infrastructural development, equipment/material provision, and micro-credit.

Chapter 7 gives an overview of the organisational structure of the TNFD. First, in order to confirm the capacity of the TNFD regarding information technology, the capacity of GIS and MIS within the TNFD were examined from the viewpoints of both software and hardware. The Geomatics Center in the TNFD manages many types of GIS data and maps, and has experience with various kinds of training. At the same time, two types of management information systems (MIS) in operation, including the Tamil Nadu Forest Department Management Information System (TNFMIS) and MIS developed by the TBGP, were identified, and the usage status of these MIS were examined. Although it was found that these MIS generally function well, the shortage of human resources and the need for the development of infrastructure necessary for the latest technology were identified as future issues. The current monitoring and evaluation (M&E) system of the TNFD was also examined. In addition to the status of collaboration with regional offices, the organisational structure within the TNFD was reviewed by project implementation level (e.g. headquarters, circle, Forest Extension Center (FEC), division/district, and range levels).

Chapter 8 discusses the results of the DPR review. The main points of each chapter from Chapter 4 to 12 of the DPR are summarised and organised in Table 1.

Table 1: Main Points Discussed in Each Chapter of the DPR

Chapter	Main Points Discussed
4	This chapter describes the rehabilitation of coral and seagrass and improvement of wildlife abundance, rehabilitation and protection, especially dugongs and sea turtles. Improvement methods are listed from four perspectives: human, biology, habitat, and management.
5	This chapter explains ex situ conservation of wildlife. It has been proposed to build an advanced interpretation center and prehistoric park at the Arignar Anna Zoo, which covers an area of more than 602 hectares and was built in a protected forest in Vandalur, Chennai 34 years ago. About 2,500 wild animals of about 180 species, including mammals, birds and reptiles, are on display at the zoo.
6	This chapter describes the eradication of invasive alien species, which are perceived as a serious threat to the entire ecosystem. Mesquites (*Prosopis juliflora*) occupy most of the forest area in the plains and influence grass-bearing flower communities and animal feeding behavior. The issue of invasive alien species has received attention at the judicial level, and the Hon'ble Madurai Bench of the Madurai High Court has ordered the removal of invasive alien species throughout Tamil Nadu.
7	This chapter explains measures to alleviate conflicts between humans and wildlife. Changes in land use patterns in habitats around forest areas are associated with conflicts between humans and wildlife, so the TNFD has introduced various mitigation measures, for example, the setting up of solar-powered electric fences, the installation of ditches to prevent elephants from entering, and the development of an infrared early warning system. It has also been pointed out that there is room for improvement with the methods of research, monitoring and information analysis regarding wildlife conservation in Tamil Nadu. Further, effective wildlife research is needed to address these problems. Due to the

	increasing importance of wildlife research in recent years, the Wildlife Conservation Institute (AIWC), Animal Care Science Center (CACS), Conservation Education Center, and Wildlife Forensic Center (CWFS) have been operated. However, sufficient equipment to deal with the above problems is not yet in place, and human resource development such as scientists remains another challenge for the future.
8	This chapter features the review of development in ecotourism, specifically 'Community-based ecotourism' (CBET) proposed in two areas: i) the Gene Pool Garden in the Gudalur Forest Division of Nilgiris District; and ii) four sites in the Eastern Ghats. For each area, objectives, locations, management structure, and activities are outlined.
9	This chapter mentions forest and wildlife research. The items/themes of technological research and development are: (1) research and development of urban forestry model and related technology; (2) strengthening of forest tree breeding technology; (3) capacity development and training of forestry extension workers; (4) improvement of productivity of forests and biological resources (bio-productivity); and (5) investigation of endangered species and data shortage species (CR / EN / DD) and the data integration.
10	In the form of expanding Tree Cultivation Outside Forests (TCOF) in the preceding project, the Project has a policy of promoting greening in urban areas and the area that connect the urban areas and rural areas (peri-urban areas), and this chapter explains the strategy of tree-planting activity. As its strategy, demand-driven (providing seedlings and tree-planting services thereof to those who seek them), a reward system for successful planting, forestry dissemination of forestry and strengthening of forest extension centers, and strengthening of seedling production system and relevant activities are explained.
11	This chapter focuses on the issues of combating forest land and wildlife habitat degradation by ecodevelopment activities and soil and water conservation. Four components are specified with detailed content: i) Ecodevelopment activities; ii) Soil and water conservation measures; iii) Preservation of traditional knowledge of tribal and local people; and iv) Heritage conservation.
12	The content of the proposal for strengthening the organisational structure is stated in this chapter. Specifically, the need for organisational capacity development, such as GIS and MIS, establishment of business management planning cell, preparation of working plans, procurement of vehicles and equipment, and construction of accommodation facilities, can be identified.

Chapter 9 considers the issues to be addressed in the Project based on the above-mentioned DPR review results and the results of the Study. In the field of biodiversity conservation, the main issues include the protection of seagrass, dugongs, and sea turtles, the elimination of invasive alien species, and countermeasures against conflicts between human and wildlife. To address these issues, in addition to strengthening the capacity of the TNFD and raising the awareness of local stakeholders and residents, it also becomes increasingly important to collaborate with research institutes and academic institutions, because advanced technology and specialised knowledge are required.

Regarding research and development related to forests and forestry, technology for using large seedlings, planting technology for each tree species used for urban tree planting, purification technology for soil pollution through tree planting and the development of planting tree species to implement this technology, and the development of eco-parks around the city are proposed as technical research and development of tree planting projects in and around urban areas. In addition, the following is proposed for the forest tree breeding development: identified seed orchards using excellent trees, the development of new seed orchards and their high-tech nursery gardens, and the strengthening of human resources for forestry promotion; and for strengthening biological resources and forest resources: the development of e-markets for wood and non-timber products and the increase of its profitability; and conservation strategies for endangered species and information-deficient species.

As for ecotourism, the identification of CBET target sites, as well as clarification of CBET activities

in the Eastern Ghats, and the examination of processes for CBET development are identified as crucial for the scope of work. In the meantime, the following three issues are identified as necessary for consideration in ecodevelopment activities: i) Determination of target villages; ii) Review of proposed ecodevelopment activities; and iii) Examination of processes for ecodevelopment activities.

2 Project Overview

In this section, an overview of the Project, which corresponds to Chapter 10 of the final report, is presented. In particular, this section focuses on (1) objectives, (2) overall framework of components and activities, (3) implementation schedule, (4) institutional arrangement, (5) monitoring and evaluation, (6) estimated project cost, and (7) project evaluation, including cost-benefit analysis and calculation of estimated CO_2 reduction.

2.1 Objective

The key objective of the Project is "to improve biodiversity conservation through habitat improvement of flora and fauna, afforestation and institutional capacity development, thereby contributing to the resilient socio-economic development in harmony with nature in Tamil Nadu".

2.2 Overall Framework

To maximise the results, as well as to address current and future requirements, the Project has identified five key components. These are: Component 1: Ecosystem Based Climate Change Measures; Component 2: Human Wildlife Conflict Measures; Component 3: Promoting Supply Chain Development; Component 4: Livelihood Improvement Activities; and Component 5: Management Capacity Development.

Table 2: Outline of the Project Components and Key Activities

Project Components and Key Activities
1 Ecosystem Based Climate Change Measures
1.1 Climate change measures through improvement of marine ecosystems
1.1.1 Coral
Survey and assessment of selected site
Facilitation of reef building planning at communities
Survey and assessment of selected site
Coral monitoring
Establishment of interpretation centre/ecotourism collarium
1.1.2 Seagrass/seaweed
Assessment of seagrass habitats
Seagrass transplantation work in degraded areas
Monitoring and maintenance
Awareness programme for local fishermen's communities
Encouraging native seaweed cultivation in the area
1.1.3 Dugongs
Fixing permanent monitoring sites and conducting population survey
Protection by engaging anti-poaching watchers
Awareness programme for local fishermen's communities
Inter-departmental coordination
1.1.4 Sea turtles
Establishment of sea turtle hatchery
Patrolling by engaging anti-poaching watchers
Map preparation for identification of potential and existing nesting sites
Data collection using mobile application for grant of rewards/compensation to fisherfolk
Awareness building
Monitoring and documentation
Inter-departmental coordination

1.2 Climate change measures through improvement of land ecosystem
    1.2.1 Invasive alien species
        Survey and demarcation of all-inclusive species in Protected Areas (PA)
        Removal of invaded alien species
        Nursery establishment of indigenous/native fodder species
        Trial on utilisation of invasive species
        Carbon management in invaded areas
    1.2.2 Mangrove plantations
        Site assessment for mangrove
        Propagules preparation for mangrove
        Seedling preparation for mangrove
        Tending for mangrove
        Blue carbon monitoring for mangrove
    1.2.3 Promoting urban and peri-urban forestry
        Procurement of equipment for transportation and planting
        Transportation and planting equipment
        Promoting publicity
        Forest Extension Center revamping
        Promoting a reward system
        SHEP
1.3 Research and implementation of climate change measures (mitigation, adaptation) utilising land and marine ecosystems
    1.3.1 Forensic work
    1.3.2 Animal care science studies
    1.3.3 Wildlife policy research and development
    1.3.4 India-Japan research consortium

2   Human Wildlife Conflict Measures
2.1 Measures for human wildlife conflict
    2.1.1 Mitigation planning
    2.1.2 Improvement of corridors
    2.1.3 Capacity building for local staff
    2.1.4 Development of mobile application
    2.1.5 Infection disease measures
2.2 Infectious diseases measures

3   Promoting Supply Chain Development
3.1 Forestry research
    3.1.1 Afforestation technology for urban and peri-urban forestry
    3.1.2 Tree improvement
    3.1.3 Bio-productivity enhancement
    3.1.4 Conservation of CR/EN/DD
3.2 Promoting supply chain development
    3.2.1 NTFP supply chain development
    3.2.2 Timber supply chain development

4   Livelihood Improvement Activities
4.1 Ecotourism
    4.1.1 Genepool garden in Gudalur
    4.1.2 Four circuits in the Eastern Ghats
4.2 Ecodevelopment activities
    4.2.1 Hold state-level workshop
    4.2.2 Orient communities on the scope and purpose
    4.2.3 Train field staff teams to design and facilitate participatory processes using appropriate tools
    4.2.4 Facilitate participatory planning of ecodevelopment plans
    4.2.5 Constitute EDCs and their executive committees
    4.2.6 Facilitate study tours to expose EDCs to other successful groups
    4.2.7 Prepare ecodevelopment plans, addressing socio-economic and ecological requirements and opportunities including skill training
    4.2.8 Implement ecodevelopment plans
    4.2.9 Participatory assessment of impacts of interventions

5   Management Capacity Development

5.1 Policy planning and implementation ability
5.2 Activation of research activities
5.3 Map preparation
     5.3.1 Estimation of areas of trees outside of forest areas (pilot study)
     5.3.2 Soil type mapping for reserved forests (pilot study)
5.4 Infrastructure and mobility
     5.4.1 GIS enhancement
     5.4.2 MIS enhancement
     5.4.3 Equipment
     5.4.4 Vehicles
     5.4.5 Construction of office buildings
     5.4.6 Management plan development cell
     5.4.7 Preparation for working plans
5.5 Capacity development
     5.5.1 Identification of training
5.6 Pilot studies
     5.6.1 Biological diversity study
5.7 Monitoring and evaluation
     5.7.1 Baseline survey
     5.7.2 Mid-term evaluation
     5.7.3 Terminal evaluation
     5.7.4 Annual planning and review meeting/workshop
     5.7.5 Annual statutory audit
     5.7.6 Concurrent monitoring
     5.7.7 Review meeting/process monitoring
     5.7.8 Activity monitoring
     5.7.9 Thematic studies and documentations
     5.7.10 Regular publication
     5.7.11 Procurement committee meeting
5.8 Project management unit (PMU)
     5.8.1 Staff cost
5.9 PMU Operation Cost
     5.9.1 Improvement of MIS capacity in TNFD
     5.9.2 Operation and maintenance

2.3 Implementation Schedule

The TBGCP has an eight-year project period, and this project period will be divided into the three phases, namely an assessment and preparation phase (one year), implementation phase (five years), and consolidation (final touches and winding up) phase (two years), as shown in Table 3.

Table 3: Tentative Project Phases and Activities

Phase	Year	Main Project Activities
Assessment and Preparation Phase	2022/23 (one year)	Setting up of the Project Management Unit (PMU) and other required units, the selection of Project Management Consultants (PMC), preparation of all manuals including Operational & Accounting procedures (an Operation Manual providing detailed guidelines for project implementation), procurement of necessary equipment, a compendium of on-going government programmes/schemes, the selection of resource organisations/teams from NGOs, detailed remote sensing satellite data-based mapping and analysis, the finalisation of selection criteria, orientation of the PMU and other required units, the finalisation of target areas, initiation of required strengthening and development of infrastructure, site preparation, the selection of sites, and baseline surveys.
Implementation	2023/24-2027/28	Preparation of implementation plans in target areas and activities

Phase	(five years)	and implementation of project activities.
Consolidation Phase	2028/29-2029/30 (two years)	Ensuring of the sustainability of assets created under TBGCP, internalisation of project learning, experiences, procedures, and best practices evolved in the course of project implementation, and transfer of charges of all assets created under TBGCP and documents.

2.4   Institutional Arrangement

In the Project, a Project Management Unit (PMU) will be set up as the main implementation body of the Project (Figure 2).
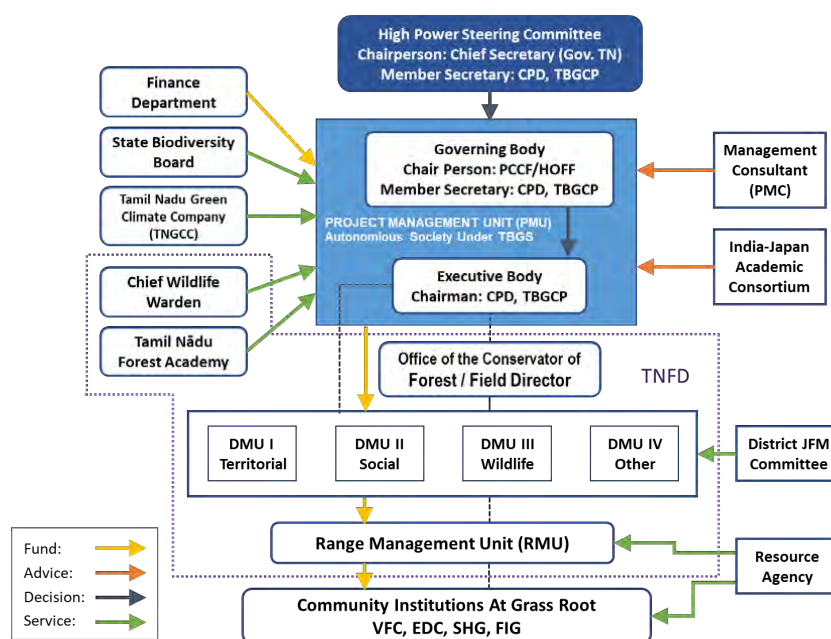
Source: Developed by the Study Team

Figure 2: Institutional Arrangement for the Project Implementation

In addition, a total of 81 Division Management Units (DMUs) located in the state will be responsible for the activities of each component in the Project. Figure 3 shows the names and locations of DMUs involved in the Project.
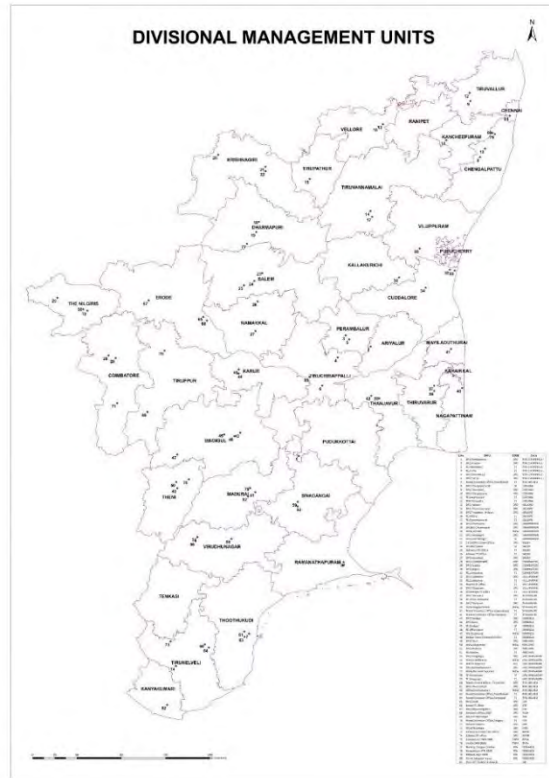
Figure 3: Location of the Target 81 Divisional Management Units (DMUs)

2.5 Monitoring and Evaluation (M&E)

Monitoring and evaluation of TBGCP progress and achievement will tentatively involve the following events:

- Baseline survey;
- Mid-term evaluation;
- Terminal evaluation;
- Annual planning and review meeting/workshop;
- Annual statutory audit;
- Concurrent monitoring;
- Progress Monitoring/monthly review meetings;
- Activity Monitoring; and
- Thematic studies and documentation

2.6 Estimated Project Cost

Close to the Public

Table 4: Summary of Breakdown Costs

Close to the Public

Close to the Public

Close to the Public

Table 5: Annual Fund Requirement

Close to the Public

Close to the Public

Table 6: Division of Foreign and Local Currencies

Close to the Public

Close to the Public

Close to the Public

Table 7: Summary of the Financial Plan by Component

Close to the Public

2.7   Project Evaluation

2.7.1 Cost-Benefit Analysis

(1) CO$_2$ Reduction

Based on the CO$_2$ reduction estimation results, the economic value of CO$_2$ reduction is estimated. For the valuing of reductions of CO$_2$ emissions in monetary terms, the price per ton of CO$_2$e is conservatively set at USD 3.0, based on a study of opportunity cost per ton of CO$_2$e.[7] The CO$_2$ reduction estimation results are shown in Table 8.

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[7] "The Financial Costs of REDD: Evidence from Brazil and Indonesia", IUCN, 2009.

Table 8: Value Calculation for CO_2 Reduction

Year	Component A Reduction (tCO₂/year)	Component B Reduction (tCO₂/year)	Total Reduction (tCO₂/year)	Unit Price (INR/tCO₂)	Value (1,000 INR/year)
2	2,322	236,553	238,875	148.52	35,480
3	6,966	236,553	243,519	148.52	71,303
4	9,287	236,553	245,840	148.52	106,782
5	9,287	236,553	245,840	148.52	150,666
6	9,287	236,553	245,840	148.52	185,800
7	9,287	236,553	245,840	148.52	220,933
8	9,287	236,553	245,840	148.52	304,067
9	9,287	236,553	245,840	148.52	403,201
10	9,287	236,553	245,840	148.52	1,085,585
11	9,287	236,553	245,840	148.52	1,256,469
12	9,287	236,553	245,840	148.52	1,411,603
13	9,287	236,553	245,840	148.52	1,534,737
14	9,287	236,553	245,840	148.52	1,655,870
15	9,287	236,553	245,840	148.52	2,543,004
16	9,287	236,553	245,840	148.52	2,582,388
17	9,287	236,553	245,840	148.52	2,702,272
18	9,287	236,553	245,840	148.52	2,727,406
19	9,287	236,553	245,840	148.52	2,724,540
20	9,287	236,553	245,840	148.52	1,343,674
21	9,287	236,553	245,840	148.52	1,892,807
22	9,287	236,553	245,840	148.52	1,789,191
23	9,287	236,553	245,840	148.52	1,750,325
24	9,287	236,553	245,840	148.52	1,713,459
25	9,287	236,553	245,840	148.52	1,692,593
26	9,287	236,553	245,840	148.52	1,097,727
27	9,287	236,553	245,840	148.52	1,090,860
28	9,287	236,553	245,840	148.52	1,097,994
29	9,287	236,553	245,840	148.52	1,093,128
30	6,966	236,553	243,519	148.52	1,415,917
31	2,322	236,553	238,875	148.52	1,426,361
32	-	236,553	236,553	148.52	3,381,150
33	-	236,553	236,553	148.52	3,392,284
34	-	236,553	236,553	148.52	3,427,418
35	-	236,553	236,553	148.52	5,763,552
36	-	236,553	236,553	148.52	5,798,686
37	-	236,553	236,553	148.52	3,889,820
38	-	236,553	236,553	148.52	3,924,954
39	-	236,553	236,553	148.52	3,960,087
40	-	236,553	236,553	148.52	3,995,221

Source: Developed by the Study Team

(2) Cost Benefit Analysis

The economic internal rate of return (EIRR), net present value (NPV), and cost-benefit ratio (B/C) of the Project were calculated to assess the economic viability of the Project based on the projected economic cash flow. The EIRR is 13.3%, which is higher than the discount rate of 12%, and the NPV and B/C are 2,668,598 thousand INR and 6.969, respectively (Table 9), so that the Project can be said to be economically viable.

Table 9: Results of the Cost-Benefit Analysis

Year	Economic Cost (Rs. 1,000)		Total Economic Cost (Rs. 1,000)	Net Economic Benefit (Rs. 1,000) D				D-(Total Economic cost) (Rs. 1,000)
	Investment Cost	O&M Cost[*1]		Component B Teak/Other broadleave		Component A Mangrove	Total	
				CO2 reduction	Timber & seed	CO2 reduction		
1	869,195	0	869,195		0		0	-869,195
2	1,575,016	0	1,575,016	35,133	0	345	35,478	-1,539,538
3	1,382,496	0	1,382,496	70,266	0	1035	71,300	-1,311,196
4	1,229,511	0	1,229,511	105,399	0	1379	106,778	-1,122,733
5	1,063,962	0	1,063,962	140,531	8,750	1379	150,661	-913,302
6	751,762	0	751,762	175,664	8,750	1379	185,794	-565,969
7	377,063	0	377,063	210,797	8,750	1379	220,926	-156,136
8	175,601	0	175,601	245,930	56,750	1379	304,059	128,459
9	99,015	0	99,015	281,063	120,750	1379	403,192	304,177
10	0	75,236	75,236	316,196	768,000	1379	1,085,575	1,010,339
11	0	75,236	75,236	351,329	903,750	1379	1,256,458	1,181,222
12	0	75,236	75,236	386,461	1,023,750	1379	1,411,591	1,336,355
13	0	75,236	75,236	421,594	1,111,750	1379	1,534,724	1,459,487
14	0	75,236	75,236	456,727	1,197,750	1379	1,655,856	1,580,620
15	0	75,236	75,236	491,860	2,049,750	1379	2,542,989	2,467,753
16	0	75,236	75,236	526,993	2,054,000	1379	2,582,372	2,507,136
17	0	75,236	75,236	562,126	2,138,750	1379	2,702,255	2,627,019
18	0	75,236	75,236	597,258	2,128,750	1379	2,727,388	2,652,152
19	0	75,236	75,236	632,391	2,090,750	1379	2,724,521	2,649,284
20	0	75,236	75,236	667,524	674,750	1379	1,343,654	1,268,417
21	0	75,236	75,236	702,657	1,188,750	1379	1,892,786	1,817,550
22	0	75,236	75,236	737,790	1,050,000	1379	1,789,169	1,713,933
23	0	75,236	75,236	772,923	976,000	1379	1,750,302	1,675,066
24	0	75,236	75,236	808,056	904,000	1379	1,713,435	1,638,199
25	0	75,236	75,236	843,188	848,000	1379	1,692,568	1,617,332
26	0	75,236	75,236	878,321	218,000	1379	1,097,701	1,022,464
27	0	75,236	75,236	913,454	176,000	1379	1,090,833	1,015,597
28	0	75,236	75,236	948,587	148,000	1379	1,097,966	1,022,730
29	0	75,236	75,236	983,720	108,000	1379	1,093,099	1,017,863
30	0	75,236	75,236	1,018,853	396,000	1035	1,415,887	1,340,651
31	0	75,236	75,236	1,053,986	372,000	345	1,426,330	1,351,094
32	0	75,236	75,236	1,089,118	2,292,000	0	3,381,118	3,305,882
33	0	75,236	75,236	1,124,251	2,268,000	0	3,392,251	3,317,015
34	0	75,236	75,236	1,159,384	2,268,000	0	3,427,384	3,352,148
35	0	75,236	75,236	1,194,517	4,569,000	0	5,763,517	5,688,281
36	0	75,236	75,236	1,229,650	4,569,000	0	5,798,650	5,723,414
37	0	75,236	75,236	1,264,783	2,625,000	0	3,889,783	3,814,546
38	0	75,236	75,236	1,299,916	2,625,000	0	3,924,916	3,849,679
39	0	75,236	75,236	1,335,048	2,625,000	0	3,960,048	3,884,812
40	0	75,236	75,236	1,370,181	2,625,000	0	3,995,181	3,919,945
			9,855,945	(Sum of economic cost)			**EIRR**	13.3%

*1 The O&M cost is estimated at 1% of the economic investment cost.   NPV   2,668,598

B/C   6.969

Source: Developed by the Study Team

2.7.2 Calculation of CO₂ Reduction

Forest management activities in Component A and B that involve afforestation will contribute to the reduction of CO_2 emissions through increases in the carbon stock because of the growth of trees. In the Study as well, the amount of CO_2 emissions reduction was estimated. The estimation results indicate that the Project will contribute to a total of 9,722,160 t-CO_2 sequestration and emissions reduction in 40 years (Table 10).

Table 10: CO$_2$ Sequestration and Emission Reduction in the Project

Project activity	Area (ha)	Project period (year)	Total CO$_2$ sequestration/reduction (t-CO$_2$)	Average annual CO$_2$ sequestration/reduction (t-CO$_2$/y)
Mangrove plantation	1,400	30	260,046	6,501
Teak +Broad-leaved afforestation	4,000	40	9.462,120	236,553
Total	5,400		9,722,166	243,054

Source: Developed by the Study Team

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Abbreviations

Abbreviation	Full Name
ACF	Assistant Conservator of Forests
ACR	Annual Confidential Report
ADB	Asian Development Bank
ADTWD	Adi Dravidar and Tribal Welfare Department
AED	Agricultural Engineering Department
AG	Accountant General
AGM	Annual General Body Meeting
AIBP	Accelerated Irrigation Benefit Programme
AIIB	Asian Infrastructure Investment Bank
AIWC	Advanced Institute for Wildlife Conservation
ANCF	Asian Nature Conservation Foundation
APCCF	Additional Principal Chief Conservator of Forests
APO	Annual Plan of Operation
ASL	Above sea level
AWiFS	Advanced Wide Field Sensor
B/C	Cost Benefit Ratio
BCRLIP	Biodiversity Conservation and Rural Livelihood Improvement Project
BHS	Biodiversity Heritage Sites
BMC	Biodiversity Management Committee
C.A.M.P.	Conservation Assessment and Management Plan
CACS	Centre for Animal Care Science
CAG	Comptroller & Auditor General
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CB	Capacity Building
CBET	Community-based Ecotourism
CBO	Community-based Organisation
CCF	Chief Conservator of Forests
CCTV	Closed circuit television
CD	Check Dam
CEM	Commission on Ecosystem Management
CF	Conservators of Forests
CMDA	Chennai Metropolitan Development Authority
COP	Conference of the Parties
CPCB	Central Pollution Control Board
CPD	Chief Project Director
CPI	Consumer Price Index
CPT	Candidate Plus Tree
CPU	Clonal Propagation Unit
CR	Critically Endangered
CRZ	Coastal Regulation Zone
CSMCRI	Central Salt & Marine Chemicals Research Institute
CSR	Corporate Social Responsibility

Abbreviation	Full Name
CSC	Common Service Centre
CWFS	Centre for Wildlife Forensic Sciences
CWLW	Chief Wildlife Warden
DAC	Department of Agriculture and Cooperation
DBH	Diameter at Breast Height
DC	District Collector
DCF	Deputy Conservator of Forest
DD	Data Deficient
DFO	District Forest Office
DGPS	Differential Global Positioning System
DMU	Division Management Unit
DOLR	Department of Land Resources
DPC	Departmental Purchase Committee
DPMU	District Project Management Unit
DPR	Detailed Project Report
DRC	Disaster Recovery Centre
DRIP	Dam Rehabilitation and Improvement Project
E&F	Environment and Forests
EAC	Expert Appraisal Committee
EAP	Externally Aided Project
EC	Environment Clearance
Eco-DRR	Ecosystem-based Disaster Risk Reduction
ED	Ecodevelopment
EDC	Ecodevelopment Committee
EIA	Environmental Impact Assessment
EIAF	Environment Impact Assessment Framework
EIRR	Economic Internal Rate of Return
ELCOT	Electronics Corporation of Tamil Nadu
EMP	Ecotourism Management Plan
EMoP	Environment Monitoring Plan
EN	Endangered
EODB	Ease of Doing Business
EPT	Elephant Proof Trench
ER	Elephant Reserve
ERM	Extension, Renovation and Modernisation
ESD	Ecologically Sustainable Development
ESG	Environment, Social, and Governance
ESRP	Endangered Species Recovery Plans
ETF	Elephant Task Force
ETMC	Ecotourism Management Committee
ETMS	Ecotourism Management Society
ETRP	Emergency Tsunami Reconstruction Project
FAC	Forest Advisory Committee
FAO	Food and Agriculture Organization of the United Nations

Abbreviation	Full Name
FC&RI	Forest College and Research Institute
FD	Forest Division
FDA	Forest Development Agency
FEC	Forest Extension Centre
FIG	Farmer Interested Group
FMAS	Financial Management and Accounting System
FMU	Field Management Unit
FR	Fundamental Rules
FRS	Forest Range Office
FSC	Forest Stewardship Council
FSI	Forest Survey of India
FSO	Forest Settlement Officer
FUU	Forest Utilisation Unit
G2B	Government-to-business
G2C	Government-to-citizen
G2G	Government-to-government
GA	Geographical area
GAP	Gender Action Plan
GB	Governing Body
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GEMS	Global Environmental Monitoring System
GHG	Greenhouse Gas
GIS	Geographic Information System
GOI	Government of India
GoM	Gulf of Mannar
GPS	Global Positioning System
GS	General Service
GSDP	Gross State Domestic Product
GST	Goods and Services Tax
GVA	Gross Value Added
HADP	Hill Area Development Programme
HLEC	High Level Executive Committee
HO	Head Office
HOFF	Head of Forest Force
HPC	Higher Purchase Committee
HPSC	High Power Steering Committee
HTL	High tide line
HWNI	Human-wildlife Negative Interaction
IAP	Internal Audit Party
IAS	Invasive Alien Species
ICT	Information and Communication Technology
ICZM	Integrated Coastal Zone Management
IEC	Information, Education and Communication

Abbreviation	Full Name
IEDP	India Eco-development Project
IFS	Indian Forest Service
IIRS	Indian Institute of Remote Sensing
INCOIS	Indian National Centre for Ocean Information Services
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
IRS	Indian Remote Sensing
ISFR	India State of Forest Report
ISP	Internet Service Provider
IT	Information Technology
ITDP	Integrated Tribal Development Programme
ITEWC	Indian Tsunami Early Warning Centre
IUCN	International Union for Conservation of Nature
IWMP	Integrated Watershed Management Programme
JBIC	Japan Bank for International Cooperation
JDO	Junior Drafting Officer
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
JICA	Japan International Cooperation Agency
LAN	Local Area Networking
LISS	Linear Imaging and Self Scanning Sensor
LPC	Lower Purchase Committee
LPG	Liquefied petroleum gas
LULUCF	Land Use, Land-use Change, and Forestry
M&E	Monitoring & Evaluation
M/D	Minutes of Discussion
MARSIS	Marine Remote Sensing Satellite Information Services
MDF	Moderately Dense Forest
MINARS	Monitoring of Indian National Aquatic Resources
MGBL	Meters below ground level
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MIS	Management Information System
MODIS	Moderate Resolution Imaging Spectroradiometer
MoEF	Ministry of Environment and Forests
MOEFCC	Ministry of Environment, Forest, and Climate Change
MOSPI	Ministry of Statistics and Programme Implementation
MOU	Memorandum of understanding
MOWR, RD & GR	Ministry of Water Resources, River Development & Ganga Rejuvenation
MPEDA	Marine Products Export Development Authority
MPI	Multidimensional Poverty Index
MS	Member Secretary
MSL	Mean sea level
MSP	Minimum Support Prices
MSSRF	M S Swaminathan Research Foundation

Abbreviation	Full Name
NABARD	National Bank for Agriculture and Rural Development
NADP	National Agriculture Development Programme
NAFCC	National Adaptation Fund for Climate Change
NAMP	National Air Quality Monitoring Programme
NAPCC	National Action Plan on Climate Change
NBA	National Biodiversity Authority
NBWL	National Board for Wildlife
NCZMA	National Coastal Zone Management Authority
NDB	New Development Bank
NDC	Nationally Determined Contribution
NF	Non-forest
NGO	Non-governmental Organization
NGT	National Green Tribunal
NOC	No Objection Certificate
NPV	Net Present Value
NRSC	National Remote Sensing Centre
NTFP	Non-Timber Forest Products
NWAP	National Wildlife Action Plan
NWPC	National Wages and Productivity Commission
ODA	Official Development Assistance
OECF	Overseas Economic Co-operation Fund
OF	Open Forest
OFWM	On Farm Water Management
OJT	On-the-job training
OM	Operational Manual
OPEC	Organization of the Petroleum Exporting Countries
OSC	One Stop Centre
OVOP	One Village One Product
PA	Protected Area
PAC	Public Accounts Committee
PAR	Performance Appraisal Report
PCCF	Principal Chief Conservator of Forests
PD	Project Director
PEFC	Programme for the Endorsement of Forest Certification
PF	Protected Forest
PGD	Post Graduate Diploma
PMC	Project Management Consultant
PMKSY - WD	Pradhan Mantri Krishi Sinchayee Yojana - Watershed Development
PMU	Project Management Unit
PSU	Public Sector Undertaking
PV & WCB	Protection, Vigilance and Wildlife Crime Bureau
PVC	Polyvinyl chloride
PVTG	Particularly Vulnerable Tribal Groups
RAPF	Resettlement Action Plan Framework

Abbreviation	Full Name
REC	Regional Empowered Committee
REDD	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
RET	Rare Endangered Threatened
RF	Reserved Forest/ Reserve Forest
RFA	Recorded Forest Area
RFO	Range Forest Officer
RFRI	Rain Forest Research Institute
RL	Reserved Land
RO	Regional Office
RRTs	Rapid Response Teams
RTSP	Regional Tsunami Service Provider
RVP	River Valley Project
SADP	Special Area Development Programme
SAG	State Advisory Group
SBB	State Biodiversity Board
SBWL	State Board of Wildlife
SC	Scheduled Caste
SCAP	Species Conservation Action Plan
SCZMA	State Coastal Management Authority
SDGs	Sustainable Development Goals
SDO	Senior Drafting Officer
SEAC	Expert Appraisal Committee
SEB	State Ecotourism Board
SEIAA	State Environment Impact Assessment Authority
SEM	Stakeholder Engagement Mechanism
SEZ	Special Economic Zone
SFDA	State Forest Development Agency
SFS	State Forest Service
SG	State Government
SHEP	Smallholder Horticulture Empowerment & Promotion
SHG	Self-help Group
SIDA	Swedish International Development Cooperation Agency
SMC	Soil and Moisture Conservation
SNPP	Suomi National Polar-Orbiting Partnership
SoE	Statement of Expenditure
SOI	Survey of India
SRDH	State Resident Data Hub
SSDG	State Services Delivery Gateway
ST	Scheduled Tribes
STFDP	Scheduled Tribe and Forest Dweller Plan
STFDPF	Scheduled Tribe and Forest Dweller Plan Framework
STPF	Scheduled Tribes Plan Framework
SWC	Soil and Water Conservation

Abbreviation	Full Name
SWOT	Strengths, weaknesses, opportunities, and threats
TAFCORN	Tamil Nadu Forest Plantation Corporation Limited
TANII	Tamil Nadu Innovation Initiatives
TANTEA	Tamilnadu Tea Plantation Corporation Limited
TANUVAS	Tamil Nadu Veterinary and Animal Sciences University
TAP 1	Tamil Nadu Afforestation Project (1)
TAP 2	Tamil Nadu Afforestation Project (2)
TAWDEVA	Tamil Nadu Watershed Development Agency
TBGP	Tamil Nadu Biodiversity Conservation and Greening Project
TBGCP	Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project
TCOF	Tree Cultivation Outside Forests
TCPL	Tree Cultivation in Private Land
TEDs	Turtle Exclusion Devices
TFP	Timber Forest Products
TIES	The International Ecotourism Society
TN	Tamil Nadu
TNAU	Tamil Nadu Agricultural University
TNBB	Tamil Nadu Biodiversity Board
TNCZMA	Tamil Nadu Coastal Zone Management Authority
TNeGA	Tamil Nadu e-Governance Agency
TNEIAA	Tamil Nadu Environment Impact Assessment Authority
TNFA	Tamil Nadu Forest Academy
TNFD	Tamil Nadu Forest Department
TNFMIS	The Tamil Nadu Forest Department Management Information System
TNFTC	Tamil Nadu Forestry Training College
TNFUSRC	Tamil Nadu Forest Uniformed Services Recruitment Committee
TNGIS	Tamil Nadu Geographical Information System
TNGS	Tamil Nadu Biodiversity Conservation and Greening Society
TNPCB	Tamil Nadu Pollution Control Board
TNSAPCC	Tamil Nadu State Action Plan on Climate Change
TNSDC	Tamil Nadu State Data Centre
TNSDMA	Tamil Nadu State Disaster Management Authority
TNSWAN	Tamil Nadu State Wide Area Network
TNUFIP	Tamil Nadu Urban Flagship Investment Programme
TOF	Trees outside Forests
TOR	Terms of Reference
TOT	Training of Trainers
TPOF	Tree Planting Outside Forest
TPP	Twenty Point Programme
TS	Total Station
TSP	Tribal Sub-Plan
UA	User Agency
UF	Unclassed Forest

Abbreviation	Full Name
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USDA	United States Department of Agriculture
UT	Union Territory
VDC	Village Development Committee
VDF	Very Dense Forest
VDF	Village Development Fund
VFC	Village Forest Committee
VU	Vulnerable
WB	World Bank
WDF	Watershed Development Fund
WGDP	Western Ghats Development Programme
WII	Wildlife Institute of India
WL	Wildlife
WLS	Wildlife Sanctuary
WP	Working Plan/ Working or Management Plan
WPI	Wholesale Price Index
WTI	Wildlife Trust of India
WWF	World Wildlife Fund
ZSI	Zoological Survey of India

Local Words Used in the Report

Local Words	English Translation/ Description
Dharnas	The practice of exacting justice or compliance with a just demand by sitting
Firka	Governmental body under taluk level
Roko	A protest or demonstration, typically one that involves the obstruction of a railway or road.
Taluk	Governmental body under district level/ a group of village in a district

Chapter 1.   Introduction

1.1.   Background and Objectives

The state of Tamil Nadu is located in the southern part of India. It has a long and narrow shape with a width of about 670 km from north to south and about 200 km from east to west (380 km at its longest in the central part of the state). Tamil Nadu has a total area of about 130,000 km², with characteristics that vary depending on region. Forests and grasslands (such as elephant habitats) with significant biodiversity are found in the western part of the state. On the eastern side, a coastline of more than 1,076 km extends from north to south.[1] Mangroves and wetlands, which are important for biodiversity, are widely distributed in this area. In the northern part of the state, where the large city of Chennai is located, industry, and commerce, and agriculture are flourishing because of moderate rainfall compared with the rest of the state. Also, many timber production areas of important tree species, such as teak, sandalwood, and rosewood, are distributed. In addition, Chennai suffered severe damage from a flood that killed more than 300 people in 2015.[2] This disaster was due to unplanned urban expansion, itself due to rapid urban expansion. In the southern part of the state, precipitation is relatively low and there is increasing aridity. As a result, many abandoned cultivated lands are found in this region. In the central part of the state, there is much important biodiversity and many forests are distributed.

The Tamil Nadu Forest Department (hereinafter "TNFD"), which is the implementing agency of the "Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project" (hereinafter "TBGCP")[3], has implemented three yen-loan projects: the "Tamil Nadu Afforestation Project (1)" (hereinafter "TAP 1") (1997-2005); "Tamil Nadu Afforestation Project (2)" (hereinafter "TAP 2") (2005-2013); and "Tamil Nadu Biodiversity Conservation and Greening Project" (2011-2021) (hereinafter "TBGP"). In order to improve the forest coverage rate in particular, the first two projects focused on improving the density of degraded and degrading reserved forests by gap planting, whereas the TBGP focused on tree planting activities outside of forest areas. In addition to these activities, the extermination of exotic plants, provision of alternative livelihoods, awareness activities, and improvement of community-based nature reserve management were also implemented. The TBGP improved the forest coverage rate was improved through the afforestation of about 143,000 ha. However, the biodiversity of the state is still at risk due to recent rapid population growth and economic development, the increased proximity of areas of human activity and wildlife habitats as a result of urbanisation, and the excessive consumption of forest resources by the residents around the forest. Climate change and its impacts have caused a severe strain on many of the wild ecosystems in the state, threatening their existence as well as endangering the ecosystem services that flow from such ecosystems. Moreover, certain critical habitats like corals, sea grass beds, and mangroves have not received due attention. Under these circumstances, the conservation of biodiversity is urgently needed.

As mentioned above, the area of Tamil Nadu covers an extremely large area. The natural and socio-economic conditions in the state greatly vary depending on the region. Though the TBGP focused on the improvement of forest coverage rate through afforestation, especially on lands outside of the forest areas throughout the state, in places with the greatest need of conservation activities, such as areas in the central part of the state, relevant activities remained limited. Therefore, in the TBGCP, the methods and results demonstrated in the TBGP will be verified, utilised, and strengthened. In addition, ecosystem services that were not undertaken in the TBGP will be strengthened in the TBGCP, focusing on the conservation of areas with particularly important biodiversity and forests,

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[1] Ministry of Environment, Forest, and Climate Change, Environmental Information System.

[2] https://www.bbc.com/news/av/world-asia-india-35129556.

[3] The title of the project was renamed in the middle of this study from "Tamil Nadu Biodiversity Conservation and Greening Project (Phase 2)", which is a title of this study as shown on the title of this report, to "Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project".

such as the Eastern Ghats area, which was not included as a target in the TBGP. At the same time, to achieve social and economic development around those conservation areas, it is important to develop and implement activities for the "improvement of animal and plant habitats", the "forestry promotion", and the "strengthening of organisational structure" in the TBGCP.

In this regard, the purposes of the study of TBGCP (hereinafter "the Study") are to gather and analyse the information necessary for review of the TBGCP as a Japan yen-loan project — which include the validity of TBGCP, project components, project cost, implementation schedule, implementation system, operation and maintenance system, procurement/construction method, environmental and social considerations, economic/financial analysis, and operation and effect indicators — and to make an appropriate proposal for the implementation of the TBGCP.

1.2.   Overview of Outcomes

According to the detailed project report (DPR), the main components of the yen-loan-financed project targeted by the Study for achieving TBGCP purpose were: (1) biodiversity conservation; (2) increasing the natural resource base; (3) combatting forest land and wildlife habitat degradation by eco-development activities and soil and water conservation; and (4) institutional capacity development. The DPR also indicated that TBGCP would consist of the assessment and preparation phase (one year), the implementation phase (four years), and the consolidation phase (one year), and the implementation period of TBGCP would be six years in total. After the series of discussion between JICA and TNFD during the Study, the main components of TBGCP were reorganized to: (1) Ecosystem Based Climate Change Measures, (2) Human Wildlife Conflict Measures, (3) Promoting Supply Chain Development, and (4) Livelihood Improvement Activities, and the implementation period was changed to eight years consisting of the assessment and preparation phase (one year), the implementation phase (five years), and the consolidation phase (two years).

1.3.   Methodology and Approach

This final report is an output of the Study as per literature reviews including the DPR, interviews with relevant agencies and university professors, field surveys by local consultants, a subcontracting work, progress report meetings with TNFD, and component-wise technical meetings with the contact team members of TNFD.

Progress report meetings

- Kick-off meeting: May 18, 2021
- First progress report meeting with TNFD: June 18, 2021
- Second progress report meeting with TNFD: July 2, 2021
- Third progress report meeting with TNFD: July 16, 2021
- Fourth progress report meeting with TNFD: July 30, 2021
- Fifth progress report meeting with TNFD: August 16, 2021
- Sixth progress report meeting with TNFD: August 27, 2021
- Seventh progress report meeting with TNFD: October 29, 2021
- Eighth progress report meeting with TNFD: November 2, 2021

Component-wise technical meetings

- Component-wise technical meetings with the contact team members of TNFD were irregularly held as needed.

1.4.   Report Structure

This final report is structured in the following order: (1) Basic understanding of Tamil Nadu (Chapter

2). (2) Examination of the present status in forest and forest management, biodiversity, forest products, livelihood improvement and ecotourism, and institutional arrangement (Chapters 3, 4, 5, 6, and 7). (3) Review of the DPR (Chapter 8). (4) Issues identified from the preparatory study to date and the DPR (Chapter 9). (5) Proposed project outline and scope of work for a new project (Chapter 10). Figure 1.1 illustrates the overall report structure.
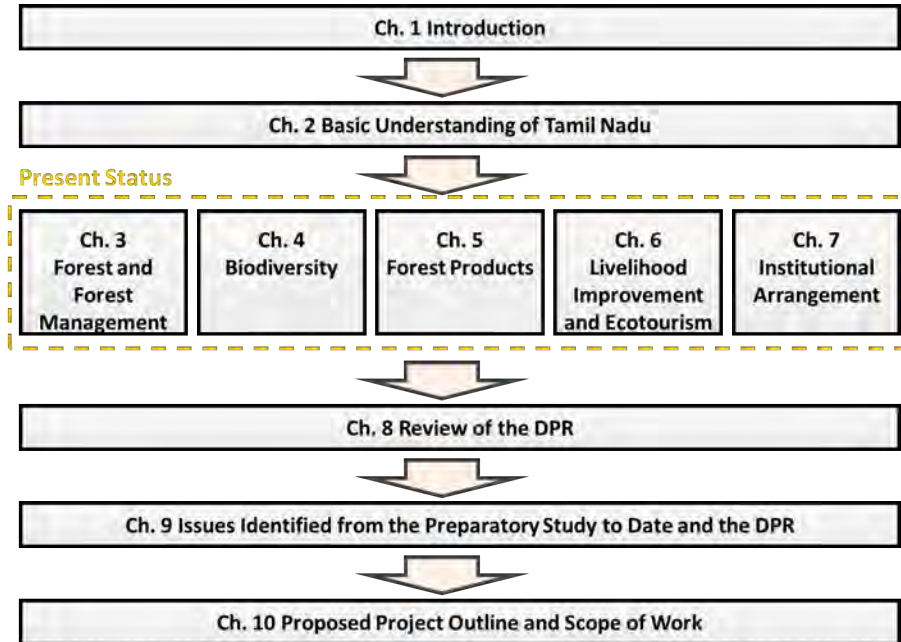
Figure 1.1: Overall Structure of the Final Report

Chapter 2. The Study Area: Tamil Nadu

2.1. Area, Location, and Physiography

Tamil Nadu lies in the southernmost part of the Indian subcontinent, located between 8°05'N - 13°34'N and 76°14'E - 80°21'E. The state borders the Bay of Bengal in the east, the Indian Ocean in the south, and the neighbouring states of Kerala in the west, Andhra Pradesh in the north, and Karnataka in the northeast. Tamil Nadu is the tenth largest state in India, with a total area of 130,058 km^2, accounting for 4% of the country's geographical area. The physiography of Tamil Nadu is naturally classified into four zones, namely Western Ghats, Eastern Ghats, Plateaus, and Coastal and Inland Plains. The hill region, consisting of Western Ghats and Eastern Ghats, is much more complex compared to other areas. The average elevation of the state of Tamil Nadu is around 300 m above sea level (ASL), which varies along the coast. Mountain ranges lie at an altitude of above 1,000 m ASL in the Eastern Ghats and Western Ghats, with others exceeding 2,000 m in Palani and Nilgiri Hills of the Western Ghats. Cauvery is the largest river in the state of Tamil Nadu (known as 'Ponni' in Tamil). It is also the fourth largest river in southern India, flowing into Tamil Nadu from adjoining Karnataka. With a catchment of approximately 81,155 km^2 in total and 43,856 km^2 in Tamil Nadu, the river plays a vital role in agriculture of the state of Tamil Nadu. The other rivers are the Adyar, Courtaliar, South Pennar, Periyar, Vaigai, and Tamiraparani.

2.2. Administrative System of the State of Tamil Nadu

Tamil Nadu was formed under a previous name, Madras State, by the government of India in 1950. The state was ultimately renamed Tamil Nadu in 1969. The government of Tamil Nadu is the governing authority for the Indian state of Tamil Nadu. The governor is the constitutional head of the state government. State administration is run in the name of the governor, while executive power is exercised by the Council of Ministers, with the chief minister as its head.

According to the government of Tamil Nadu, the state of Tamil Nadu consists of 38 districts. These districts are further divided into 87 revenue divisions. Following this, there are smaller administrative units, including 310 taluks, 1,349 firkas, and 17,680 revenue villages. Under the government of Tamil Nadu, there are different departments responsible for the state management of various sectors, such as agriculture, animal husbandry, finance, forest and environment, fisheries, health and family welfare, labour, and public works. The TNFD has a mandate to manage the field of biodiversity conservation.

2.3. Population, Economy, and Social Conditions of the State of Tamil Nadu

2.3.1. Demography

As per Table 2.1, the population of Tamil Nadu is 72.147 million, growing 15.61% (rural 6.49%, urban 27.16%) compared to the population of 2001. The male population is 36.138 million and the female population is 36.01 million, with a sex ratio of 966 females per 1,000 males. The rural population occupies 52% (37.230 million) of the total population, while the proportion of urban population is at 48% (34.917 million). Tamil Nadu is one of the states that has the fastest rate of urbanisation in India. Specifically, only 34.15 % of the total population in Tamil Nadu was classified as urban in 1991, but after ten years had passed, this number had risen to 48% by 2011, which is an increase of 14.3%. This leaves the states of Kerala, Maharashtra, and Gujarat behind in terms of the urbanisation rate.

Table 2.1: Population by Sex, Area, and District

State/Districts	Rural (Millions)			Urban (Millions)		
	Total	Male	Female	Total	Male	Female
Tamil Nadu	37.230	18.679	18.551	34.917	17.459	17.459
Chennai	Na			4.647	2.336	2.311
Kancheepuram	1.460	0.735	0.725	2.538	1.278	1.260
Tiruvallur	1.300	0.650	0.649	2.428	1.226	1.203
Cuddalore	1.721	0.869	0.852	0.885	0.443	0.442
Viluppuram	2.940	1.481	1.458	0.519	0.259	0.260
Vellore	2.234	1.117	1.117	1.702	0.845	0.857
Tiruvannamalai	1.970	0.990	0.980	0.495	0.246	0.249
Salem	1.708	0.883	0.825	1.774	0.898	0.876
Namakkal	1.030	0.521	0.510	0.696	0.349	0.348
Dharmapuri	1.246	0.643	0.603	0.261	0.131	0.130
Krishnagiri	1.451	0.742	0.709	0.428	0.218	0.211
Erode	1.094	0.552	0.541	1.158	0.577	0.581
Coimbatore	0.839	0.419	0.420	2.619	1.310	1.309
Tiruppur	0.958	0.479	0.479	1.521	0.767	0.754
The Nilgiris	0.300	0.146	0.154	0.436	0.214	0.221
Tiruchirappalli	1.384	0.689	0.696	1.338	0.664	0.674
Karur	0.630	0.313	0.317	0.435	0.216	0.219
Perambalur	0.468	0.234	0.234	0.097	0.048	0.049
Ariyalur	0.671	0.333	0.338	0.084	0.041	0.042
Thanjavur	1.555	0.765	0.789	0.851	0.417	0.434
Nagapattinam	1.252	0.619	0.632	0.365	0.179	0.186
Thiruvarur	1.006	0.500	0.507	0.258	0.127	0.131
Pudukkottai	1.302	0.646	0.656	0.316	0.158	0.159
Madurai	1.191	0.601	0.590	1.847	0.925	0.922
Theni	0.575	0.291	0.285	0.670	0.335	0.336
Dindigul	1.352	0.679	0.673	0.808	0.402	0.406
Ramanathapuram	0.943	0.475	0.468	0.411	0.208	0.203
Virudhunagar	0.962	0.480	0.482	0.980	0.487	0.493
Sivaganga	0.926	0.462	0.464	0.413	0.206	0.206
Tirunelveli	1.557	0.769	0.788	1.520	0.752	0.768
Thoothukudi	0.873	0.430	0.443	0.877	0.435	0.442
Kanniyakumari	0.331	0.165	0.166	1.540	0.761	0.778

Source: Tamil Nadu Statistical Hand Book 2019, India Census 2011

The total number of households in the state of Tamil Nadu is 23.1 million, which is an increase of 36.3% (17 million) compared to 2001. Since fertility rates are falling while the urbanisation rate is growing, the state's average family size is gradually falling. According to the Census 2011, the average household size of Tamil Nadu is 4.0. Tamil Nadu is also ranked as the state with the lowest household size in the nation, followed by Kerala with 4.0 members.

Tourist arrivals, including domestic and foreign arrivals, are raising sharply year by year (Table 2.2). Specifically, there were only 28.545 million in 2001, but this number rose to 140.059 million (an increase of 390%, equal to 111.514 million) by 2011 before reaching 349.922 million in 2017 (an increase of 1,125%, equal to 321.376 million). Chennai is one of the biggest tourist destinations, accounting for about 11% of total arrivals in 2017, followed by the districts of Rameswaram and Madurai.

Table 2.2: Tourist Arrivals in Tamil Nadu

Year	Domestic (Millions)	Foreign (Millions)	Total (Millions)
2001	23.812	0.773	24.585
2011	136.751	3.308	140.059
2017	345.061	4.860	349.922

Source: Website of the government of Tamil Nadu (https://www.tn.gov.in/)

Consequently, an increase of the tourist population is leading to an increase in the production of waste and pollutants, unsustainable development in ecologically sensitive areas, and conflict between tourists and locals, all of which contribute to biodiversity loss.[4]

2.3.2. Scheduled Tribes and Traditional Decision-making Structures

Ranking by proportion of Scheduled Tribes (ST), Tamil Nadu belongs to the bottom five states in India. The state of Tamil Nadu is home to only 1.1% of the ST population of the country. As per the Scheduled Castes and Scheduled Tribes Order (Amendment) Act, 1976, there are 36 ST in Tamil Nadu, of which the Malayali, Kurumbas, Kanikaran, Kammara, Kota, and Toda have been known as areas where some restrictions are in effect. The Kammara, Kota, and Toda have the widest distribution throughout the state, except for the district of Kanniyakumari and Shencottah taluk in the district of Tirunelveli. The Kurumbas are distributed quite narrowly, being located only in Nilgiri District. The Census 2001 shows that the Kurumans were recorded as being the ST with the highest growth rate, with 43% (a population of 24,963), while the Malayali is the ST with the largest population, at 310,042, making up 47.6% of the state ST population (at a growth rate of 24.2%). Most tribal members live in the forests; their economy depends on forests for livelihood, hence their lives may have both positive and negative impacts on the management of forests and biodiversity conservation.

Since the social and cultural life of tribal communities is centred on nature and their lives depend considerably on forests, the high rate of deforestation recently has affected the tribes, particularly in food availability, livelihood options, and quality of life. To settle this issue, there are many tribal development programmes are implemented by the Tamil Nadu government, such as the Integrated Tribal Development Programme (ITDP), Hill Area Development Programme (HADP), and Western Ghats Development Programme (WGDP).

2.3.3. Poverty Level

Tamil Nadu has obtained a significant achievement in poverty reduction over the last few decades. The per capita gross state domestic product (GSDP) of the state of Tamil Nadu increased sharply between 2004 and 2018, from INR 134,331 in 2004 to INR 197,930 in 2018.[5] According to a report of the World Bank (WB) on population below the poverty line in 2012, Tamil Nadu is on the top list of 11 states with less population under the poverty line (Figure 2.1). Furthermore, Tamil Nadu also has the highest rank amongst large states in India in term of urbanisation.
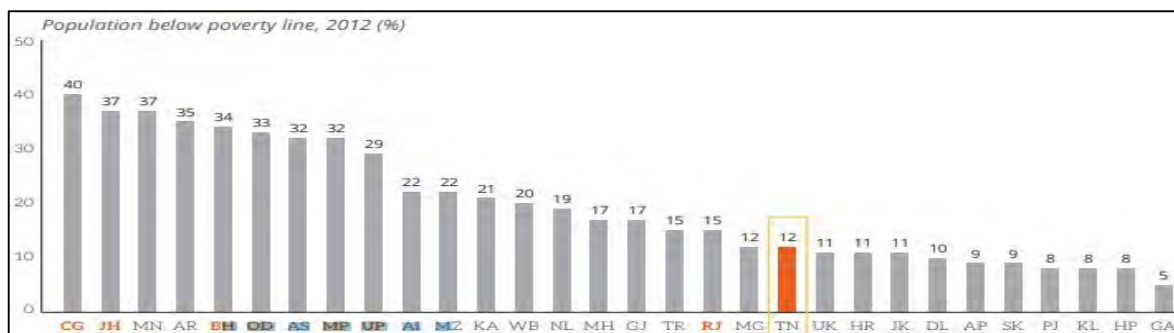
Source: The World Bank

Figure 2.1: Population below the Poverty Line

The state's per capita income has recently increased thanks to the positive growth of GSDP together with a slower growth rate of population, broad-based industrialisation, a high volume of trade and commerce, higher investment activities, a trader-friendly tax structure, a host of welfare measures tailored to pro-poor needs: universal education, better sanitation, potable drinking water, affordable

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[4] State of Environment Report for Tamil Nadu 2017.
[5] Finance of the State Government of Report, 2019.

housing, and good governance in administration.[6]

Despite the good achievements mentioned above, several parts of the state of Tamil Nadu still record high levels of poverty, particularly in Ariyalur, Virudhunagar, Ramanathapuram, Perambalur, and Dharmapuri. Based on the Multidimensional Poverty Index (MPI), an international measure of acute multidimensional poverty, the districts of Tamil Nadu are classified into three categories, namely high poverty districts (with more than 40% of the population living below the poverty line), moderately poor districts (with 30% to 40% of the population living below the poverty line), and low level poverty districts (below 30%).[7]

Table 2.3: Top and Bottom Five MPI Districts in Tamil Nadu

No.	Top 5 Districts	Index	Rank	Bottom 5 Districts	Index	Rank
1	Kancheepuram	0.34	1	Ariyalur	0.62	28
2	Chennai	0.34	2	Virudhunagar	0.62	29
3	Cuddalore	0.38	3	Ramanathapuram	0.63	30
4	Coimbatore	0.41	4	Perambalur	0.63	31
5	Nagapattinam	0.41	5	Dharmapuri	0.70	32

Source: Tamil Nadu State Human Development Report-2017

Table 2.3 indicates that Dharmapuri has the highest MPI and that Kancheepuram ranks in the lowest position. The districts of Dharmapuri, Perambalur, Ramanathapuram, Virudhunagar, and Ariyalur have very poor health, education, standards of living, low sanitation coverage, and high infant mortality rate. This condition leads these districts to be classified as having multiple deprivations. In contrast, Kancheepuram and Chennai have the lowest level of deprivation, belonging to the top five districts, which are highly urbanised and have greater education and well-connected health facilities.

2.3.4. Literacy

As described in the Census of India, a person is identified as literate who can both read and write with understanding in any language. The literacy rate of Tamil Nadu has drastically improved since 1961. Specifically, the literate population of the state of Tamil Nadu occupied only 36.39% of the total population in 1961, while the rate was 80.33% in 2011. This is much higher than the average for all of India, which is 74.04%, ranking the state of Tamil Nadu as eighth amongst other states. Table 2.4 shows that the literacy rate in Tamil Nadu has always been above the national level in general though the years.

Table 2.4: Literacy Rates in India and Tamil Nadu 1961-2011

Year	Tamil Nadu				India			
	Persons	Male	Female	Gap	Persons	Male	Female	Gap
1961	36.39	51.59	21.06	30.53	28.30	40.40	15.35	25.05
1971	45.40	59.54	30.92	28.62	34.43	45.96	21.97	23.99
1981	54.39	68.05	40.43	27.62	43.57	56.38	29.76	26.62
1991	62.66	73.75	51.33	22.42	52.21	64.13	39.29	24.84
2001	73.47	82.33	64.55	17.78	64.83	75.26	53.67	21.59
2011	80.33	86.81	73.86	12.95	74.04	82.14	65.46	16.68

Source: Tamil Nadu Statistical Hand Book 2019; India Census 2011

Progress in literacy is a good achievement at the state level, but there are poor results in certain districts. In 2011, the three rural districts of Dharmapuri, Erode, and Salem, and the eleven urban districts of Virudhunagar, Karur, Tiruvannamalai, Perambalur, Dindigul, Dharmapuri, Ariyalur, Theni, Namakkal, Salem, and Erode registered literacy rates below the national level. In 2011 the number increased further, with four rural districts (with the addition of Krishnagiri) and twelve urban

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[6] State Income Report, Government of Tamil Nadu, 2014.

[7] Dr. M. Saravanan & V. Babitha, 2019. "Multi-dimensional Poverty Index: An Over View of Tamil Nadu". *International Journal of Research and Analytical Reviews*, Volume 6, Issue 1.

districts (with Viluppuram and Tiruppur replacing Perambalur). It has been noted that the number of urban districts is three times higher than the rural ones.[8] As opposed to the low performance of the aforementioned districts, Krishnagiri District had the highest rural literacy rate growth over the decade at 9.8%. Kanyakumari had the highest rural literacy rate in both 2001 and 2011 at 86.17% and 90.95%, respectively.

2.3.5.   Gender Issues

(1) Women's Status in India

In the past decade, the government of India developed and implemented various policies and programmes, such as the National Policy for Women 2016, "Mahila Shakti Kendra", which is planned to provide One Stop Convergent Services for Empowering Rural Women, and "SAKHI", which is a One Stop Centre (OSC) intended to support women affected by violence, along with a campaign called 'Beti Bachao, Beti Padhao', in order to empower women and to achieve gender equality, as well as to protect women from violence.

In the Global Gender Gap Index 2021, India still ranked low, at 140 out of 156 countries. Of the four elements of the Index, each of which are composed of multiple sub-indicators, India ranked 151 in the element of 'Economic Participation and Opportunity', 114 in 'Educational Attainment', and 147 in 'Health and Survival', while at 51 the rank for 'Political Empowerment' is relatively high. According to the third edition of Sustainable Development Goals (SDGs) India Index 2020-21, the score for SDG5 (Gender Equality) was increased from 36 in 2018 to 48 in 2020, but it is still low in the international ranking. In the SDG report by the think tank NITI Aayog, SDG5 is selected along with SDG1 (No Poverty) and SDG2 (Zero Hunger) as the Top Priority Development Needs in India.

(2) Gender Issues in Tamil Nadu

The government of Tamil Nadu laid the formal framework for attaining universal primary education with the Tamil Nadu Compulsory Education Act, 1994, and the Tamil Nadu Right of Children to Free and Compulsory Education Rules, 2011. As a result, the literacy rates of both men and women in Tamil Nadu have been higher than the national average and steadily increased from 1991 to 2011, while the gender gap in literacy drastically decreased, as shown in the table and figure below.

Table 2.5: Literacy Rates in 1991, 2001, and 2011

Literacy rate (%)	1991			2001			2011		
	Persons	Male	Female	Persons	Male	Female	Persons	Male	Female
Tamil Nadu	62.66	73.05	51.33	73.45	82.33	64.55	80.33	86.81	73.86
India	52.21	64.13	39.39	64.83	75.26	53.67	74.04	82.14	65.46

Source: Census of India in 1991, 2001, and 2011

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[8] P, Devi Priya and M, Helen Mary Jacqueline, 2020. "Literacy Differentials in Tamil Nadu: A District Level Analysis". *Munich Personal RePEc Archive,* Paper No. 101775.
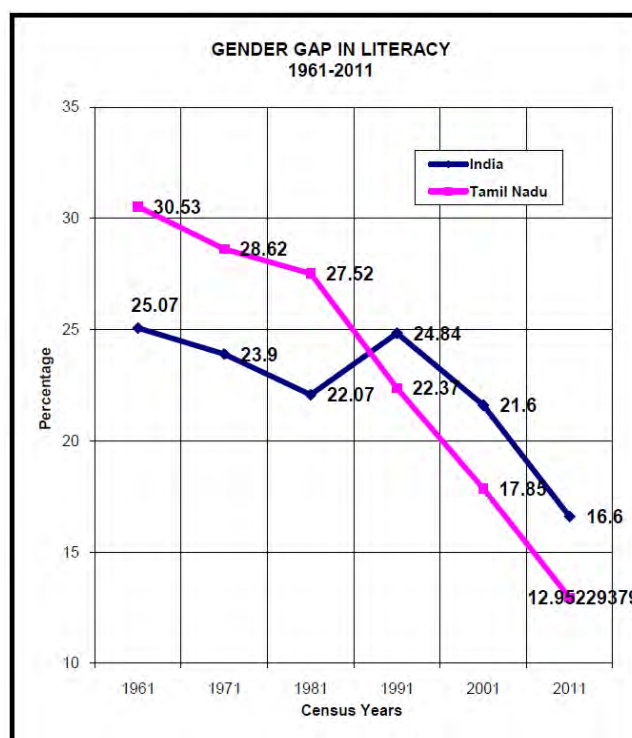
Note: For 1981-2011, the literacy rate is computed for population aged 7 and above.

For 1961 and 1971, it is with reference to the 5+ age population.

Source: Census of India 2011, Provisional Population Totals, Tamil Nadu

Figure 2.2: Gender Gap in Literacy 1961 - 2011

The state of Tamil Nadu has also formed a Gender Budget Cell in the Finance Department and has included a Gender Budget Statement in the state budget since 2017-18. In addition, the Social Welfare and Women Empowerment Department (Social Welfare and Nutritious Meal Programme Department) is implementing various schemes and acts for the welfare of girls, such as the Cradle Baby Scheme, Chief Minister's Girl Child Protection Scheme, Beti Bachao Beti Padhao Scheme, Special Need Children Homes, and the Prohibition of Child Marriage Act, 2006, in order to eliminate all forms of discrimination and violence against girls, as well as to achieve the targets of SDG5. In addition, the department also implements schemes such as Marriage Assistance Schemes, the Working Women's Hostel, Service Home, and the Women's Co-operative Society, to ensure the safety and protection of women and their rights.

However, the sex ratio at birth (females per 1,000 males), one of the main indicators of SDG5, has not improved much, from 898 in 2018 to 908 in 2020. This is far below the national target of 950.[9] In addition, the ratio of female to male labour force participation, also an important SDG5 indicator, is 0.49, higher than the national average of 0.33, but still much lower than the national target of 1.0.[10] In an urban area like Chennai, the female workforce participation rate is lower than it is in rural areas due to a lack of job opportunities for educated women.[11] According to the SDG India Index 2020-2021, the ratio of female to male average wage/salary earnings received among those receiving a regular wage/salary is 0.73, slightly below the national average of 0.74. Regarding the percentage of elected women of total seats in the state legislative assembly, another indicator of SGD5, in the recent state assembly elections, only about five per cent of those who won the election were women. The figure declined from 9% in the previous election of 2016, and is far below the national target of 50%.

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[9] NITI Aayog, SDG India Index & Dashboard 2020-21.

[10] Ibid.

[11] Tamil Nadu State Planning Commission, Tamil Nadu Human Resource Development Report 2017.

The Adi Dravidar and Tribal Welfare Department (ADTWD) emphasises education to empower women of the ST/Scheduled Caste (SC). The net primary education enrolment ratio of ST girls increased from 82.00 in 2002-2003 to 97.91 in 2010-2011, while the dropout rate in primary education sharply decreased from over 18% in 2002-2003 to 1.28% in 2010-2011, although it was larger than the state average of 0.95%.[12] The literacy rate of ST females has been increasing, but there is still a gap between females in ST and other categorised women, as shown in the table below.

Table 2.6: Gap between ST Females and Other Categorised Women's Groups

Literacy rate (%)	2001			2011		
	Persons	Male	Female	Persons	Male	Female
ST	41.5	50.2	32.8	73.0	80.9	64.6
SC	63.2	73.4	53.0	79.6	86.1	73.2
Tamil Nadu (all)	73.5	82.3	64.6	80.3	86.8	73.9

Source: Census of India in 1991, 2001, and 2011

2.3.6. Gross Domestic Product (GDP)

In the period of 2015 - 2018, the GSDP in 2018 at current prices is INR 1,427,074 crore, growing at a rate of 12.32% (Table 2.7). Figure 2.3 shows the contributions of agriculture, manufacturing, and services to be 13%, 34%, and 53% of the Gross Value Added (GVA) by sector. These sectors have grown by 22%, 10%, and 11%, respectively. This period has witnessed fast growth in agriculture, with an increase of 22%.[13]

Table 2.7: GSDP Trends in Tamil Nadu

GDP/Years	2014	2015	2016	2017	2018
GSDP (in billion)	9,685.30	10,726.78	11,765.00	12,704.90	14,270.74
Growth rate of GSDP (%)	13.30	10.75	9.68	7.99	12.32

Source: Finance of the State Government of Report, 2019
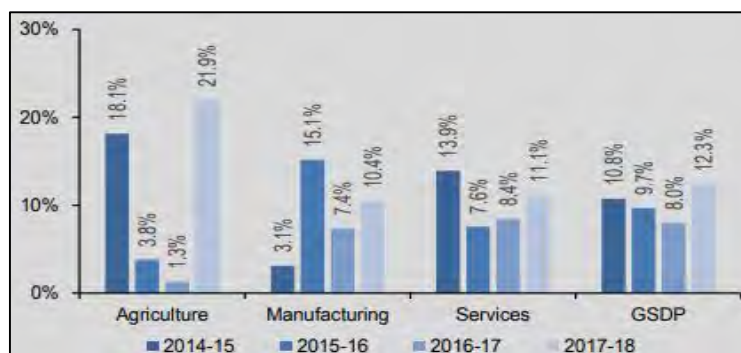
Source: Central Statistics Office, MOSPI

Figure 2.3: Growth in GSDP by Sector

Tamil Nadu's Vision 2023 projects the sectorial composition of output to undergo some drastic changes — the share of the primary sector will decline from 12.0% to 7.0%, while the share of services will go up from 57.0% to 63.0%, and the share of manufacturing from 20.0% to 22.0% between 2004 and 2023. In order to achieve this share of GSDP, the overall growth of the economy is expected to grow at 10.90% per annum during the decadal period of 2012 to 2023. An annual growth rate is predicted of 5.10% for the primary sector, 13.80% for manufacturing, 9.50% for non-manufacturing, and 11.10% for services.[14]

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[12] Ibid.

[13] https://prsindia.org/ (accessed in June, 2021).

[14] The state income report of the government of Tamil Nadu, 2014.

Table 2.8: Share and Growth Target of GSDP, Vision 2023

Sector	2005 (%)	2011 (%)	2023 (%)	Projected Average Growth (%)
Primary	12.00	12.00	7.00	5.10
Manufacturing	20.00	16.60	22.00	13.80
Non-manufacturing*	11.00	9.20	8.00	9.50
Services	57.00	61.60	63.00	11.10
Total	100.00	100.00	100.00	10.90

Source: Vision 2023, Government of Tamil Nadu

Although the share and growth rate of the primary sector (which includes agriculture, forestry, and fishing) is likely to decline in the future, while the industrial sector goes up, the importance of the primary sector cannot be overstated. This sector plays an instrumental role in the growth process, i.e. its part in serving the end of development by assisting in the growth of other sectors, in particular, manufacturing, which are viewed as the locomotives for economic development. Thus, growth in the primary sector, including in forestry and agriculture, encourages growth elsewhere.

2.4. Natural Conditions of the State of Tamil Nadu

2.4.1. Meteorology and Hydrological Condition

(1) Temperature

The climate of Tamil Nadu is basically tropical. Due to its proximity to the sea, the summer is less hot and winter is less cold. In general, the maximum temperature rarely exceeds 43°C and the minimum temperature rarely falls below 18°C. The mean annual temperature is 28.2°C in the plains and 15.2°C in the hills. The minimum temperature in December is 24.7°C, with a maximum in May of 37.3°C. Soil temperature data available for a few places indicate a range from 30.7°C to 32.3°C in the plains and around 14.4°C in the hills. On the basis of temperature, the coastal plain (Aduthurai) is classified as hyperthermic (very hot), while the northern part (Coimbatore) and southern part (Kovilpatti) are iso-hyperthermic (steadily very hot), and the hill area (Udhagamandalam) is iso-mesic (steadily cold).[15]

(2) Rainfall Pattern

The state of Tamil Nadu mainly receives rainfall in three seasons, namely during the southwest monsoon, the northeast monsoon, and the pre-monsoon season. The normal annual rainfall is 958.4 mm. About 50% of the total annual average rainfall is received during the northeast monsoon, while about 31% is received during the southwest monsoon and the balance in other seasons. The coastal districts receive about 65-75% of the annual rainfall and interior districts get about 40-50 % in these three seasons. The hilly regions in the west and hilly/plain lands in northwestern part of the region receive a major share from the southwest monsoon.

Figure 2.4 shows the time series of annual rainfall in millimetres for the months of June, July, August, September, and the southwest monsoon season, respectively. In the last 30 years, the highest rainfall on record was in June (127.6 mm) and July (155.1 mm) in the years 1991 and 1989, respectively. In 2015, the highest rainfall in August was 159.5 mm and in September 2004, 207.2 mm. The highest annual rainfall of 1,324 mm fell in 2005 and highest southwest monsoon rainfall was 436.2 mm in 1996.[16]

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[15] Tamil Nadu State Action Plan for Climate Change, 2014.

[16] The report on Observed Rainfall Variability and Changes over Tamil Nadu State, 2018.

Source: https://imdpune.gov.in/hydrology
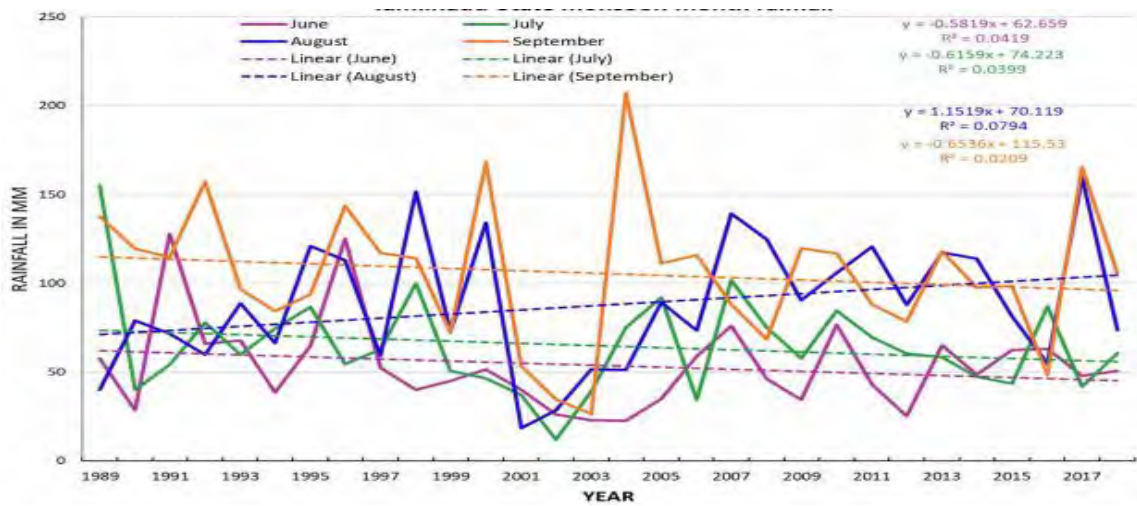
Figure 2.4: Monsoon Month Rainfall

(3)   Hydrogeology

Tamil Nadu forms a part of the peninsular shield and is composed of geologically ancient rock of diverse origins (i.e., different soils). About three to four areas of the state of Tamil Nadu are composed of unclassified crystalline rocks of the Archean eon and the rest is sedimentary rock. The state of Tamil Nadu can broadly be divided into three major physiographic divisions and ten land forms. The climate is semi-arid in the plains and humid to sub-humid in the hills, with an annual rainfall from 750 mm in some parts of the plains to over 2,400 mm in the high hills.[17]

There are a variety of hard and fissured crystalline rocks like charnockite, gneisses, and granites, occupying around 73% of the total area of the state of Tamil Nadu. The depths of open wells and bore wells generally vary from 6 to 30 meters below ground level (MGBL) and from 30-100 MGBL, respectively. Sedimentary formations consist of sandstone, limestone, and shale, whereas quaternary sediments in the state of Tamil Nadu are represented by older alluvium, recent alluvium, and coastal sands. In the Cauvery delta in the district of Thanjavur, the artesian pressure head ranges between 4.5 to 17 MGBL, with free flow up to 270 m^3/hr. Regarding the yield of wells, alluvium varies from 27 to 212 m^3/hr, while the fissured formations vary from seven to 35 m^3/hr.

2.4.2.   Land Use

There are various definitions of land use, which differ depending on the organisation, which use them for different purposes. As per the nine fold classification of land use maintained by the Ministry of Agriculture in India, Table 2.9 presents land use classification of Tamil Nadu as shown below. This table shows that the Net Cropped Area occupies a largest proportion of 35.16% (4.582 million ha), followed by Land Put to Non-Agricultural Use and Forest, with proportions of 19.9% (2.202 million) and 16.55% (2.157 million ha), respectively. Permanent Pastures accounts for the smallest proportion at 0.83 % (0.108 million ha).

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[17] http://tnenvis.nic.in/ (accessed in June 2021)

Table 2.9: Land Use Pattern of Tamil Nadu

No.	Land use	Area (Million ha)	Percentage
1	Forest	2.157	16.55
2	Net Cropped Area (*)	4.582	35.16
3	Area under Misc. Tree Crops	0.226	1.73
4	Permanent Pastures	0.108	0.83
5	Current Fallow	1.047	8.03
6	Other Fallow	1.930	14.81
7	Culturable Waste	0.323	2.48
8	Land Put to Non-Agricultural Use	2.202	16.90
9	Barren and Unculturable Land	0.458	3.51
10	Total Geographical Area	13.033	100.00
11	Cropping Intensity (%)		124

Source: Department of Economics and Statistics, Government of Tamil Nadu, 2019

Over the last few decades, land use patterns in Tamil Nadu have experienced tremendously dynamic changes due to the high rate of urbanisation and industrialisation, which is always associated with ecological changes. In this context, it seems like that there is a greater demand for land for non-agricultural purposes. A quick spatial analysis of the National Remote Sensing Centre's programme presents land use changes for the period of 2005 – 2017 (Table 2.10). Built up area (settlements, industrial, and infrastructure including roads, railways, ports, and canals) shows an increase of 1.2% (from 2.82 % to 4.02 %). At the same time, water body area declined by 1.12% (from 6.4% to 5.28%). The total cropped area declined from 53.69% to 50.72% (a decrease of 2.97%), whereas the net sown area had a smaller reduction of 0.7% (from 34.94% to 34.24%). Fallow area increased by 2.34% (from 20.17% to 22.51%).

Table 2.10: Land Use Change of Tamil Nadu (Bhuvan Portal Analysis)

Land Use	2005	2017
Built Up	2.82%	4.02%
Water (Post-Monsoon)	6.40%	5.28%
Forest Dense	4.75%	4.42%
Forest Moderate	13.00%	12.18%
Forest Open	0.96%	0.89%
Grasslands	0.84%	0.69%
Littoral Swamps	0.09%	0.07%
Agriculture (Kharif)	6.26%	5.37%
Agriculture (Rabi)	9.93%	12.18%
Agriculture (Double or Triple Cropping)	18.75%	16.47%
Agriculture (Current Fallow)	20.17%	22.51%
Agriculture (Zaid)	0.00%	0.22%
Plantations	7.74%	7.30%
Wasteland	8.30%	8.39%
Total	**100.00%**	**100.00%**

Source: National Remote Sensing Centre programme (Bhuvan Portal Analysis)

Nowadays in Tamil Nadu, soil erosion, alkali and salinisation, water logging, pollution, and a reduction in organic matter content are the main drivers leading to the degradation of productive land. In addition, land degradation is also caused by the disposal of domestic and industrial wastes (both solid and liquid) on river systems and water bodies. Above all, the lack of conducive policies is considered a causal factor, which may create inefficient and inequitable land allocation and management, thus leading to land degradation.

The government of Tamil Nadu recognises that a sound land-use policy coupled with a review of the fiscal and non-fiscal incentives that are creating unintentional impacts is critical for effective land

management and the environmental health of the state.[18]

2.4.3. Land Resources

(1) Mines and Quarries

Tamil Nadu is one of the leading states in mineral resources, particularly in lignite, garnet, magnesite, quartz, feldspar, clay, limestone, bauxite, graphite, and granite. As per the Indian Minerals Yearbook 2012, the state of Tamil Nadu accounts for 81% of the country's volume of lignite, 75% of vermiculite, 69% of dunite, 59% of garnet, 52% of molybdenum, and 30% of titanium. The districts of Salem and Namakkal have rich reserves of platinum, molybdenum and gold, while granite is found in the districts of Dharmapuri, Erode, Kanchipuram, Madurai, Salem, Tiruvannamalai, Tiruchirappalli, Tirunelveli, Vellore, and Viluppuram. The urbanisation as well as the growth of cities require ever larger amounts of construction materials. Consequently, sand and stone are extracted in many places in the state of Tamil Nadu. In particular, sand mining is being done in the riverbeds of Tamiraparani, Nambiyar, Vaigai, Cauvery, Kollidam and Palar.

(2) Environmental Regulations on Mining

In Tamil Nadu, along with agriculture and power generation, mining plays an important role in state economic development. However, to avoid severe environmental implications from the exploitation and extraction of mineral resources (whether by open-cast or underground methods), proper planning and management strategies are required. The state government regulates mining and quarrying operations in such a way that they lead to the least environmental damage. In line with the government of India's direction, District Level Environment Impact Assessment Authorities and District Level Expert Appraisal Committees are being constituted to accord Environmental Clearance for mining and quarrying projects. To mitigate any impact due to the mining activities, strategies and actions[19] are regulated as below:

- Comprehensive Environmental Impact Assessment studies to be the basis for allocating mining and quarrying activities;
- Effective Implementation of all regulations for mining and quarrying;
- Implementation of an appropriate Environmental Management Plan for the restoration of affected areas;
- Recycling of construction debris and promotion of alternative construction materials to avoid pressure on natural resources mainly river sand.

2.4.4. Soil Types

The predominant soils of Tamil Nadu are red loam, laterite, and black, alluvial, and saline soils. The distribution of soil types have their own characteristics, of which red loam occupies a large area of the state of Tamil Nadu, particularly in interior districts, while alluvial soil is found in coastal and deltaic areas and saline soil in areas of poor drainage and high evaporation (Table 2.11).

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[18] Tamil Nadu State Environment Policy, 2017.
[19] Tamil Nadu State Environment Policy, 2017.

Table 2.11: Soil Type Distribution by Districts and Agro-climatic Zone

Zone	Districts	Soil Type
North Eastern Zone	Kancheepuram, Tiruvallur, Cuddalore, Vellore, Viluppuram, and Tiruvannamalai	Red sandy loam, clay loam, saline coastal alluvium
North Western Zone	Dharmapuri, Krishnagiri, Salem, and Namakkal (Part)	Non-calcareous red, non-calcareous brown, calcareous black
Western Zone	Erode, Coimbatore, Tiruppur, Theni, Karur (part), Namakkal (part), Dindigul, Perambalur, and part of Ariyalur	Red loam, black
Cauvery delta	Thanjavur, Nagapattinam, Tiruvarur, Trichy, and parts of Karur, Ariyalur, Pudukkottai, and Cuddalore	Red loam, alluvium
Southern Zone	Madurai, Sivaganga, Ramanathapuram, Virudhunagar, Tirunelveli, and Thoothukudi	Coastal alluvium, black, red sandy soil, deep red soil
High rainfall	Kanyakumari	Saline coastal alluvium, deep red loam
Hilly	Nilgiris and Kodaikanal (Dindigul)	Lateritic

Source: Website of Department of Horticulture and Plantation crops (http://tnhorticulture.tn.gov.in/)

The soil texture in Tamil Nadu has a wide range from sand to clay, consisting of 18% sandy surface, 53% loam, and 22% clay. Characteristic of soil drainage that does not seriously impact crop production, Tamil Nadu has poorly- to imperfectly-drained soils (14%), moderately- to well-drained soils (64%), and TGA excessively-drained soils (15%). It has been noted that soil calcareousness affects 34% of the area in the state of Tamil Nadu. Regarding the classification of land capability, most of the land in the state is suitable for cultivation, of which good land (class II) covers about 34%, moderately good land (class III) covers about 30%, and fairly good land (class IV) covers about 15% of the area of the state of Tamil Nadu. Land that is not suitable for cultivations makes up 21% of total area.[20]

As with other parts of India, soil resources in Tamil Nadu are facing a degradation problem due to various causes. Firstly, erosion is the main reason leading to the depletion of fertility through the removal of the soil surface. There are around 1.3 million ha of land affected by soil erosion in the state of Tamil Nadu. Figure 2.5 shows that severely eroded areas are mostly distributed in districts including Salem, Erode, and Dharmapun, whereas the erosion intensity in districts including Tiruvannamalai, Thanjavur, and Virudhunagar, is classified at none to slight and moderate level. The next cause is salinity, particularly in coastal areas. Salinisation is a serious problem for crop cultivation and the ecological restoration of degraded wetlands; the estimated extent of the saline area is about 0.248 million ha. Furthermore, soil degradation is also caused by the excessive use of chemical fertilisers, destroying the soil's biological activity and building up toxicity. The organic matter content in the soil in the state of Tamil Nadu declined from 1.20% in 1971 to 0.68% in 2002.[21]

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[20] http://tnenvis.nic.in/ (Accessed in June 2021).
[21] http://tnenvis.nic.in/ (Accessed in June 2021).
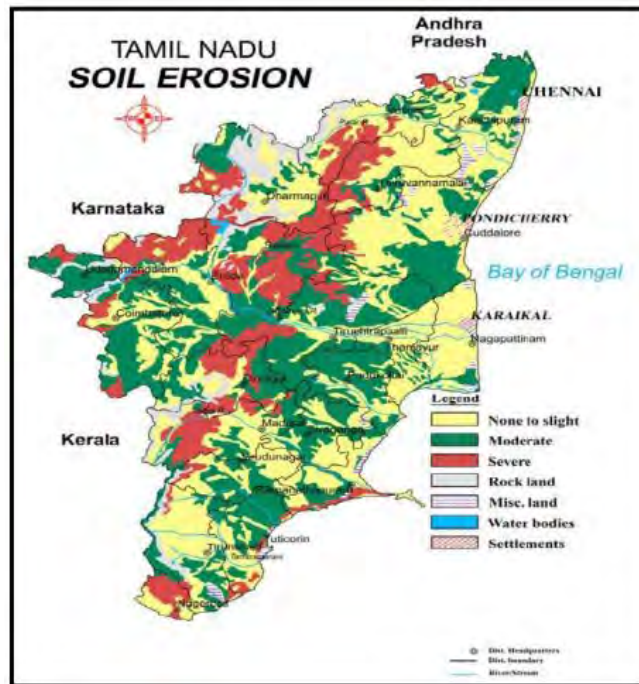
Source: NBSS & LUP, 1997

Figure 2.5: Tamil Nadu Soil Erosion

2.4.5. Drainage and the Catchments

'Drainage system' refers to the well-defined channels of a river system in an area. Tamil Nadu has various river systems, forming the drainage system of the state of Tamil Nadu. Most rivers flow from the east and merge in the Bay of Bengal. Some major rivers and how they flow through the state of Tamil Nadu are described below.

Bhavani River originates in a valley located in the Palghat range in the neighbouring state of Kerala. After the Siruvani River flows into it, the Bhavani River flows into the district of Coimbatore, where it gets reinforced by the Kundah River before entering the district of Erode. The river feeds the Bhavanisagar reservoir, taking an easterly course flowing through Gopichettipalaiyam, Sathyamangalam, and Bhavani taluks.

Kaveri River (also spelt Cauvery) is among the most sacred rivers. It is known as 'the Dakshina Ganga' or the 'Ganges of the South'. The river has a length of 760 km and its main tributaries are the Bhavani, Noyil, Amaravati, and Kollidam.

Noyil River is a tributary of the Kaveri. Its natural characteristics are very unpredictable. The flow of the river often leads to flooding, as it is fed by the northeast monsoon, which brings a high amount of rainfall. However, as with being fed by the southwest monsoon, the river helps to irrigate considerable areas in Palladam taluk in the district of Coimbatore and Dharapuram taluk in Erode.

Palar River originates in the Eastern Ghats near Coimbatore, flowing through the districts of Vellore and Changelpattu and terminating in the Bay of Bengal near Caturangapattinam. The river is facing serious polluted conditions due to the activities of tanneries on the banks. Currently, water from the river is not potable and agriculture cannot be conducted as before, with many acres of fertile land having become wasteland, unusable for cultivation.

There are 17 major river basins in Tamil Nadu. For hydrological studies and water resource planning purposes, they are further divided into 34 river basins, listed in Table 2.12.

Table 2.12: River Basin Group and River Basins in Tamil Nadu

No.	River Basin Group	River Basins	Area (km^2)
1	Chennai Basin Group	1. Araniyar 2. Kusaithalaiyar 3. Cooum 4. Adayar	5,542
2	Palar	5. Palar	10,911
3	Varahanadhi	6. Ongur 7. Varahanadhi	4,214
4	Ponnaiyar	8. Malattar 9. Ponnaiyar 10. Gadilam	11,257
5	Vellar	11. Vellar	7,659
6	Paravanar	N/A	760
7	Cauvery	12. Cauvery	43,867
8	Agniyar	13. Agniyar 14. Ambuliyar 15. Vellar	4,566
9	Pambar and Kottakaraiyar	16. Koluvanar 17. Pambar 18. Manimuthar 19. Kottakaraiyar	5,847
10	Vaigai	20. Vaigai	7,031
11	Gundar	21. Uthirakosamangaiyar 22. Gundar 23. Vembar	5,647
12	Vaippar	24. Vaippar	5,423
13	Kallar	25. Kallar 26. Korampallam Aru	1,879
14	Tamiraparani	27. Tamiraparani	5,969
15	Nambiyar	28. Karmaniar 29. Nambiyar 30. Hanumanadhi	2,084
16	Kodaiyar	31. Palayar 32. Valliyar 33. Kodaiyar	1,533
17	PAP	34. West flowing river	3,462

Source: The report on Performance of Agriculture in River Basins of Tamil Nadu, NITI Aayog

The classifications of the 17 river basins of Tamil Nadu are as follows: one major river basin, 13 medium river basins, and three minor river basins. As per Figure 2.6, the Cauvery basin is located in the centre position and occupies the largest area in Tamil Nadu with 43,86 km^2, consisting of the districts of Nilgiris, Salem, Erode, Coimbatore, Namakkal, Dindigul, Karug, Thanjavur, Thiruvarur, and Tiruchirappalli. Kodaiyar basin is the smallest, at 1,533 km^2, which belongs to the district of Tirunelveli.

Source: National Institution for Transforming India (NITI Aayog)

Figure 2.6: River Basin of Tamil Nadu

A series of droughts and water shortages occurred recently in Tamil Nadu, showing the importance

of water resources. Agriculture is the sector most affected by water scarcity. This sector is estimated to consume around 75% of the state's water resources.[22] Moreover, demand for water is increasing from industry and domestic sectors, creating ever tougher competition for surface water. In this context, it is necessary for the government to strengthen and integrate institutional structures which can help farmers access irrigation management and improved agriculture practices.

2.4.6. Natural Disasters and Disaster Management

Out of 35 states and union territories (UTs) in India, Tamil Nadu is one of the states that has suffered the most from multi-hazards. The frequency of disaster in the state of Tamil Nadu is higher than others that have a variety of nature and different intensities. In coastal areas, communities face threats from tsunami, which may strike the southern coast of India any time. For plains and hilly regions, landslides, earthquakes, and floods are disasters. In urban areas, flooding is becoming the most concerning problem.

(1) Cyclones

All of the 13 coastal districts in Tamil Nadu are highly vulnerable to cyclones at high/very high impact, including flooding. The Rameswaram cyclone, Cyclone Nisha, Cyclone Thane, Cyclone Nilam, and Cyclone Vardah are regarded as the most powerful storms on record to have hit India, causing severe destruction. In particular, a cyclone in 2015 brought the highest amount of rainfall recorded in a century, with Chennai and neighboring districts suffering from devastation and deluge.

(2) Heavy Rainfall and Flooding

High rainfall in Tamil Nadu is mostly caused by cyclones during the northeast monsoon period from October to December. In addition, the state of Tamil Nadu also gets rainfall as a result of the formation of low pressure/depressions in the Bay of Bengal. In these events, the low pressure/depressions that form last for at least three to four days and bring intense rains to vulnerable areas. Regarding flooding, cyclones and heavy rains are considered the main reason for such disasters. However, the coastline of Tamil Nadu also suffers from flooding at depression time. As an example from the period of 1997-2005, even without cyclonic storms, heavy rainfall caused severe floods in most of the coastal areas and affected the districts of Chennai, Kancheepuram, Tiruvallur, Cuddalore, Thanjavur, Nagapattinam, Thiruvarur, Pudukkottai, and Tiruchirappalli. According to the Tamil Nadu State Disaster Management Authority (TNSDMA), in the past several years it is estimated that about 5,000 houses have been damaged annually due to rains, storm surges, and local flooding.

(3) Drought

In Tamil Nadu, drought has a direct and significant impact on food production and the overall economy. The most severe droughts were recorded in the years of 1980, 1982, 1983, 1987, and 1989, with the one in 1987 particularly crippling the state's economy. This kind of natural disaster occurs annually at different intensities in areas with low rainfall, together with the erratic behaviour of the monsoon during June and September. Scientists believe that rainfall aberrations, ground water level, reservoir level, crop conditions, and soil type have a close link to the severity and extent of drought. This is to explain why the districts in sandy soil regions of the southeast of the state of Tamil Nadu often suffer from chronic droughts. The top eight most-affected districts are Dharmapuri, Madurai, Coimbatore, Ramanathapuram, Salem, Tiruchirappalli, Tirunelveli, and Kanyakumari.

(4) Landslides

The Nilgiris Hill Range is recorded as the area in which landslides most frequently occur, particularly in the rainy season. Major landslides are the Runnymede landslide, the Glenmore landslide, the Coonoor landslide, the Karadipallam landslide, and the Marapalam landslide. Other districts in the state of Tamil Nadu that have also been affected by landslides are Salem, Erode, Coimbatore, Vellore and Dindigul (Kodaikanal hills). Debris flows, mudslides, and debris avalanches are common types of fast-moving landslides, which often lead to the disruption of traffic.

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[22] https://documents.worldbank.org/en/publication/documents-reports (accessed in June, 2021).

(5)   Tsunami

In 2004, a tsunami struck the 7,516 km long coastline of India. A stretch of more than 4,500 km was badly affected by the 9.0 magnitude earthquake-triggered tsunami, resulting in the total destruction of the living environment along the coast. The worst affected areas along the Indian coast were in the states of Tamil Nadu, Kerala, and Andhra Pradesh.[23] Tamil Nadu suffered maximum loss, with the damage concentrated in four districts. These giant waves took 7,993 lives and caused the destruction of about 123,105 houses, mostly in Nagapattinam, Chennai, Cuddalore, Velankanni, and Poompuhar. After this disaster, the Indian National Centre for Ocean Information Services (INCOIS) was formed to provide round-the-clock monitoring and warning services for the coastal population on tsunamis, storm surges, and high waves through the in-house Indian Tsunami Early Warning Centre (ITEWC). The ITEWC is also designated as the Regional Tsunami Service Provider (RTSP) to provide tsunami warnings to countries on the Indian Ocean Rim by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO).[24]

(6)   Disaster Management

The government of Tamil Nadu constituted the TNSDMA in line with Section 14 (2) of the Disaster Management Act, 2005, {Central Act, 53 of 2005}. The chief minister is the chairperson of this authority. The TNSDMA has a mandate to coordinate the response to disasters and to risk reduction, particularly in the supervision of measures for mitigation, preparedness, response, and recovery. In addition, the TNSDMA also approves the State Disaster Management Plan and District Disaster Management Plans in accordance with the guidelines laid down by the National Disaster Management Authority.

In the policy published in 2014, a new model for disaster management was developed by the state government. This model shows a continuous process to respond to disaster, of which the activities are managed at the same time rather than in a sequence, as with the traditional method (Figure 2.7).
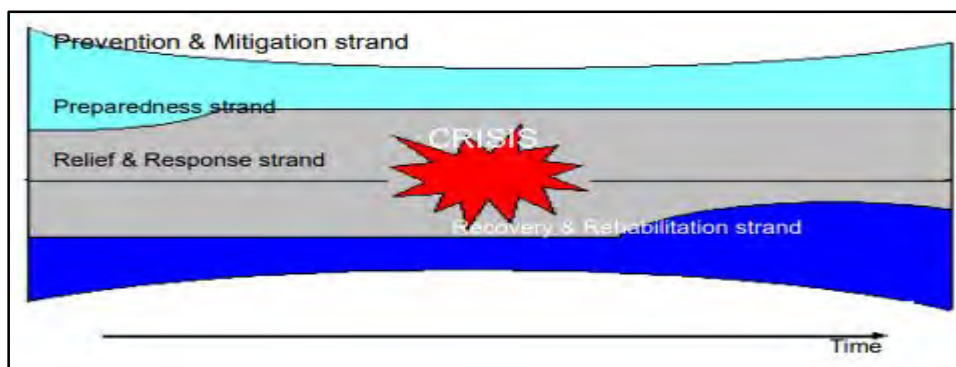
Source: Tamil Nadu State Disaster Management Authority (TNSDMA)

Figure 2.7: Disaster Management Model

Disaster management activities are divided into three phases, consisting of the pre-disaster phase (Phase 1), impact phase (Phase 2), and post-disaster phase (Phase 3). Phase 1 includes activities related to prevention, mitigation, and preparedness to face these disasters. Phase 2 takes place immediately after the disaster has actually happened. Saving human life, treating the injured, and preventing further injury and other forms of loss are priority activities in this phase. The aim of Phase 3 is to restore the affected areas to their previous normal status. Efforts in this phase involve activities such as rebuilding destroyed property, re-employment, and the repair of other essential infrastructure, as well as the re-opening of essential services at the hospital. It permits the re-allocation of all resources to longer-term recovery activities. It may extend over years, depending upon the nature and

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[23] Vasudha A. Gokhale, 2005. "Analytical Study of Living Environment in the Tsunami-Affected Areas of Tamil Nadu, India". *ISET Journal of Earthquake Technology*, Volume 42, No. 4, pp. 219-225.

[24] https://tnsdma.tn.gov.in/ (Accessed in June, 2021).

magnitude of the disaster.

2.5.   Development Plans, Programmes, and Projects in the State of Tamil Nadu

2.5.1.   State and Regional Development Plans

(1)   Sustainable Development Goals: 2030 Agenda

In the United Nations General Assembly in September 2015, 193 countries adopted the Agenda for Transforming the World by 2030. SDGs are a comprehensive and ambitious development agenda for the world collectively. There are 17 goals, 169 targets, and 300 global indicators that constitute the SDGs.

India took a leading role in implementing the agenda, replacing five-year plans with a 15-year vision, and preparing the first SDG India Index in 2018 with a set of 62 indicators covering 39 targets and 13 goals, in order to formulate the framework to monitor and evaluate the progress in each state and Union Territory. The third version of SDG India Index was prepared in 2021, with a set of 115 indicators covering 60 targets and 16 goals.

Index 3.0 has the following objectives:

- To rank the states/UTs based on their performance across the 17 SDGs.
- To promote healthy competition among the states/UTs towards achieving the Global Goals.
- To support the states/UTs in identifying priority areas which demand more attention.
- To enable the states/UTs to learn from the good practices of their peers.
- To highlight data gaps in the statistical system of the states/UTs and identify the sectors in which robust and more frequent data needs to be collected.

In Tamil Nadu, the state government took the initiative in establishing an implementing mechanism in the following ways, to achieve the SDGs and become a model state in India.

- By establishing a High Power Committee under the chairmanship of the chief secretary to government to oversee the implementation of SDGs.
- By formulating eight thematic Working Groups to review and monitor the achievement of goals and targets. The implementation is co-ordinated by the Planning & Development Department and State Planning Commission. In total, 388 indicators, including state-specific ones, have been identified by the Working Groups and various departments concerned so that the state's priorities are covered.
- By formulating SDG Units at each department to monitor and track the progress of SDGs and to provide data and inputs to State Planning Commission
- By formulating SDG Units at the district level, to make it possible for the state to evaluate the progress of SDGs at the district level and to rank the districts within the state of Tamil Nadu (the District Indicator Framework and Block Indicator Framework are being finalised.[25])
- By planning to localise SDGs at the panchayat level

A SDG Dashboard has been developed by the Tamil Nadu e-Governance Agency (TNeGA) in order to support tracking, monitoring, and visualizing the performance of the goals.

The SDG India Index 3.0 score for Tamil Nadu is 74, improving from the score of 67 in Index 2.0, and taking the second position among states, following Kerala. The performance of SDG1 (No Poverty), SDG6 (Clean Water and Sanitation), and SDG7 (Affordable and Clean Energy) are highly evaluated, but it is necessary to improve the performance on SDG5 (Gender Equality), SDG13

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[25] Planning, Development and Special Initiatives Department, Policy Note, 2020-2021.

(Climate Action), and SDG14 (Life Below Water).

(2)   Vision 2023

Vision 2023, a strategic plan for infrastructure development in Tamil Nadu, was formulated in 2012 with the support of the Asian Development Bank (ADB), aiming to make the state India's most prosperous and progressive state by 2023 with the status of a poverty-free state.

Vision 2023 includes 217 infrastructure projects in six major sectors — energy, transport, industrial and commercial infrastructure, urban infrastructure and services, agriculture, and human development.

2.5.2.   Tribal Sub-Plan

The Tribal Sub-Plan (TSP) was introduced in the country in 1974 to accelerate development in tribal areas and has been implemented in Tamil Nadu since the year 1976-77. The following six groups out of 36 — Toda, Kota, Kurumbas, Irular, Paniyan, and Kattunayakan — are designated as 'Particularly Vulnerable Tribal Groups (PVTG)'. There are 10 ITDP (Integrated Tribal Development Programme) tribal pockets in seven districts.

Table 2.13: Location of ITDP Pockets

Sl.No	Districts	ITDP Areas
1	Namakkal	(1) Kolli Hills
2	Salem	(2) Yercaud Hills
		(3) Kalrayan Hills
		(4) Aranuthumalai
		(5) Pachamalai
3	Tiruvannamalai	(6) Jawadhu Hills
4	Viluppuram	(7) Kalrayan Hills
5	Dharmapuri	(8) Sitheri Hills
6	Tiruchirappalli	(9) Pachamalai
7	Vellore	(10) Jawadhu & Yelagiri Hills

Source: Government of Tamil Nadu, Tribal Sub Plan 2015-16

The basic objective of this Tribal Sub-Plan is to ensure flow of funds from the State Annual Plan in proportion to the ST population in the state of Tamil Nadu, under the guideline of the Union Planning Commission. According to the policy note of the ADTWD, for the year 2019-2020, a sum of INR 12.7784 billion (2.25%) has been allocated under the Tribal Sub-Plan. In addition, Scheduled Castes Sub-Plan and Tribal Sub-Plan funds should be non-divertible. The ADTWD is the organisation responsible for formulating and implementing the Tribal Sub-Plan at the state level, and the schemes under Tribal Sub-Plan are implemented through 17 Sectoral Departments comprising 43 Heads of Departments for the Welfare and Development of the Tribes.

2.5.3.   Poverty Alleviation and Livelihood Improvement Programme

(1)   State Balanced Growth Fund

The State Balanced Growth Fund is a scheme introduced in 2012-13 with the primary objective of reducing regional disparities in key measurable socio-economic development indicators and improving 'Human Development Status'. It also seeks to create capacity in districts to monitor the Human Development Status at the district and sub-district level in order to achieve inclusive economic growth.

Regional imbalances in terms of per capita income, employment, poverty, health, education and gender issues were considered for assessing backwardness. Under this scheme:

- 105 blocks in rural areas, which are backward within these parameters, are covered.
- In urban areas, town panchayats which fall under the selected 'Backward Blocks' and those with high population density are covered.
- In municipalities and corporations, one-fourth of wards with predominant slum populations are covered.

Detailed guidelines were provided to the districts for the preparation of perspective plans for the Backward Blocks. The district collectors identify projects to address specific backwardness of the identified Backward Blocks. In order to address common issues in blocks across districts, departments have been involved in the identification of schemes. The State Level Empowered Committee is responsible for the selection and approval of the projects.

In order to address the backwardness of hilly/forest areas, 55 projects in the tribal areas were approved to provide road connectivity, basic amenities, educational infrastructure, the value addition of non-timber forest products and agricultural products, the improvement of girls education, promotion of co-curricular activities in tribal schools, hostel facilities for girls, among other things, from 2017-18 to the end of January 2020.

(2) Tamil Nadu Innovation Initiatives (TANII)

Under the initiative of the then Hon'ble Chief Minister, the Tamil Nadu Innovation Initiatives (TANII) have been established in the State Planning Commission as a follow-up on an important theme of the Vision Tamil Nadu 2023, in order to encourage a culture of innovation in the government and government agencies.

Since the start in the financial year 2015-2016, 320 projects have been approved under TANII up to 2019-2020. Thus far, 30 departments have received funding under TANII. The TNFD has been awarded about 40 projects in various areas, including the schemes of 'augmenting drinking water supply to wildlife through motors energized by solar power', 'women empowerment through conservation of medicinal plants', and 'surveillance of forest and wildlife areas through drone technology'.

(3) Special Area Development Programme

The Special Area Development Programme (SADP) has been implemented in Tamil Nadu by the state government since 2015-16 as an immediate follow up after the government of India ended its financial support for the HADP (Hill Area Development Programme) and the WGDP (Western Ghats Development Programme).

SADP now covers ten districts. Under Unit-I, the scope and functioning of the present project director, HADP (i.e. SADP) has been expanded to cover four districts, namely Nilgiris, Coimbatore, Tiruppur, and Erode. Under Unit-II, the Land Use Division at the State Planning Commission takes care of the implementation of SADP in the remaining six districts, which are Dindigul, Madurai, Theni, Virudhunagar, Tirunelveli, and Kanniyakumari

In the designated area for the Special Area Development Programme, it is targeted at the hill ranges of Tamil Nadu, which are at an absolute altitude of > 600 m ASL from the base and foothills, which do not ordinarily get covered in other programmes.

The main objectives of the programmes are eco-preservation and eco-restoration with a focus on the sustainable use of biodiversity, ensuring community participation in the design and implementation of strategies for conservation of biodiversity and sustainable livelihoods, basic needs and aspirations of local communities, watershed based development on a participatory approach for ensuring efficiency, transparency, and accountability. The SADP also focusses on the buffer zone adjoining the protected forests area, which often suffer from a lack of investment, as they fall neither in the

forests areas nor close to habitations but are critical to soil and water conservation. The scope of the SADP would also cover the interaction between water and production landscapes and human livelihood, water and ecosystem services, and water biodiversity.

2.5.4. Watershed Management Programmes

The Agricultural Engineering Department (AED) under the Agriculture and Farmers Welfare Department is the organisation responsible for soil and water conservation. In addition, the Tamil Nadu Watershed Development Agency (TAWDEVA) was established as an agency to implement 'Watershed Development Projects' with the prime objective of conserving natural resources and developing resources in a sustainable and participatory way to improve the livelihoods of the watershed community, in addition to improving agricultural productivity. TAWDEVA is implementing such central government funded projects as 'Pradhan Mantri Krishi Sinchayee Yojana - Watershed Development' (PMKSY - WD) (the former Integrated Watershed Management programme, or IWMP), the 'Watershed Development Fund' (WDF) assisted by National Bank for Agriculture and Rural Development (NABARD), and 'Climate Proofing of Rainfed Watersheds in Salem and Virudhunagar Districts of Tamil Nadu under the National Adaptation Fund for Climate Change' (NAFCC).

The following watershed management programmes are being implemented in Tamil Nadu.

(1)   River Valley Project (RVP)

The River Valley Project (RVP) is implemented with the objectives of prevention of soil loss, reducing the siltation of multipurpose reservoirs, prevention of land degradation, improvement of the soil moisture regime, and promotion of land use to match land capability in inter-state catchments. In Tamil Nadu, the RVP has been implemented in South Pennaiyar and Mettur catchments under the National Agriculture Development Programme (NADP) from 2013-14 onwards.

The soil and water conservation measures in community lands are taken up with 100% assistance, while the construction of stone wall bunds in farmers' fields are executed with 50% farmers' contributions.

(2)   Dam Rehabilitation and Improvement Project (DRIP)

The Dam Rehabilitation and Improvement Project (DRIP) has been implemented with support from the WB in Tamil Nadu and three other states, Kerala, Madhya Pradesh, and Orissa. In the first phase of the DRIP, 223 large scale dams with substantial need of rehabilitation and improvements are to be included in the project. The catchment area treatments in the Krishnagiri and Kundah Reservoir project areas were entrusted to the Agricultural Engineering Department.

The catchment areas of Vaigai project in Theni District and the Parapalar, Nanganchiar, and Kudaganar Reservoir Projects in the district of Dindigul will be the targets of the second phase projects.

2.5.5. Wetland Management Programmes

Tamil Nadu has a vast network of inland and coastal wetlands. The total wetland area in Tamil Nadu is about 902,524 ha, comprising 6.92% of the geographical area of the state of Tamil Nadu.

Tamil Nadu State Wetland Authority has been constituted and is the nodal agency for conservation and sustainable management of wetlands in the state of Tamil Nadu. It was established according to the Wetland (Conservation and Management) Rules, 2017, and mandated with the task of policy development, implementing regulatory functions, capacity building, research networking, communications, awareness, and raising funds for wetland management.

The following wetland management programmes are being implemented in Tamil Nadu.

(1) Eco-Restoration of Pallikaranai marsh land in Chennai

The Pallikaranai marshland is a unique fresh water swamp located within the Chennai Metropolitan Area and is a major ground water recharging wetland. Restoration activities, such as habitat improvement, protection, research, monitoring, and publicity and awareness at the marshland have been implemented since 2018-2019 under the National Adaptation Fund for Climate Change.

(2) Improved Resilience of Urban Ecosystems through Targeted Restoration of Wetlands

This was proposed by the TNFD and approved by the State Level Steering Committee in Tamil Nadu and the Ministry of Environment, Forest, and Climate Change (MOEFCC).

2.5.6. Central Sponsored Programmes

(1) Twenty Point Programme - 2006

The Twenty Point Programme (TPP) was formulated as a composite poverty alleviation project in 1975 and was restructured in 1982, 1986, and 2006. It is now renamed 'TPP-2006'.

The main objective of the TPP is to eradicate poverty and improve the quality of life of the poor and under-privileged population. The programme's components span specific issues of the reduction in poverty, employment generation, education, housing, health, agriculture, land reforms, irrigation, drinking water, protection, the empowerment of weaker sections, and consumer protection.

The state level Monitoring Committee Meeting on TPP-2006 is periodically held under the chairmanship of the chief secretary to government to review the performance of various schemes implemented by departments and organisations. The quarterly progress reports received from the departments concerned are compiled and sent to the Ministry of Statistics and Programme Implementation (MOSPI).

(2) Transformation of Aspirational Districts

The programme 'Transformation of Aspirational Districts' was introduced by the government of India in 2017 and is managed by NITI Aayog. The government of India has identified 115 Backward Districts as 'Aspirational Districts' based on their position in 11 key parameters in Poverty, Education, Health, Nutrition, and Infrastructure.

The Ministry of Home Affairs selected 35 districts affected by left-wing extremism that are included in the 115 districts. In Tamil Nadu, the districts of Ramanathapuram and Virudhunagar have been identified as Aspirational Districts among the 115 identified districts.

The Aspirational Districts Programme is directly managed by NITI Aayog, interacting with District Collectors, along with Central, State-level 'Prabhari' Officers, who visit the districts and submit reports to NITI Aayog. Each central level ministry is assigned with an Aspirational District to monitor and guide the development activities. In addition, a central level minister is also in charge of certain number of Aspirational Districts to guide and monitor progress.

The core areas of focus are 'Health and Nutrition', 'Education, Agriculture and Water Resources', 'Financial Inclusion and Skill Development', and 'Basic Infrastructure'. In order to assess the performance of these districts, an online monitoring portal for capturing the progress made by the districts on a monthly basis has been established. To measure the progress of the districts, 49 key performance indicators have been chosen.

(3)   Pradhan Mantri Krishi Sinchayee Yojana - Watershed Development (PMKSY - WD) (former the Integrated Watershed Management Programme, IWMP)

PMKSY is implemented by TAWDEVA. Its objective is to achieve a convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation, improve on-farm water use efficiency to reduce wastage of water, enhance the adoption of precision-irrigation and other water saving technologies ('more crop per drop'), enhance the recharging of aquifers, introduce sustainable water conservation practices by exploring the feasibility of reusing treated municipal waste water for peri-urban agriculture, and attract greater private investment in a precision irrigation system.

PMKSY has been formulated, amalgamating ongoing schemes such as the Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development & Ganga Rejuvenation (MOWR, RD & GR), IWMP of the Department of Land Resources (DOLR) and the On Farm Water Management (OFWM) of the Department of Agriculture and Cooperation (DAC). The scheme will be implemented by the Ministry of Agriculture, Ministry of Water Resources, and Ministry of Rural Development.

2.5.7.   Externally Assisted Projects

At present, the following externally-funded projects are being implemented in Tamil Nadu.

Table 2.14: List of Externally Assisted Projects in Tamil Nadu

No.	Project Name	Funding Agency	INR Million
1	Chennai Metro Rail Project Phase I	Japan International Cooperation Agency (JICA)	37,700.0
2	Chennai Metro Rail Project Phase II	JICA ADB Asian Infrastructure Investment Bank (AIIB) New Development Bank (NDB) WB	691,800.0
3	Chennai Peripheral Ring Road Project (Phase 1)	JICA AIIB Organization of the Petroleum Exporting Countries (OPEC) Fund	123,010.0
4	Tamil Nadu Urban Health Care Project	JICA	16,340.0
5	Chennai Kanyakumari Industrial Corridor project	ADB	64,480.0
6	Extension, Renovation and Modernisation (ERM) of Irrigation Infrastructure in the Cauvery Basin	AIIB	USD 230 million
7	Tamil Nadu Urban Flagship Investment Programme (TNUFIP) Tranche 1 Tranche 2	ADB	USD 500 million 169 million 206 million
8	Tamil Nadu Health System Reforms Project	WB	28,570.0

Chapter 3.   Forests and Forest Management

3.1.   Forests of the State

3.1.1.   Forest Types

On the basis of temperature zones, forests in Tamil Nadu are classified into three groups, namely tropical forests, montane subtropical forests, and montane temperate forests. These are divided into nine forest types based on moisture and physiognomic variation, and further divided into 39 sub-types. Table 3.1 shows the nine types of forest by species, distribution, and diversity (*Shannon-Wiener Index*),[26] as well as by proportion.

Table 3.1: Forest Type by Species, Diversity, Distribution, and Proportion

No.	Forest Type (Sub-groups)	Species	Shannon-Wiener Index			Distribution	Proportion (%)
			Tree	Shrub	Herb		
1	Tropical wet evergreen	*Hopea parviflora, Artocarpus hirsutus, Syzygium cumini, Cinnamomum zeylanicum.*	3.25	3.23	2.03	Western Ghats of Tirunelveli, Kanyakumari, The districts of Nilgiris and Coimbatore on the upper slopes and top hills and sometimes on steep slopes lower down	2.57
2	Tropical semi evergreen	*Artocarpus hirsutus, Hopea parviflora, Lagerstroemia lanceolata, Terminalia paniculata*	2.77	2.82	2.30	Hills up to 1,000 m in the districts of Tirunelveli and Kanyakumari between western tropical evergreen and the moist deciduous type, with a mixture of occasional evergreen and abundant moist deciduous tree species.	2.73
3	Tropical moist deciduous	*Bamboos are common. Bombax ceiba, Dillenia pentagyna, Mitragyna parviflora and Terminalia spp., are the common trees*	3.39	3.27	2.31	Lying below the zone of semi-evergreen and evergreen forests	7.47
4	Littoral and swamp	*Rhizophora mucronata, R. apiculata, Avicennia officinalis, A. marina,*	Not found.	1.04	1.43	Coastal areas in the river deltas along the edges of the delta streams, tails of islands, and over sea faces where	2.40

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[26]The Shannon-Wiener index of diversity (information index) developed by Claude E. Shannon and Norbert Wiener and published in 1949. Generally, the index is used to describe the disorder and uncertainty of individual species. The higher the uncertainty, the higher the diversity.

No.	Forest Type (Sub-groups)	Species	Shannon-Wiener Index			Distribution	Proportion (%)
			Tree	Shrub	Herb		
		Clerodendrum inerme, Acanthus ilicifolius, etc. Stilt roots are very typical notably in *Rhizophora spp*				accretion is in progress	
5	Tropical dry deciduous	*Albizia amara, Anogeissus latifolia, Butea monosperma, and* Terminalia	3.92	3.91	2.26	400 m and above	41.47
6	Tropical thorn	*Acacia ferruginea, Acacia leucophloea, Albizia amara,* and *Azadirachta indica*	3.09	3.10	1.85	From plains up to 400 m	13.54
7	Tropical dry evergreen	*Manilkara hexandra, Albizia amara, Memecylon umbellatum, Atlantia monophylla*, and *Phoenix sylvestris*	2.81	2.82	1.77	GNP, Hosur, Tirupattur, Vellore, Sivaganga, Point Calimere, Tiruvannamalai, Chengalpet, Vellore	1.41
8	Sub-Tropical Broad-leaved hill	*Cedrela toona, Atrocarpus lakoocha, A. hirsuta, A. heterophyllus*, and *Mangifera indica.*	2.94	3.20	0.62	In Eastern Ghats, the upper slopes and plateau of Shevaroy, Kollimalai, and Pachamalai	0.69
9	Montane wet temperate	*Ilex denticulate, I. wightiana, Michelia nilagirica, and Syzygium*	2.18	2.68	2.36	Moist and sheltered valleys, glens, and hollows as in the Anamalais, Nilgiris, and Palanis above 1000 m	1.42
10	Plantation/Trees outside Forests (TOF)	N/a	N/a	N/a	N/a	N/a	28.40

Source: Indian State of Forest Report ISFR, 2019.

Tamil Nadu is on the top list of states that have a large number of forest types, high tree species richness, and shrub species richness, particularly in tropical wet evergreen and semi-evergreen forests in the Western Ghats, along with Kerala and Karnataka. Located in the Western Ghats Mountain system, the Nilgiri Biosphere Reserve has a unique ecosystem. Among others, it is one of the biodiversity hotspots in India, but it is currently under threaten of degradation.

Table 3.1 shows the result of a forest biodiversity assessment in Tamil Nadu carried out by the Forest Survey of India (FSI) in 2019. The number species of trees, shrubs, and herbs are 252, 313, and 87, respectively. Regarding diversity, the Shannon-Wiener Index of tree tropical dry deciduous forests has the highest diversity, with the index of trees, shrubs, and herbs being 3.92, 3.91, 2.26, respectively. In contrast, the diversity of the littoral and swamp forests is the lowest, with the index of shrubs and herbs being 1.01 and 1.43, respectively. (*There were no findings of a tree index for the group of*

littoral and swamp forests).

3.1.2. Forest Cover in the State

The results of forest interpretation, using Indian Remote Sensing (IRS) Resource Sat-2 Linear Imaging and Self Scanning Sensor (LISS) III satellite data captured during October 2017 - August 2018, show that forest cover in the state is 26,364.02 km^2, occupying 20.27% of the state's geographical area. Regarding forest canopy density classes, Very Dense Forest (VDF), Moderately Dense Forest (MDF), and Open Forest (OF) are 3,605.49 km^2, 11,029.55 km^2, and 11,728.98 km^2 respectively. Figure 3.1 represents the forest distribution of the state of Tamil Nadu.
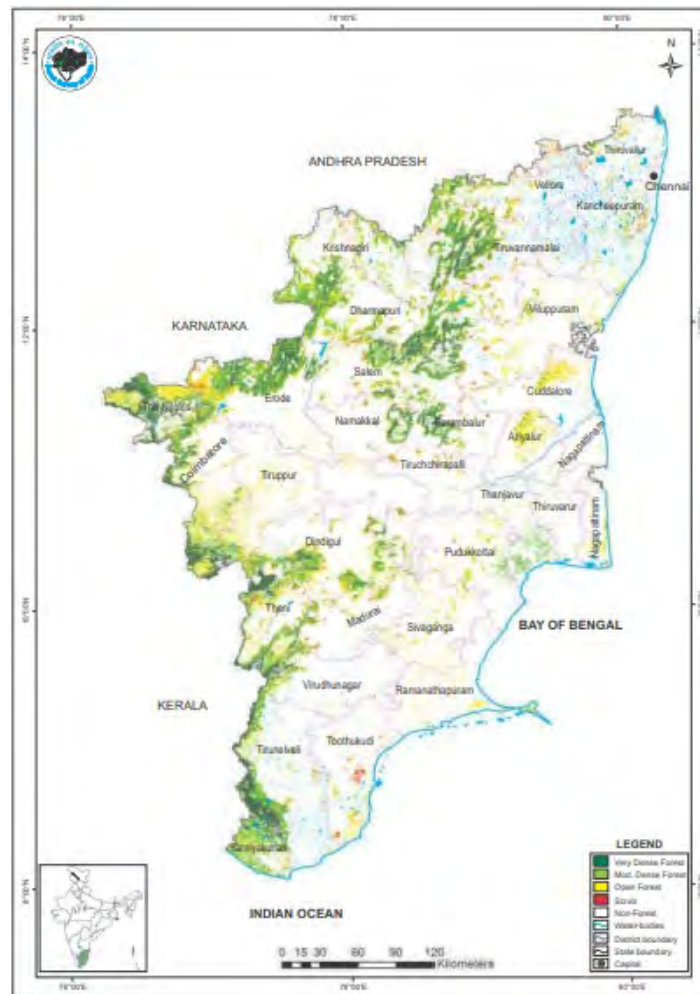
Source: Indian State of Forest Report ISFR, 2019

Figure 3.1: Forest Cover Map of Tamil Nadu 2019

(1) District-wise Forest Cover in Tamil Nadu

According to the India State of Forest Report (ISFR) 2019 (Table 3.2), forest cover is different depending on the state district. Kancheepuram, Coimbatore, Dindigul, Vellore, and Nilgiris Hills are the top five districts in the state of Tamil Nadu, of which Kancheepuram has the largest area at 1,984.64 km^2. In terms of forest cover as a percentage of total geographical area (GA), Coimbatore has the highest rate, at 41.94%. From the bottom up, Chennai, Karur, Nagapattinam, Perambalur, and Thiruvarur are the five districts with the lowest forest cover. These districts also have a very low forest cover percentage of GA, at less than 10%, particularly Thiruvarur at 2.97%. Different forest types are described at the Table 3.2 as below.

Table 3.2: District-wise Forest Cover in Tamil Nadu

District	Area (GA)	2019 Assessment				% of GA
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total	
Ariyalur	1,940	0.00	40.45	352.69	393.14	20.26
Chennai	175	0.00	6.34	6.50	12.84	7.34
Coimbatore	4,732	360.80	680.01	943.83	1,984.64	41.94
Cuddalore	3,703	0.00	47.86	343.10	390.96	10.56
Dharmapuri	4,497	261.85	835.79	603.50	1,701.14	37.83
Dindigul	6,036	253.19	779.85	841.36	1,874.40	31.05
Erode	5,760	402.17	1,128.56	763.73	2,294.46	39.83
Kancheepuram	4,483	0.00	69.95	237.83	307.78	6.87
Kanniyakumari	1,684	137.18	572.65	293.71	1,003.54	59.59
Karur	2,904	2.24	43.01	73.21	118.46	4.08
Krishnagiri	5,129	94.87	827.67	694.87	1,617.41	31.53
Madurai	3,710	39.51	232.20	283.41	555.12	14.96
Nagapattinam	2,569	0.00	23.53	135.66	159.19	6.20
Namakkal	3,420	83.75	283.58	211.72	579.05	16.93
Perambalur	1,756	10.03	64.81	66.42	141.26	8.04
Pudukkottai	4,644	0.91	96.04	267.84	364.79	7.86
Ramanathapuram	4,104	0.00	23.84	233.11	256.95	6.26
Salem	5,237	198.62	756.76	514.46	1,469.84	28.07
Sivaganga	4,233	0.00	42.32	287.34	329.66	7.79
Thanjavur	3,411	0.00	265.06	81.13	346.19	10.15
The Nilgiris	2,565	466.72	629.85	634.44	1,731.01	67.49
Theni	2,868	183.06	470.23	522.00	1,175.29	40.98
Tiruvallur	3,394	11.00	45.87	228.80	285.67	8.42
Thiruvarur	2,274	0.46	35.94	31.07	67.47	2.97
Thoothukudi	4,745	0.00	26.08	230.60	256.68	5.41
Tiruchirappalli	4,509	53.53	228.35	189.48	471.36	10.45
Tirunelveli	6,693	442.45	567.02	290.77	1,300.24	19.43
Tiruppur	5,187	48.28	237.68	558.47	844.43	16.28
Tiruvannamalai	6,188	233.79	595.83	478.74	1,308.36	21.14
Vellore	6,075	202.86	937.68	678.05	1,818.59	29.94
Viluppuram	7,194	79.48	301.56	476.52	857.56	11.92
Virudhunagar	4,241	38.74	133.18	174.62	346.54	8.17
Grand Total	1,30,060	3,605.49	11,029.55	11,728.98	26,364.02	20.27

Source: Indian State of Forest Report ISFR, 2019

(2) Forest Cover Change

Per Table 3.3, forest cover increased by 83.02 km^2 in the period from 2017 to 2019. The main reasons for the increase in forest cover in Tamil Nadu are afforestation and conservation activities. Another reason leading to forest increase is that natural forest such as VDF and MDF are mostly distributed in complex terrains with high altitudes and slope areas, which are difficult to access for illegal logging.

Analysis of Table 3.3 shows that 141 km^2 of Non-forest (NF) changed to MDF, and 985 km^2 NF changed to OF, contributing mainly to forest gain. The quality of forest also changed positively as 127 km^2 of OF changed to MDF. However, the forest degradation and forest cut were still there when this period witnessed 101 km^2 of VDF change to MDF and 917 km^2 of OF change to NF, particularly with 121 km^2 of MDF changing to NF.

Table 3.3: Forest Cover Change Matrix

Class	Assessment 2019 (km^2)					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	3,552	101	4	0	15	3,672
Moderately Dense Forest	35	10,661	159	3	121	10,979
Open Forest	2	127	10,567	17	917	11,630
Scrub	0	0	14	611	32	657
Non-forest	16	141	985	84	101,896	103,122
Total ISFR 2017	**3,605**	**11,030**	**11,729**	**715**	**102,981**	130,060
Net Change	-67	51	99	58	-141	

Source: Indian State of Forest Report ISFR, 2019

3.1.3. Forest Classification

Recorded Forest Area (RFA) is a common term used to describe the extent of forest. RFA defines forest extent in terms of legal status or gives a definition of land as 'forest' irrespective of actual forest canopy cover on the ground[27] (Table 3.4). On the basis of legal status, forest in Tamil Nadu is classified into three categories, namely Reserved Forest (RF), Protected Forest (PF), and Unclassed Forest (UF), which are constituted under the Indian Forest Act 1972.

Table 3.4: Legal Classification of Recorded Forest Areas

Category	Restrictions on Activities
Reserved Forest (RF)	An area defined under the provisions of Indian Forest Act or the State Forest Acts as having full degree of protection. In Reserved Forests all activities are prohibited unless officially permitted.
Protected Forest (PF)	An area defined under the provisions of Indian Forest Act or the State Forest Acts as having limited degree of protection. In Protected Forests all activities are permitted unless officially prohibited.
Unclassed Forest (UF)	An area recorded as forest but not included in the categories of RF or PF. The ownership status of such forests varies from state to state.

Source: India State of Forest Report 2001

According to the ISFR 2019, the RFA extent is 22,877 km^2, accounting for 17.59% (4,024 km^2) of GA, of which RF, PF, and UF make up 88.70% (20,291 km^2), 7.79% (1,782 km^2), and 3.51% (804 km^2), respectively. Total area of forest cover inside of RFA is 17,589 km^2 (Table 3.5). Trees outside Forests (TOF), a term used to refer to tree resources found outside of the forests as defined in government records, has an extent of 13,605 km^2, consisting of 8,775 km^2 forest cover outside of RFA and 4,830 km^2 tree cover. (*Note: The digitised boundary of RFA from the state covers 21,653.95 km^2.*)

Table 3.5: Forest Cover Inside/Outside of Recorded Forest Area

Forest Cover Inside RFA (km^2)				Forest Cover Outside RFA (km^2)			
VDF	MDF	OF	Total	VDF	MDF	OF	Total
3,330	8,578	5,681	17,589	275	2,452	6,048	8,775
18.93%	48.77%	32.30%		3.14%	27.94%	68.92%	

Source: Indian State of Forest Report (ISFR), 2019

3.2. Forest Management in the State

3.2.1. Forest Acts and Policies

Tamil Nadu was one of the first states in India to implement forest protection activities. The enactment of the Forest Act in 1882 by Madras Presidency, namely the Madras Forest Act, 1882 (now Tamil Nadu Forest Act, 1882), was a milestone in history of the state of Tamil Nadu. Against this background, the government of Tamil Nadu manages forest in compliance with the provisions of

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[27] *India State of Forest Report, 2019*

the National Forest Policy (1988), which outlines the principles, concepts, and approaches in forest management. Table 3.6 describes the key acts, rules, and policies at the state and national levels, which are closely related to forest management in Tamil Nadu.

Table 3.6: Forest Acts, Rules and Policies in Tamil Nadu

No.	Act, Rule, Policy	Objective
	National Level	
1	Indian Forest Act 1927	The main objective of the Indian Forest Act (1927) was to secure exclusive state control over forests to meet the demand for timber.
2	Wildlife Protection Act 1972	To prohibit hunting, protect and manage wildlife habitats, establish Protected Areas (PA), regulate and control trade in parts and products derived from wildlife, and manage zoos.
3	Environment Protection Act 1986	To protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and/or operation of any industrial facility on environmental grounds.
4	Forest Conservation Act 1980 with amendments (1988)	To protect the forest, its flora, fauna, and other diverse ecological components. To protect the integrity, territory, and individuality of the forests. To protect the forests and prevent deforestation that will lead to land erosion and subsequent degradation of the land. To prevent the loss of forest biodiversity.
5	National Forest Policy 1988	To ensure environmental stability and the maintenance of ecological balance, including atmospheric equilibrium, which is essential for the sustenance of all life forms - plant, animal, and human.
6	Biological Diversity Act 2002	To provide for the conservation of biological resources, managing its sustainable use and enabling fair and equitable sharing benefits arising out of the use and knowledge of biological resources with the local communities.
7	The Scheduled Tribes & Traditional Forest Dwellers Act 2006	To recognise the forest rights of the Scheduled Tribes (ST) and traditional forest dwellers. It also aims to protect the culture of the ST living in these areas. The act also provides the right to occupation to ST and traditional forest dwellers.
8	National Environment Policy 2006	To apply the principles of good governance (transparency, rationality, accountability, reduction in time and costs, participation, and regulatory independence) to the management and regulation of use of environmental resources.
9	National Wildlife Action Plan (2016)	To conserve in situ all taxa of flora and fauna along with the full range of ecosystems they inhabit. The ecological requirements for the survival of threatened, rare and endangered species, together with their community associations of flora and fauna, must be ensured.
10	Environment Protection Rules 1986	To provide for the regulation of standards for emissions or discharge of environmental pollutants, prohibitions and restrictions on the location of industries and the carrying on processes and operations in different areas, procedure of taking samples, prohibition and restriction on the handling of hazardous substances in different areas, etc.
11	Biological Diversity Rules 2004	To provide for the regulation of procedure for access to biological resources and associated traditional knowledge, restriction on activities related to access to biological resources, procedure for seeking approval for transferring results of research, constitution of Biodiversity Management Committees, etc.
12	Forest Conservation Amendment Rules 2014	To provide for the regulation of submission of proposal seeking approval of the central government, processing proposal received by the central government, submission of report on compliance to conditions stipulated in the in-principle approval and grant of final approval, etc.
	State Level	
1	The Tamil Nadu Wild Elephants Preservation Act 1873	To prevent the indiscriminate destruction of wild elephants.
2	Tamil Nadu Forest Act 1882	To make provision for the protection and management of forests.

No.	Act, Rule, Policy	Objective
3	Tamil Nadu Preservation of Private Forest Act 1949	To prevent the indiscriminate destruction of private forests and interference with customary and prescriptive rights therein and for certain other purposes.
4	Tamil Nadu Hill Areas (Preservation of Trees) Act, 1955	To provide for the regulation of the cutting of trees and the cultivation of land in hill areas in the Tamil Nadu.
5	The Tamil Nadu Private Forests (Assumption of Management) Act 1961	To provide for the taking over of the management of private forests in certain areas
6	Tamil Nadu Prevention of Dangerous Activities of Bootleggers, Drug Offenders, Forest Offenders, Goondas, Immoral Traffic Offenders and Slum Grabbers Act, 1982	To provide for preventive detention of bootleggers, cyber law offenders, drug offenders, forest-offenders, goondas, immoral traffic offenders, sand-offenders, sexual-offenders, slum-grabbers, and video pirates for the prevention of dangerous activities prejudicial to the maintenance of public order.
7	Tamil Nadu Patta Sandalwood Rules, 2008	To provide for regulation of form and manner of making an application to sell sandalwood trees to the government, verification of ownership of sandalwood trees on patta land, and the extraction and processing of sandalwood trees.
8	Tamil Nadu Regulation of Wood Based Industries Rules, 2010	To provide for regulation of restriction on the establishment of wood based industries, applications for grant of licences, renewal of licences, transfer of licences, timber to be covered by transit permits, etc.
9	Tamil Nadu Forest and Wildlife Areas (Regulation of Trekking) Rules, 2018	To provide for the regulation of trekking in any forest area or wildlife sanctuary in Tamil Nadu, which requires prior approval from the forest and wildlife authorities
10	Tamil Nadu Eco-Tourism Policy 2017	To identify, promote, and develop natural areas as ecotourism destinations; develop ecotourism on each site based on carrying capacity and regulate the influx of visitors; promote eco-friendly infrastructure; create livelihood opportunities and share benefits with local communities, etc.
11	Tamil Nadu State Forest Policy 2018	To preserve natural forests and wildlife, conserve ecosystems and their genetic diversity, stabilise the environment, enhance forest productivity, augment water resources from forests, increase tree cover, and climate change mitigation.

Source: Website of TNFD (https://www.forests.tn.gov.in/)

3.2.2. Forest Management System

The guidelines of the National Forest Policy 1988 are framed for the preservation and management of forests in India. On this basis, the government of Tamil Nadu continues to be equally concerned about the vulnerability of natural resources on account of climate change and is committed to sustainably manage and enhance forests and wildlife on scientific principles, while meeting the livelihood needs of forest dependent communities. The objectives of forest management of Tamil Nadu are outlined as follows.[28]

- Biodiversity and genetic resource conservation by protection of forests and wildlife.
- Augmentation of water resources in forest areas.
- Rehabilitation and restoration of degraded forests for improvement of forest cover.
- Enhancing tree cover outside forests for livelihood security and climate change mitigation.
- Welfare of tribal and forest fringe communities to ensure economic prosperity and ecological stability.

Forest management was constituted in the long history of Tamil Nadu in the colonial era in the 18th

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[28] https://www.forests.tn.gov.in/ (accessed in June 2021).

century, before being formed as it is today. Major aspects of the forest management system are summarised and described below.

(1)   Forest Administration

In accordance with regulation of the Indian Forest Service (Cadre) Rules, 1966 (Amendment 28.01.2014), forests in Tamil Nadu are administered by the Principal Chief Conservator of Forests (PCCF, also named the Head of Forest Force1 (HOFF)), assisted by 3 PCCFs (Principal Chief Conservator of Forests & Chief Wildlife Warden, Principal Chief Conservator of Forests & Chief Project Director (TBGP), Principal Chief Conservator of Forests (Research & Education)), 21 Additional Principal Chief Conservator of Forests (APCCFs), 15 Chief Conservator of Forests (CCFs), 13 Conservators of Forests (CFs) and 38 Deputy Conservator of Forest (DCFs). Moreover 141 officers of the State Forest Service and Tamil Nadu General Service also assist the PCCF (HOFF) in the administration. Figure 3.2 depicts the administrative setup.

Administrative Officer	:	Principal Chief Conservator of Forests
		↓
		Additional Principal Chief Conservator of Forests
		↓
		Chief Conservator of Forests
		↓
		Conservator of Forests
Controlling Officer		Deputy Conservator of Forests
		↓
		Assistant Conservator of Forests
		↓
Implementing staff	:	Forest Range Officer
		↓
		Forester
Protection staff	:	Forest Guard
		↓
		Forest Watcher

Source: Website of TNFD (https://www.forests.tn.gov.in/)
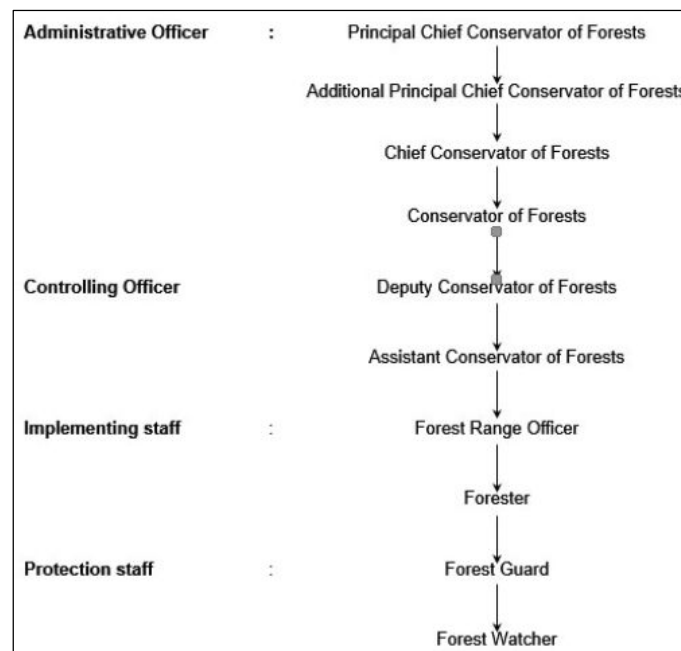
Figure 3.2: Administrative Setup of Forest Administration

(2)   Working Plans

Scientific forest management always requires a good Working Plan (WP), because it is considered a tool for the evaluation of forest resource status, assessment of the impact of management practices in the past, and a selection of suitable management interventions in the future. The practice of systematic management planning of forests in India was established in the colonial period through a written statement of prescriptions titled a 'Working or Management Plan (WP)' for a fixed period, generally for ten years in the post-independence period.[29] To be in line with the statement of the National Forest Policy 1988, all forests are to be sustainably managed under the prescription of a WP and no forest should be permitted to be worked without a WP approved by the competent authority.

WP development is a kind of highly technical assignment undertaken at regular intervals in each forest division; the forest manager or owner is responsible for this task. The concerned authority, designated by the MOEFCC, is in charge of approval as well as implementation of the plan. In general, a WP is to be revised every ten years, while the preparation of a WP of a territorial forest division should normally take two years, which may vary depending upon the volume of work and technical facilities available. In the state of Tamil Nadu, 32 forest divisions are required to develop a

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[29] https://www.forests.tn.gov.in/ (accessed in June 2021)

WP. As of November 2020, 11 WPs were approved by the MOEFCC, three were submitted to the concerned agencies, and 18 were under the drafting stage. The approved WPs belong to the Forest Divisions of Nilgiris, Theni, Salem, Madurai, Chengalpattu, Namakkal, Tiruvannamalai, Chennai, Tiruvallur, Vellore, and Tirupattur.

(3) Forest Management inside RFA

As mentioned above, PA, which are classified as RF, occupy most RFA area at 88.70% (20,291 km^2), while other categories, consisting of PF and UF, make up only a small proportion at 11.3% (2,586 km^2). Hence, the management of forest in PA plays a vital role in forest protection and development inside RFA.

1) Recognised Protected Areas

Tamil Nadu is one of the initiators in the management of PA as well as in the development of forest resources and wildlife in India. Acknowledging the role that forest and wildlife conservation can play in environmental protection, the Indian government issued the Wildlife (Protection) Act in 1972. However, much before this, the Wild Elephants Preservation Act and the Wild Birds and Animals (Protection) Act were enacted by the Tamil Nadu government in 1983 and 1912, respectively. In addition, the first PA were also established in the state of Tamil Nadu. Specifically, Vedanthangal Bird Sanctuary, the first bird sanctuary in India, was declared in 1936. Mundanthurai Tiger Sanctuary was declared in 1962, which is almost eleven years earlier than the launch of 'Project Tiger' in the country in 1973.

PA occupy 30.92% of the state's forest area at 707,294.992 ha, consisting of five national parks, 15 wildlife sanctuaries, 15 bird sanctuaries, and two conservation reserves, which have been established under the Wildlife (Protection) Act, 1972. (Table 3.7).

Table 3.7: Sanctuary and National Parks in Tamil Nadu

No.	Sanctuary & National parks	Total	Area (ha)
1	Wildlife Sanctuaries	15	606,389.657
2	Birds Sanctuaries	15	17,666.155
3	National Parks	5	82,751.570
4	Conservation Reserve	2	487.610
Total			707,294.992

Source: Website of TNFD (https://www.forests.tn.gov.in/)

Along with the aforementioned RF, Tamil Nadu also owns many other important reserves and biodiversity hot spots. Three biosphere reserves, namely Nilgiris, the Gulf of Mannar, and Agasthyamala are internationally acclaimed for their rich and unique biodiversity. In addition, Western Ghats is one of the 25 global hotspots as well as one of the three mega-centers of endemism in India. Moreover, tiger reserves in Western Ghats — namely those of Mukurthi, Srivilliputhur, Kanniyakumari, and Megamalai — have very high species richness in flora and fauna.

2) Human-Wildlife Conflict

In Tamil Nadu, incidents of human – animal conflict, particularly between humans and elephants, has been increasing over the years. Cases have been reported in various parts of PA, of which Nilgiris Eastern Ghats (Nilgiri Elephant Reserve), Nilambur-Silent Valley Coimbatore (Nilambur Elephant Reserve), Periyar (Srivilliputhur Elephant Reserve), and Anamalai-Parambikulam (Anamalai Elephant Reserve) are the four places in which the highest intensity of conflict is located (Table 3.8). These conflicts cause crop destruction, property damage, the loss of livestock, human injury, and the loss of human life to local communities.

Table 3.8: Human Wildlife Conflict Zones

No.	Name of the Elephant Reserve	Name of the Division	Intensity
1	Nilgiris Eastern Ghats (Nilgiri Elephant Reserve)	1. Mudumalai Tiger Reserve	High
		2. Gudalur Forest Division	High
		3. Nilgiris North Forest Division	High
		4. Sathyamangalam Tiger Reserve	High
		5. Erode Forest Division	Medium
		6. Dharmapuri Forest Division	Medium
		7. Hosur Forest Division	High
		8. Nilgiris South Forest Division.	Medium
2	Nilambur - Silent Valley Coimbatore (Nilambur Elephant Reserve):	1. Coimbatore Division	High
		2. Mukurthi National Park	Low
		3. Nilgiris South Forest Division	Medium
3	Periyar (Srivilliputhur Elephant Reserve):	1. Grizzled Giant Squirrel Wildlife Sanctuary	Medium
		2. Theni Forest Division	Medium
		3. Tirunelveli Forest Division.	Medium
4	Anamalai - Parambikulam (Anamalai Elephant Reserve):	1. Anamalai Tiger Reserve	High
		2. Dindigul Forest Division	Medium
		3. Kodaikanal Forest Division.	Medium

Source: Website of TNFD (https://www.forests.tn.gov.in/)

Addressing these conflicts and mitigating their impact require effective management with the participation of both the government and local community. The state government initiates measures that benefit both wildlife and local human communities, enabling mutually beneficial co-existence. The key initiatives are described as below.

- Surveillance of vulnerable areas and monitoring of wildlife habitats.
- Mitigation measures to prevent human-wildlife conflicts
- Geographic Information System (GIS)-enabled information and technology driven system for monitoring wildlife habitats to reduce human-wildlife conflicts.
- Sensitising the inhabitants and locals through modern tools and technologies.
- Timely distribution of benefits to win the confidence of people.
- Protocols for the rescue and rehabilitation of wildlife that stray out of forest areas.
- Strengthening of veterinary services for wildlife through Rapid Response Teams and Mobile Veterinary Units.[30]

(4)   Forest Management outside of RFA

As mentioned earlier, the extent of TOF is 13,605 km^2, consisting of 8,775 km^2 of forest cover and 4,830 km^2 of tree cover. The National Forest Policy of 1988 set a national objective of increasing the forest and tree cover of India to 33% of the total area of the country. To be in line with the national target, the state government has formulated policies and innovative strategies to increase forest cover to 33% by 2030. To obtain the objective, the expansion of TOF plays a key role. Various programs are implemented through the state, such as Tree Cultivation in Private Land (TCPL) and Urban Forestry, of which local people, communities, land owners, and institutions are involved as much as possible, as associated with the principle of 'Social Forestry'.

1)   Tree Cultivation in Private Lands

TCPL is an initiative of the Tamil Nadu government, which is promoted thanks to the assistance of TBGP. Under the project, local people are supported in raising commercial timber trees on their lands and also educated about the scope of agroforestry and plantation forestry. The first TCPL program was implemented during the period 2007 – 2012. As a result, 161,110 acres were planted with 0.545

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[30] https://www.forests.tn.gov.in/ (accessed in June 2021).

million tree seedlings on the land of farmers, with 84,099 persons benefitting. The objectives of TCPL are shown below.[31]

- To contribute to the national goal of bringing 33% of the geographical area under forest and tree cover by increasing tree cover in the villages
- To increase the supply of wood and non-wood products from private land for industrial as well as household consumption contributing to the reduction of pressure on forest land
- To establish a tree-based farming system as a sustainable and viable economic enterprise for farmers
- To strengthen the technical capabilities of the farmer to create farm plantations

Under the support of TBGP, TCPL are implemented according to follow steps.

- Village Cluster Selection and Rapid Appraisal
- Engaging Non-governmental Organizations (NGOs)/Resource organisations
- Entry Level Activity
- Preparation of Micro-plan for TCPL
- Micro-plan Implementation
- Monitoring & Evaluation (M&E)

2)   Urban Forestry

Previous studies show that urban greening is not only increasing forest and tree cover in urban areas, but that it is also integral to the ecological, economic, and societal well-being of our communities. Forest area contributes to the removal of atmospheric pollutants, stabilises soil, and contributes to ground water recharge. Unfortunately, the tree and forest cover rate per capita is very small over urban areas of India in general and Tamil Nadu in particular. A report from Care Earth Trust 2018 shows an example from Chennai (the capital city of Tamil Nadu). Each person in Chennai has just 0.46 m^2 of open space and there is only one tree for every 33 people on the city's roads. Furthermore, green cover in this city is declining by 2% every year.

To cope with this issue, the policy of Tamil Nadu envisages the following:

- Taking up planting along highways to increase green cover in the state;
- Carrying out specific urban planning programmes to provide livelihood security;
- Supporting the mitigation of the rising temperature onslaught.

(5)   Joint Forest Management (JFM)

The Joint Forest Management (JFM) programme is an initiative undertaken by the government of Tamil Nadu that was initiated in 1997 with the aim of protecting, regenerating, and developing degraded forest lands through the involvement of village communities. JFM was first introduced in about 1,000 villages over a period of five years, under a project supported by the Japanese Overseas Economic Co-operation Fund (OECF). Thanks to this assistance, watershed development, through large-scale afforestation and water harvesting activities undertaken on a micro-watershed basis with the active involvement and cooperation of local communities, form the core component of JFM in the state.[32] As of 2013, Tamil Nadu had 3,337 JFM committees with over 1.06 million members, and the area under JFM was approximately 0.72 million ha.[33]

According to the government of Tamil Nadu, village or government forest areas delineated on a watershed basis are defined as a JFM management unit. A Village Forest Committee (VFC) is formed

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[31,] The Tree Cultivation in Private Lands (TCPL) document, Tamil Nadu Biodiversity Conservation and Greening Project (TBGP).

[32] Reframing Joint Forest Management in Tamil Nadu through Compensation for Environmental Services. http://www2.inecc.gob.mx/ (accessed in June 2021).

[33] The Ministry of Statistics and Programme Implementation (MOSPI) (accessed in June 2021).

in each JFM village, consisting of a male and female member from all willing households. It functions as the people's representative body for JFM. The VFC has a mandate to regulate access to forests, resolve intra-village conflicts, and ensure an equitable distribution of JFM benefits. Similar to other JFM in India, products such as fuel, fodder, green manure, and Non-Timber Forest Products (NTFP) harvested from restored forest are offered free of charge to VFC members. Through this, local people are encouraged to join VFC activities. Moreover, additional products can be sold by the VFC, and any proceeds are then to be distributed equally among VFC members after remitting 25% to a specially-constituted Village Development Fund (VDF). The VDF is then used for village-level development activities, including laying roads, providing drinking water facilities, and constructing community halls. About 70% of the VDF is used to compensate individuals or small groups who were dependent on forests but lost access to them due to restrictions (e.g., grazing) that came about after the onset of JFM.[34]

Along with the positive achievements obtained through the implementation of JFM, challenges are inevitable. Several discussions are described below.[35]

- The initiation of water augmentation activities, while providing benefits to some villagers, imposes costs on certain other groups, such as cattle grazers using the forest catchment. In addition, half of the respondents did not perceive any of the above-mentioned benefits. This led to the idea of taxing those who benefit in order to compensate those adversely affected. However, this approach did not work, since water harvesting efforts led to enhanced ground water, which is both legally and practically very difficult to regulate.

- Opening up JFM to all willing households in a village led to the recruitment of a large number of villages belonging to various groups and castes, anticipating various development benefits. Managing such heterogeneous groups led to high transaction costs related to negotiating and enforcing contractual agreements.

- Although social fencing is supposed to be the forest protection norm in JFM, with different hamlets being grouped together as a single JFM village, covering such distant and scattered habitations suddenly meant that the VFCs had to hire forest protection 'watchers'. With no resources to pay for these watchers, in many places forest protection came to a standstill after three years, according to VFC presidents and field level forest officials.

- The TNFD and local community heads provided most of the leadership in forming VFCs and developing institutional mechanisms as part of JFM. While villagers were mostly engaged in village development and forest protection, the TNFD undertook watershed development. In many instances, these two activities ran separate from each other.

3.2.3. Nurseries and Seeding Production

Nurseries established for tree seedling production have a significant role in plantation development programmes. Based on a duration of operation basis, the nursery system is classified into two types, consisting of temporary nurseries and permanent nurseries. In Tamil Nadu, the central nursery (which is a kind of permanent nursery) is one of the main sources of tree sapling supply, which is managed by a Forestry Extension Centre. Each Forestry Extension Centre provides technical support for tree growing in rural areas through 32 such centres in Tamil Nadu (Table 3.9). These centres provide quality tree seedlings like thornless bamboo, casuarina, teak, neem, Melia dubia, grafted tamarind, and nelli to farmers and also develop demonstration plots on private land through cooperation with famers by providing them with seedlings.

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[34] http://www2.inecc.gob.mx/publicaciones2/libros/472/art3.html (accessed in June, 2021).
[35] Ibid.

Table 3.9: Forest Central Nurseries

No.	Region	Name of Forestry Extension Centre	Location
1	Central Region, Salem	Forest Extension Centre, Coimbatore	Mangarai
2		Forest Extension Centre, Dharmapuri	Harur
3		Forest Extension Centre, Erode	Arachalur
4		Forest Extension Centre, Karur	Chinnathadampalayam
5		Forest Extension Centre, Namakkal	Athanur
6		Forest Extension Centre, Nilgiris	Udhagamandalam
7		Forest Extension Centre, Perambalur	Chithali
8		Forest Extension Centre, Salem	Sitharcoil
9		Forest Extension Centre, Trichy	M.R. Palayam
10		Forest Extension Centre, Tiruppur	Sevandhampalayam
11		Forest Extension Centre, Ariyalur	Melakaruppur
12	Southern Region Madurai	Forest Extension Centre, Virudhunagar	Srivilliputhur
13		Forest Extension Centre, Sivaganga	Arasanur
14		Forest Extension Centre, Theni	Vaigai anai
15		Forest Extension Centre, Ramanathapuram	Ramanathapuram
16		Forest Extension Centre, Pudukkottai	Thoppukollai
17		Forest Extension Centre, Dindigul	Dindigul
18		Forest Extension Centre, Thoothukudi	Sathankulam
19		Forest Extension Centre, Tirunelveli	Tirunelveli
20		Forest Extension Centre, Kanniyakumari	Aralvaimozhi
21		Forest Extension Centre, Madurai	Pasumalai
22	Northern Region Chennai	Forest Extension Centre, Chennai	Nanmangalam
23		Forest Extension Centre, Kancheepuram	Chengalpattu
24		Forest Extension Centre, Krishnagiri	Krishnagiri
25		Forest Extension Centre, Tiruvannamalai	Tiruvannamalai
26		Forest Extension Centre, Thanjavur	Thanjavur
27		Forest Extension Centre, Tiruvallur	Poondi
28		Forest Extension Centre, Nagapattinam	Thiruchampalli
29		Forest Extension Centre, Cuddalore	Neyveli
30		Forest Extension Centre, Viluppuram	Ulundhurpettai
31		Forest Extension Centre, Vellore	Pallikonda
32		Forest Extension Centre, Thiruvarur	Thiruvarur

Source: Website of TNFD (https://www.forests.tn.gov.in/)

3.2.4. Locations, Activities, and Outputs of Past JICA Loan Projects

JICA actively provides technical and financial support to developing countries' efforts to address global issues. As of 2019, under JICA fund assistance, Tamil Nadu had launched three projects, namely the TAP from 1997 – 2005, the TAP 2 from 2005 – 2013, and TBGP from 2011 – 2011. Table 3.10 shows a summary of these projects by key activities and outputs.

Table 3.10: JICA Loan Projects in Tamil Nadu

No.	Project Title	Duration	Locations	Activities	Outputs
1	Tamil Nadu Afforestation Project I (TAP 1) Noted: This project was funded by the Japan Bank for International Cooperation (JBIC) (now JICA)	1997 - 2005	946 project villages spread over 27 districts (excluding Chennai, Nagapattinam, and Thiruvarur)	- Water harvesting structures - Village forest councils - Alternate employment - Local employment generation - Women's development - Community development - Integrated village development	- Afforestation in 480,179 ha - Construction of 23,454 check dams and 2,201 percolation ponds with a capacity of about 800 million cubic feet, as well as carrying out tree cultivation - Formulation of 1,367 village Forest Councils on the basis that each village should have one village Forest Council - Carrying out of 4,722 rural development works in 946 project villages spread over 27 districts
2	Tamil Nadu Afforestation Project II (TAP 2)	2005 - 2013	800 villages, including 150 tribal villages	- Institution Building Afforestation - Local Employment Generation - Local Employment Generation - Income Generation - Women's Development and Self-Help Groups - Community Development - Water Harvesting - Forestry Extension	-125,000 ha of degraded forests abutting 500 villages restored - 37,500 ha of degraded forests abutting 150 tribal villages brought under JFM - 4,152 check dams and 1,177 percolation ponds constructed - 15,000 ha planted with useful tree species - Infrastructure development in the village, such as drinking water facilities, roads, etc. - Construction of office buildings, staff quarters, and rest houses
3	Tamil Nadu Biodiversity Conservation and Greening Project (TBGP)	2011 - 2021	The entire state except for places that have been treated by TAP	- Biodiversity conservation activities (ecosystem conservation in the PA, improvement of the monitoring system for fires, poaching, and other threats in PA, etc.) - Tree planting activities outside the recorded forest areas on private farm lands - Institutional capacity development of the Department for Forest (research activities, environmental education, augmentation of office facilities and equipment, capacity development)	- Wetland planning and management strengthening (12 bird sanctuaries) - Improvement of critical habitats by removing invasive/exotic species (3,050 ha) - Consolidation of RF boundary by construction of cairns (80,000) - Eco- development activities (30 villages abutting PAs & elephant reserve (ER)) - TCPL (10 crore seedling in 143,000 ha) - Capacity development (23,959 trainees)

Source: Project completion reports; Preparatory survey on Tamil Nadu Biodiversity Conservation and Greening Project, https://www.forests.tn.gov.in/ and http://www.tbgp.org/.

Chapter 4.   Biodiversity

4.1.   Biodiversity Profile of the State of Tamil Nadu

4.1.1.   Biodiversity Description

Tamil Nadu State is endowed with rich biodiversity, from marine coastal systems in the Gulf of Mannar to the terrestrial evergreen forests in Western Ghats (one of 25 biodiversity hotspots) and temperate forests in the hilly regions.[36] There are five National Parks, 29 Wildlife Sanctuaries, and two Conservation Reserves covering 4.97% of its geographical area. The Nilgiri Biosphere Reserve is one of the biodiversity hotspots. Having such rich biodiversity, Tamil Nadu has been a pioneer state in biodiversity conservation, particularly in PA management, including conservation of marine fauna.

Tamil Nadu ranks first among the states in India in angiosperm diversity with 5,745 taxa (2,757 herbs, 1,365 shrubs, 1,115 trees, and 508 climbers). Out of 5,745 taxa, 212 are reported to be strict endemics. Of these endemic species, 86% are reported from Western Ghats and their adjoining regions, 8% from Eastern Ghats, and 6% from plains and coastal regions. This accounts for nearly one-third of the total flora of India. This includes 533 endemic species, 230 red-listed species, 1,559 species of medicinal plants, and 260 species of wild relatives of cultivated plants.[37]

Tamil Nadu's faunal biodiversity is equally rich and a considerable amount of information is available on the distribution and diversity of animal species. There are 595 species of freshwater faunal, 2,247 species of marine faunal, and 1,898 species of terrestrial faunal species in Tamil Nadu.[38] The faunal diversity of the state includes 165 species of fresh water fishes, 76 species of amphibians, 177 species of reptiles, 454 species of birds, and 187 species of mammals.

According to the Conservation Assessment and Management Plan (C.A.M.P.), the red-listed species include 126 species of fishes, 56 species of amphibians, 77 species of reptiles, 32 species of birds, and 40 species of mammals. The endemic fauna includes 36 species of amphibians, 63 species of reptiles, 17 species of birds, and 24 species of mammals. Many faunal species have been included in the various schedules of the Wild Life Protection Act 1972, considering their endangered status.

4.1.2.   Areas for Biodiversity Protection

Despite its importance as a biodiversity hotspot, many species in Tamil Nadu State are facing the threat of extinction and thus it is highly important to protect and conserve species. One cause of the endangerment of species has resulted from the spread of invasive alien species covering almost 3,000 km². There are 279 alien, invasive taxa in Tamil Nadu and about 69% of these are herbs. About 61% of the invasive taxa have migrated to Tamil Nadu from tropical America.[39]

Three megacentres and 25 microcentres of endemism, of which the megacentre Western Ghats and five microcentres occur in Tamil Nadu, based on the diversity and distribution of endemic species.[40] Endemic species in Tamil Nadu are more concentrated in Western Ghats, the richest biogeographic province of the Indian subcontinent and one of the best non-equatorial tropical evergreen forests in the world. Varied latitudinal and altitudinal gradients with varied rainfall and temperature patterns

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[36] Tamil Nadu Biodiversity Board. (2017). http://tnbb.tn.gov.in/.

[37] Government of Tamil Nadu Forest Department. Tamil Nadu Biodiversity Rules 2017. https://www.forests.tn.gov.in/pages/view/biodiversity_wild.

[38] Environmental Information System Centre. http://tnenvis.nic.in/tnenvis_old/database_bio_faunal.htm.

[39] Ansari, A. A., Gill, S. S., Abbas, Z. K., Naeem, M., ed. (2017). *Plant Biodiversity: Monitoring, Assessment, and Conservation*, Chapter 21. CAB International, Oxfordshire.

[40] Nayar, M.P. 1996. *Hot Spots of Endemic Plants of India, Nepal, and Bhutan.* Tropical Botanic Garden and Research Institute, Thiruvananthapuram.

are attributable to the species richness and high degree of endemism in the Ghats.

To protect and conserve important flora and fauna, the government of Tamil Nadu has established the Protected Area Network, which constitutes five National Parks, 15 Wildlife Sanctuaries, 15 Bird Sanctuaries, two Conservation Reserves, four Tiger Reserves, and three Elephant Reserves. The total area under PA management occupies 7,072 km^2 in the state, constituting about 30.9 % of the state's forest area.[41]

4.1.3.   Organisation Structure for Biodiversity Conservation

The central government established the National Biodiversity Authority (NBA) under the Biological Diversity Act, 2002. The Tamil Nadu Biodiversity Board (TNBB) was also established by the state government of Tamil Nadu. The Biological Diversity Act bans the collection, commercial utilisation, and research of biodiversity resources. The TNBB examines applications for the use of biological resources and decides whom to give permission regarding its use. There is, however, an exemption for local communities in the utilisation of biodiversity resources.

The TNBB functions in advising the state government in matters related to biodiversity conservation, receives and examines applications for the utilisation of biological resources before the NBA does, and carries out other tasks related to the Biological Diversity Act. In addition, the TNBB investigates and proposes establishing Biodiversity Heritage Sites (BHS) in consultation with local people, NGOs, and other relevant bodies before making a decision. After scrutiny studies, the TNBB declares the establishment of a BHS. This process is defined in the guidelines issued by the NBA.[42]

Besides the NBA, local communities constitute a Biodiversity Management Committee (BMC) for the purpose of promoting conservation and the sustainable use of biological diversity by local people and institutions in potentially rich areas. Pursuant to the guidelines of NBA, a permanent staff member from the state government is nominated to be an ex-officio secretary in the BMC. The NBA consults with the BMC before any decision making. There are 13,604 BMCs in Tamil Nadu as of 2021.[43]

4.2.   Challenges in the Biodiversity Sector of the State of Tamil Nadu

4.2.1.   Human-Wild Animal Conflict

The following target and objectives are mentioned in the final report prepared by the TNFD (Table 4.1).

Table 4.1: Mitigation of Human-Wildlife Conflict

Target	Deliverables	End Results
Mitigation of Human-Wildlife Conflict	a. Understanding species interactions on a temporal scale	Increased understanding of the behavioral ecology of problem species vis-à-vis the nature, type, and seasonality of negative interactions to enable designing and implementation of mitigation techniques.
	b. Augmentation of fodder in wildlife areas	Availability of quality fodder to wildlife.
	c. Augmentation of pinch period water availability	Prevention of wildlife movement into human habitations during pinch period of water.
	d. Habitat Connectivity Management	Restoration of degraded natural habitat of problem species and enhancement and improvement of habitat

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[41] The Government of Tamil Nadu Forest Department. (2016). Protected Areas.
https://www.forests.tn.gov.in/pages/view/Introduction-wild.
[42] Ministry of Law. (2002). The Biological Diversity Act, 2002.
[43] National Biodiversity Authority. (2021). http://nbaindia.org/content/20/35/1/bmc.html.

	quality of problem species to mitigate human-wildlife conflicts.
e. Development of infrastructures facilities	New designs of wildlife passages for roads, rails, canals, etc. Improvement in motivation level of staff.
f. Developing and strengthening barriers	Usage of latest technology in forest and wildlife management.
g. Development of Conflict Management Plan	Prevention of movement of wild animals into human habitations.
h. Capacity Building of officers and staff	Effective management of human-wildlife conflicts. Effective handling of human-wildlife conflicts and mitigations.

Source: TNFD 2019

(1)   Current Status

Despite the fact that Tamil Nadu is rich in biodiversity, due to the rapid increase of the human population and the excessive expansion of human settlements, human-animal conflict sometimes occurs in the state. There were 8,087 cases of human-animal conflict reported during the period of 2013-2018, including 7,383 instances of crop raiding and 47 of human injury or death in the state (Table 4.2).

Table 4.2: Man-Animal Conflicts between 2013-2018

Unit: Number of cases

Type	2013-14	2014-15	2015-16	2016-17	2017-18	Total
Human death	6	3	9	4	5	27
Human injury	3	3	9	3	2	20
Damage to houses	262	59	113	135	44	613
Crop damage	1,684	1,183	2,085	1,446	986	7,384
Livestock killed	39	1	3	0	0	43
Total	1,994	1,249	2,219	1,588	1,037	8.087

Such conflicts in the state mostly involve wild elephants. It was estimated that there are approximately 1,700 elephants in Tamil Nadu.[44] A main cause of the conflict is the fragmentation of forests due to economic development, such as the construction of highways or universities, mining, and the expansion of shifting cultivation areas.

(2)   Counter-measures Being Applied

The TNFD has so far launched 24 training programmes for village volunteers from vulnerable villages in elephant reserves. Traditional migratory routes for tigers, elephants, and gaur were identified and consequently managed. Data was collected in 14 PA/divisions in areas frequented by elephants and other large mammals, potential corridors have been identified, and training programmes have been carried out on a regular basis.

As the countermeasure for human-animal conflict, anti-depredation squads were introduced to protect the life and property of the people living in vulnerable villages from the depredation of elephants and other wildlife. Elephant-proof trenches over a length of 381 km have been completed. In all villages where human-wildlife conflict is frequent, monitoring such incidences and warning people in advance was done to minimise damage.

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[44] MOEFCC (2010) *Gajah, Securing the Future for Elephants in India: The Report of the Elephant Task Force*. http://www.moef.nic.in/downloads/public-information/ETF_REPORT_FINAL.pdf (last accessed March 13, 2019).

(3) Causes of Human-Wildlife Conflicts

The enrichment of forest habitat and changes in land use patterns in forest-fringe habitats have resulted in occurrences of 'Human Wildlife Negative Interaction' (TNFD, a submission report to JICA 2020). The mitigation of human-wildlife conflicts through the adoption of a combination of techniques is required. Initiatives and research coupled with field-level interventions would be required to continue with the development of new technologies and standardising them in real life scenarios with a multi-dimensional approach addressing matters from four different aspects: human, biological, habitat, and management dimensions ('TNFD Answers to Questionnaire Contact Mission_Final 2020').

Livestock grazing, a major biotic interference in forest corridors, originates from seven settlements of the Masinagudi group of villages on the eastern and the south-eastern fringes of the sanctuary. Free grazing by about 15,000–17,000 residents as well as by migratory livestock occur every year in and around the forest corridors. This may have helped the proliferation of weed species such as *Lantana camara*, *Cassia tora*, *C. occidentalis*, *Opuntia dillenii*, and *Ageratum conyzoides.* Invasive species like lantana and eucalyptus are expanding over the Nilgiris, because of which elephants have become more reliant on villages for food. The annual fodder production from the corridor forest has been able to meet the demand of about two-thirds of the resident population, while the crop residues from marginal agriculture was unable support the remaining one-third of the livestock population[45].

(4) Mitigations to Be Further Applied

It is not realistic to reduce the damage to zero, and it is essential to reduce the damage to an acceptable level. The introduction of an objective index is recommended because by doing so a policy can be introduced and creates policy accountability. The objective index shows the damage value that serves as a baseline and indicates the damage mitigation target after the introduction of the management policy for that same damage value. This is also applicable in dealing with crop damage caused by elephants.

The basis of the coexistence plan for humans and large animals is setting a vision and purpose that can be shared with the local community, and carrying out population management and zoning as follows.

- a. Core zone (PA, etc.): Priority is given to the habitat of the target species, and damage control is conducted through self-help and self-responsibility.
- b. Corridor: Set as a movement route for the target species connecting the core zones. Treated according to the core zone.
- c. Buffer zone: Located around the core zone, where entrance is allowed. The target species will be driven away with mutual assistance and public assistance and the damage controlled.
- d. Control zone

Among four types of zones, buffer zones are mentioned in *Gajah,* which is the report of the Elephant Task Force prepared by the Indian government's Ministry of Environment and Forests in 2010.

The TNFD reported that 'the movement route of the elephant has been identified'. As the next step, it is important to consider 1) why elephants appear there and 2) which population is causing the conflict.

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[45] Chandra & Bidyut 2001 Cracks in the Left bastion? The 1999 Parilamentary elections in West Bengal, Indian Social Science Revies, 3 (1).

- • 1) There are various reasons for the appearance of elephants depending on the location, such as an increase of population, the disappearance of habitat, or the presence of nutritious crops. It is important to know the number of individuals in order to determine whether or not the conflict has increased due to an increase in the number of individuals.

- • 2) It is meaningful as a countermeasure against conflicts to grasp the number of individuals in the population causing the conflict and the movement route. By comparing population data with the appropriate number, it is possible to determine whether the elephants are escaping due to overcrowding. In addition, from the data of the distribution of the population and the movement route, it is possible to obtain information on whether or not the elephant is confined within a certain range and is difficult to move.

Considering the influence of livestock population on human-wildlife conflict, measures to reduce livestock population and implement eco-development packages will be needed in order to ensure corridor connectivity for the long-term conservation of the elephant population.

4.2.2. Alien Species Invasion

The following target and objectives are mentioned in the final report prepared by the TNFD (Table 4.3).

Table 4.3: Mitigation of Alien Species Invasion

Target	Deliverables	End Results
Eradication of invasive alien species	Removal of *Lantana* and *Prosopis* species	Prevention of degradation of natural habitat. Mitigation of human-wildlife conflicts.

Source: TNFD 2019

(1)   Current Status

Table 4.4 shows the current status regarding alien species invasion in Tamil Nadu. In this table, infested area and removal area are summarized by plant species.

Table 4.4: Alien Species Invasion in Tamil Nadu

Plant *spp*	Infested Area (km^2)[46]	Removal Area (ha)[47]	Reference
Lantana camara	2,209	2,005[*]	[*]India State of Forest Report (ISFR) 2019
Prosopis juliflora	N/a		
Acacia mearnsii	N/a	1,025[**]	[**]Baseline survey prior to removal
Chromolaena odorata	420	N/a	
Solanum elaegnifolium	126	N/a	
Aegeratum conyzoides	83	N/a	
Cuscuta spp	61	N/a	
Others: *Senna spectabilis, Parthenium hysterophorus, Eupatorium odoratum*			

Source: IFSR 2019

(2)   Mitigations to Be Further Applied

Lantana camara, one of the top ten invasive weeds, is a source of livelihood for the people in the communities of Kattunayakan, Kurumbas, Malayali, and Palliyar — who process the stems and make

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[46] Though the invasion by both *Prosopis juliflora* and *Acacia mearnsii* has been reported, how much area was infested/invaded is unknown, and this situation is bidicated by "N/a" on the table.
[47] Though *Chromolaena odorata*, *Solanum elaegnifolium*, *Aegeratum conyzoides*, and *Cuscuta spp* were actually exterminated, how much area was exterminated is unknown, and this situation is indicated by "N/a" on the table.

furniture.[48] The total number of alien species in Tamil Nadu as per present data is 1,274.[49] A majority of alien species exist only under cultivation.

Verification of the effect of extermination methods: It is important to verify the effectiveness of the extermination methods that have been used so far. Approximately 2,000 ha of mesquite (*Prosopis juliflora*) has been exterminated, but it is important to investigate the effect of extermination applied to each site. It is also important to verify which extermination method was effective under what environmental conditions when the extermination method was different. By organising them, an optimal extermination method will be established according to environmental conditions. Verification of the effectiveness of extermination methods also helps to set extermination goals. In addition, since extermination has been conducted in Tamil Nadu for more than ten years, it is also meaningful to sort out the effects of extermination on recovery of native species.

Expansion forecast of mesquite: Since mesquites grow densely, it seems possible to capture them from satellite images. By identifying the distribution of mesquite from satellite images and understanding the above-mentioned natural environment conditions controlling mesquites growths, such as water and soil, an expansion of mesquite in the future can be predicted.

Alternative use of alien species: Lantana is actually used as furniture in the villages of the Kattunayakan, Kurumbas, Malayali, and Palliyar in Tamil Nadu. Local residents use mesquite with a chute diameter of 7-8 cm as fuel wood. Mesquite grows to the same size four to five years after germination; it is then worth considering the utilisation of mesquite along with exterminating it.

4.2.3. Marine Animal Protection

The Tamil Nadu State Forest Policy, 2018 mentioned coastal ecosystem conservation and management as well as conservation of biodiversity and wildlife as objectives to ensure the sustainability of natural resources. The following targets and objectives are mentioned in the final report prepared by the TNFD.

Table 4.5: Marine Ecosystem-Based Habitat and Species Recovery

Target	Deliverables	End Results
Development of marine ecosystem, habitat, and species recovery	Coral, sea grass, sea cow (dugong), and sea turtle habitat recovery	Habitat improvement and conservation leading to targeted species recovery with associated marine organisms.
Wildlife ex-situ Conservation	Awareness creation, research and education	Higher level of awareness among the public impacting better care and support to wildlife conservation

Source: TNFD 2019

(1) Dugong Conservation

Species Conservation Action Plans (SCAP) were prepared and activities such as awareness creation for fishermen, workshops for line department officials, information boards and signage, and the development of a mobile app for processing compensation claims were set up in TBGP. Presently, only indirect methods have been tried towards population estimation. The TNFD expressed a need to employ more direct and precise methods for population estimation and habitat factors/co-habitat factors ('TNFD Answers to Questionnaire Contact Mission_Final 2020').

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[48] WILD TAMIL NADU A Veritable Cornucopia of Nature; Tamil Nadu Biodiversity Board. https://www.forests.tn.gov.in/app/webroot/img/document/publications/gotn/Wild%20TN_final.pdf

[49] Environmental Information System Centre, Department of Environment, Government of Tamil Nadu. http://tnenvis.nic.in/tnenvis_old/IASintamilnadu.htm

There is no concrete plan for the protection of dugongs. Three items are important for the protection of dugongs: (1) understanding the population and distribution; (2) conservation of seaweed beds; and (3) raising awareness of residents.

As regards (1), the first step is to narrow down the places that dugongs inhabit by interviewing people living in the area, especially fishermen. Such habitat identification is important for optimising conservation efforts. There is a universal questionnaire format which shall be used to conduct questionnaires to identify the places where dugongs are often witnessed.

(2)   Sea Turtle Conservation

The TNFD has prepared the sea turtle conservation action plans. Through this plan, nesting sites have been identified along 12 coastal districts, as have threats. The conservation plan has been implemented since 2013-14; hatcheries have been formed along the coast to collect eggs and hatch them under protection, and hatchlings have later been released into the sea. Activities like awareness creation, the participation of stakeholders (the local public, fishermen communities, students, and NGOs), capacity building of field staff, and the supply of 500 Turtle Exclusion Devices (TEDs) to fishermen were conducted under the conservation plan.

The TNFD seeks modern techniques in population assessment, including mapping of the potential and existing nesting sites along with intensifying awareness efforts by increasing use of TEDs, as well as the establishment of the permanent hatcheries.

The population survey is considered as a set with the creation of a nesting site map, and is the minimum effort to be carried out. Since it is not possible to survey sea turtles in the sea, it is necessary to conduct on sandy beaches. The most effective means of observation is the counting of footprints

The TNFD's proposals include: 1) a sea turtle census; 2) nesting map creation; 3) permanent hatchery establishment; and 4) further dissemination of TEDs. Towards these four proposals, the addition of habitat environmental protection will be necessary. The loss of adjacent vegetation near nesting sites damages the reproductive ability of sea turtles. An increased temperature of beaches above 29°C due to a clearing of beach forests creates an unbalanced sex ratio, inducing a situation that only females are born.

(3)   Sea Grass Conservation

Brown seaweeds are sufficiently available in Gulf of Mannar, but there is no farming technology yet for them including *Sargassum spp, Turbinaria spp*. Farming technology for red seaweeds, *Gracilaria spp, Kappaphycus spp, Gelidiella spp* is already available however, it is required for native seaweeds. The existing seaweed bed creation methods are floating bamboo raft method, monoline method.

Seagrass are needed to increase, especially C*ymodocea serrulata, Thalassia hemprichi, Syringodium isoetifolium, Halophila ovalis*. The latter two species are known to support dugong population.

For both dugongs and sea turtles, sea grass is vital as a dietary food. In TBGP, the development of species conservation plans for dugong was prepared in Palk Bay and species conservation plans for sea turtles were developed in eight coastal divisions/districts.

4.2.4.   Mangrove Conservation

Since the coastline of Tamil Nadu extends over 1,100 km in length, it is divided into three zones. Coastal conservation is being promoted according to the characteristics of each zone.

2004 Indian Ocean Tsunami brought 16,269 dead on the Indian coast. Corresponding to this event,

the Tamil Nadu Government launched the Emergency Tsunami Reconstruction Project (ETRP) with assistance from the World Bank. ETRP aimed to revive livelihoods and promote recovery in the tsunami-affected areas in the short-term, and to reduce the vulnerability of coastal communities and create a more resilient environment in the longer term. During the 2005-2007 implementation phase of ETRP, 2,162 ha of mangrove plantations were conducted in the estuarine areas of the Koraioor River of the Cauvery Delta in Muthupet, Tiruvarur district. When Tsunami hit the area, the villages sheltered by the mangroves were not affected by the Tsunami whereas other non-sheltered villages were damaged (reported by a forest ranger in Muthupet, Mr. S. Manickam). Not absolute, but certain preventive effects of mangroves were also reported in other places proved that mangrove plantation is worth as disaster mitigation.

Coastal Regulation Zone (CRZ) legislation was enacted in 1991, and Integrated Coastal Zone Management (ICZM), in collaboration with Marine Remote Sensing Satellite Information Services (MARSIS) through the maximisation of spatial information technology, was formulated in 2004. The CRZ was revised in 2011, by which regulatory initiative for coastal management shifted to allow partial use, including community participation.

Muthupet is the largest mangrove area in Tamil Nadu. The degradation of the Muthupet mangroves has been noticed with three possible reasons which are i) Clear felling, ii) Lack of fresh water and increased salinity levels, and iii) Hyper-saline soil conditions. Clear felling stopped in 1971 by enacting the law. Lack of fresh water leads to increase salinity level, consequently the gradual formation of hyper-saline soils.

In the 1980s, the government addressed the issues related to the hyper-saline soils and the lack of tidal flushing and proposed to dig channels in degraded areas to permit the entry of tidal waters. Regular inundation would bring down salinity levels and gradually render the area suitable for regeneration. This approach was known as the Canal-Bank Planting technique. Channels are formed in pre-monsoon months so that the site is flushed with floodwater, leaching out salts from soils. Appropriate species selection, timely planting, de-silting of channels, casualty replacement, and after care all contribute to a successful regeneration.

Mangroves have faced trees falling without human activity due to frequent occurrence of drought (Chatterjee et al., 2014[50]). A drastic reduction of freshwater flow into mangrove areas has been reported. It is therefore thought that the improper mixing of freshwater and seawater and the deterioration of water and soil quality has caused this natural felling. Although the past three National Five Year Plans have recognized this problem, little has been done on this issue.

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[50] Chatterjee, R., DasGupta, R., Krishnamurthy, R. R., and Shaw, R. 2014. "Managing the Indian Coast in the Face of Disasters & Climate Change: A Review and Analysis of India's Coastal Zone Management Policies". *Journal of Coastal Conservation*. Volume 18, No. 6, pp 657-672.

Chapter 5.   Supply Chain of Forest Products

5.1.   Process of the Supply Chain Survey for Biodiversity Conservation

In TBGP, Project activities were composed with three main components: (1) Biodiversity conservation; (2) Natural resource increase base; and (3) Institutional capacity development. As a basic concept of the relationships between Biodiversity conservation and the Natural resource increase base, it can be pointed out that pressures of natural resource utilisation on biodiversity and PF and PA are decreased by increasing natural resources outside of the PF and PA, although there are other important Project concepts. According to the TNFD, the project components and the basic concept shall be continued in TBGCP. In TBGCP, the activities shall however be composed based on the activities and development of the results of TBGP. Activities of supply chain development in TBGCP accordingly shall be considered by targeting the natural resources developed and increased in TBGP.

As seen in Table 5.1, the components of TBGP and planned components of TBGCP are shown. As seen in the table, TBGCP components and activities are planned as succession activities based on the results and achievements of TBGP.

Table 5.1: Biodiversity Conservation and Natural Resource Increase Base Component in TBGP and Planned TBGCP

Components	Region Wise		Legal Status of Land	
A. Biodiversity Conservation or Habitat area Improvement of Fauna and Flora	**TBGP**	**TBGCP**	**TBGP**	**TBGCP**
Eradication of Invasive Alien Species	15 sites: 4 PAs and 10 Forest Divisions (FDs) in Elephant Reserves & Point Calimere.	Focus would be mainly in the high human-wildlife conflict areas of the Elephant Reserves.	RFs and PAs	RFs and PAs
Mitigation of Human Wildlife Conflict	13 sites: 3 PAs and 10 divisions within Elephant Reserves.	Focus would be mainly in the high human-wildlife conflict areas of the 18 FDs due to elephants, gaur, carnivore, and crocodiles.	RFs and PAs	RFs, PAs, and adjoining villages
Ecodevelopment Activities	63 villages spread over the state of Tamil Nadu	Eastern Ghats and ITDP villages	Villages around RFs/PAs	Villages around RFs/PAs
Ecotourism Development	25 Ecotourism sites	4 Community based Ecotourism circuits in Eastern Ghats	RFs	RFs and adjoining community lands
Marine Habitat and Species Recovery	Sea turtle conservation in 8 divisions and Dugong in Gulf of Mannar	Focus on establishment of permanent hatcheries for sea turtles in 8 coastal divisions and permanent	National park, biosphere reserve, and coastal villages	RFs, sanctuary, national park, biosphere reserve and coastal villages

		monitoring sites for dugong sea grass rehabilitation and coral rehabilitation in Gulf of Mannar & Palk Bay (New Work)		
Afforestation of Mangrove and Shelter Belt		Coastal areas		RFs and revenue land
B. Natural Resources Increase Base or Afforestation				
Nursery and Planting	Primarily rural villages	Urban and peri urban areas	Private land	Private and institutional land
Extension Centres	Created mostly under TAP	Urban and peri urban areas	RFs	RFs
Supply Chain Development of Forest Resources	N/A	Urban and peri urban areas	N/A	Private land and RFs

Source: TNFD

Activities of supply chain development of forest resources were not conducted in TBGP, although according to the forest resources developed in TBGP, the supply chain development have been planned to be implemented in TBGCP.

The process of the survey to collect information on the supply chain are considered as the following steps:

- Step 1: Review and classify resource forests and/or plantations for the commercial Timber Forest Products (TFP) and NTFP (Non-Timber Forest Products);
- Step 2: Review the tree species produced as forest products from the resource plantations/forests based on tree species planted in TBGP;
- Step 3: Production records of the nurseries shall be surveyed/checked for tree species identification as reference information;
- Step 4: Review characteristics of the trees such as suitable precipitation, altitude, physical feature, breeding methods, usages, forest products made of the trees, degrees of production, and distribution of products from the species.

Notable forest products/tree species to be focused on are:

- 1. Forest products/tree species that affect the livelihoods of households in villages where the livelihoods of the villagers may affect biodiversity conservation areas and/or protection areas;
- 2. Quantity of the distribution and production of the forest products of the commercially valuable tree species.

The supply chain of the selected forest products and trees shall then be scrutinised.

Generally, forest product supply chains are composed of the following four sectors: a. forest resource sector; b. manufacturing sector; c. distribution sector; and d. final buyer/consumer sector. In the supply chain detailed survey, the status and price of the tree/products of each sector are investigated.

- • 1. Forest resource sector: survey on the present status of the resource forests/plantations of trees focused on: tree species, planting area status, logging period, logging method, manufacturing cost, selling price, etc.;
- • 2. Manufacturing sector: survey on manufacturing processes, production volumes, raw material purchase prices, selling prices, etc.;
- • 3. Distribution sector: survey on route and operation processes, distances between resources and manufacturing locations and final destination, costs of transportation, etc.;
- • 4. Final buyer/consumer sector: final destination customers, selling prices, etc.;
- • 5. Present status of forest product certificate system, their chain of custody, etc.

5.2. Forest Classification in Tamil Nadu

In Table 5.2, forests and plantations for producing forest products in Tamil Nadu are classified according to land ownership, management types, and commercial or non-commercial purposes.

Table 5.2: Forest/Plantation Types and Planted Tree Species

Ownership Types	Administrative Types	Commercial or Not	Management System	Tree Names	Forest Products
State forest	Reserved Forests	Non-commercial	Cattle grazing is allowed except in planted areas / protected areas		
			NTFP is allowed with regulations		NTFP like Amla, Tamarind, Phoenix leaves
	Protected Areas	All activities prohibited unless permitted	All activities prohibited unless permitted		
			Totally protected - Yes		
	Plantation	Commercial	State plantation managed by TAFCORN	Eucalyptus / Cashew	Pulp and Cashew
	Plantation	Commercial	State plantation managed by ARUS Rubber cooperation (ARS)	Rubber tree / Commercial	Rubber latex, Tea / Coffee
	Plantation	Commercial	TANTEA	Camelia Sinensis	Tea leaves
JFM Areas (State Owned)	Reserved Forests / Reserve land etc.,	Non-commercial	Villagers are allowed to collect wood for fuel and minor forest products. Timber for local bonafide use is allowed.	All native tree species	Timber, Fuel wood and NTFP etc.,
			NTFP - Yes		
Forests / plantation on private land	Privately owned (not regarded as forest land)	Commercial	Farm forestry / Tree planting on Private Lands / Agro Forests.	Ailanthus excelsa, Teak, melia dubia, Gmelina, Arborea, Red sanders, Thornless bamboo, Casuarina, Neem etc.	Timber, Pulpwood, Plywood Match sticks, Seeds Oil etc.
			Tree planting on Private Lands / Agro Forests.		
			Farm forestry / Tree planting on Private Lands / Agro Forests.		
Other category forests if any (1)	Private Forests	Non-commercial	Managed as per TNPPF at 1949	Native species	Timber, NTFP
	Poramboke Forests	Non-commercial	Managed by Revenue Department	Native species	Timber, NTFP

	Community Forests	Non-commercial	Social Forestry Management	Native species	Timber, NTFP
	Panchayat lands	Commercial	Social Forestry Management	Acacia nilotica / Prosopis	Fuel wood
	PWD tanks	Commercial	Social Forestry Management	Acacia nilotica / Prosopis	Fuel wood

Source: TNFD

Presently, the utilisation of trees from state forest land as commercial timber products has not been permitted except for trees from state lease lands, which are plantations managed by Tamil Nadu Forest Plantation Corporation Limited (TAFCORN), a rubber plantation managed by ARUS, and a tea plantation managed by the Tamil Nadu Tea Plantation Corporation Limited (TANTEA).

From the above table, it can be identified that land categories of the related commercial forest are mainly forests / plantations on private land, JFM forests in the villages and forest on other categories, such as tree planting in on Panchayat land and, PW tanks.

From these land statuses of the forests/forest plantations in Tamil Nadu, TCPL was conducted in TBGP by mainly targeting small-scale land owners and planting on marginal lands.

5.3.   TCPL in TGBP

Tree cultivation on private land has been promoted and carried out in TBGP since 2011, including the preparation period of the first year. Activities of TBGP were conducted in 32 districts, all of which were districts in the state of Tamil Nadu at the time. TCPL activities have proceeded consequently by planting in total 79 million seedlings and about ten million seedlings every year on average in the whole state, although planting in the years 2019 to 2021 has slowed because of the COVID-19 situation. The seedlings produced and provided to beneficiaries by 32 districts are shown in Table 5.3.

Table 5.3: Tree Cultivation in Private Land under TBGP

Sl. No.	Name of District	2012-2013 Total	2013-2014 Total	2014-2015 Total	2015-2016 Total	2016-2017 Total	2017-2018 Total	2018-2019 Total	2012-2019 Total	2019-2021 (Plan) Total
1	Thiruvallur	165,000	540,000	404,600	365,000	200,000	100,000	225,000	1,999,600	52,000
2	Chennai	0	0	0	75,000	0	75,000	48,000	198,000	
3	Kancheepuram	161,000	420,000	252,000	210,000	300,000	100,000	215,000	1,658,000	95,200
4	Chengalpattu	0	0	0	45,000	205,000	310,000	205,000	765,000	47,600
5	Ranipet									
6	Vellore	273,163	855,500	285,000	255,000	390,000	430,000	439,000	2,927,663	
7	Tiruvannamalai	183,500	647,800	410,000	430,000	660,000	650,000	776,000	3,757,300	
8	Tirupattur									
9	Krishnagiri	417,900	880,000	370,000	450,000	571,300	800,000	771,000	4,260,200	
10	Dharmapuri	635,165	782,000	550,000	724,000	830,000	895,000	1,132,000	5,548,165	494,000
11	Salem	707,000	724,000	705,000	1,014,000	814,150	892,000	1,445,800	6,301,950	72,000
12	Erode	455,000	410,000	370,000	420,000	428,000	550,000	440,000	3,073,000	
13	Nilgiris	120,000	360,000	325,000	30,000	20,000	0	25,000	880,000	
14	Coimbatore	278,747	206,000	170,000	250,000	290,000	332,143	282,600	1,809,490	95,000
15	Tiruppur	48,600	62,500	0	0	0	0	140,000	251,100	
16	Namakkal	280,000	218,000	135,000	325,000	200,000	500,000	483,000	2,141,000	93,800
17	Trichy or Turichirappalli	450,000	1,070,000	320,000	300,000	270,000	180,000	335,500	2,925,500	26,200
18	Perambalur	150,000	430,000	210,000	322,000	130,000	155,000	265,000	1,662,000	
19	Karur	540,000	895,000	376,500	296,600	285,000	280,000	231,000	2,904,100	
20	Dindigul	877,250	1,681,100	996,000	1,355,000	805,000	634,500	627,000	6,975,850	
21	Theni	443,885	239,210	176,400	245,000	280,000	282,850	296,000	1,963,345	
22	Madurai	290,000	391,850	150,000	93,000	170,000	120,000	90,000	1,304,850	
23	Virudhunagar	292,550	299,000	192,000	110,000	120,000	120,000	145,000	1,278,550	
24	Villupuram	344,000	801,000	347,000	320,000	314,600	306,547	422,500	2,855,647	
25	Kallakurichi	178,700	300,000	300,000	300,000	300,000	152,381	147,000	1,678,081	
26	Cuddalore	519,900	904,000	816,000	471,500	660,000	485,714	546,500	4,403,614	95,000

27	Ariyalur	190,000	360,000	170,000	150,000	60,000	35,000	50,000	1,015,000	
28	Mayiladuthurai									
29	Thanjavur	280,000	473,080	250,000	255,000	200,000	225,000	297,000	1,980,080	52,400
30	Thiruvarur	200,000	600,000	290,000	307,000	256,000	25,000	176,000	1,854,000	
31	Nagapattinam	307,000	546,000	435,000	180,000	110,000	87,500	184,000	1,849,500	105,000
32	Pudukkottai	330,000	1,117,500	370,000	222,000	223,000	140,000	179,000	2,581,500	
33	Sivaganga	340,000	648,000	152,500	180,000	138,000	124,000	95,000	1,677,500	
34	Ramanathapuram	60,000	180,464	75,000	60,000	60,000	35,000	73,000	543,464	
35	Tenkasi									
36	Thoothukudi	99,000	359,040	150,000	100,000	50,000	50,000	110,000	918,040	
37	Tirunelveli	354,650	772,960	405,000	360,000	350,000	290,000	115,000	2,647,610	100,000
38	Kanyakumari	27,990	17,000	42,000	11,000	2,000	0	0	99,990	
39	Harur	0	0	0	0	0	0	40,000	40,000	
40	Hosur	0	0	0	0	0	0	233,000	233,000	400,000
41	PMU				43,900				43,900	
	Total	10,000,000	18,191,004	10,200,000	10,275,000	9,692,050	9,362,635	11,284,900	79,005,589	4,300,000

Harur is a third grade municipality in the Dharmapuri district of Tamil Nadu
Hosur is an industrial city located in Krishnagiri district inTamil Nadu

The main objectives of TCPL are:

- To contribute to the national goal of bringing 33% of the geographical area under forest and tree cover;
- To increase the supply of wood and non-wood products from private land for industrial as well as household consumption to reduce pressures on forest land, especially in biodiversity habitat areas;
- To establish a tree-based farming system as a sustainable and viable economic enterprise for farmers; and
- To strengthen technical capacities of farmers to create farm plantations.

5.4.   TCPL Strategy and Tree Species Adopted in TCPL

TCPL has been planned to focus on fallow lands since fallow lands have become more and more available and small scale fallow lands are prioritised for planting in order to focus more on small scale or marginal farmers.

As TCPL strategies, the following criteria have been set up for the selection of farmers:

- All farmers are eligible, but priority is to be given to small-scale and marginal farmers and women Self-help Groups (SHGs) as TCPL beneficiaries;
- Large- and medium-scale farmers are to be supported for a maximum of 5 ha of fallow land; and
- Farmers who are willing to plant at least 50 seedlings and groups (SHGs) and who are willing to plant at least 200 seedlings are to be preferred first as beneficiaries.

For the selection of land for TCPL, the following criteria have been set:

- At least one-year-old fallow land is to be prioritised for TCPL;
- More than five-year-old fallow land is to be taken for TCPL plantations only after an assessment of natural generation on the site; based on this assessment, such fallow can be considered for gap planting;
- Current fallow land is to be considered mainly for boundary plantations and inter-cropping (agro-forestry) models;
- Land suitable for dry-farming is to be avoided for growing short-rotation and quick growing species; and
- No pure *Casuarina* plantations are to be undertaken under TCPL by a single farmer.

As tree species applied in TCPL, the following 11 species were accordingly adopted.

Table 5.4: Selected Tree Species in Tree Cultivation in Private Land under TBGP

Group	Indicative list of species under TCPL	Indigenious (I) or Exotic (E)	Matuary period	Market / Use
Short Rotation crop	*Casuarina equisetifolia*	E	4-6	Construction works and as poles
	Casuarina junghuniana	E	4-6	Paper industries
	Bamboosa vulgaris (Thornless species)	I	2-4	Bamboo, various uses
Long Rotation crop	*Ailanthus excelsa*	I	10	Match industries
	Dalbergia sissoo	I	10-15	Carving industries
	Kaya senegalensis	I	30 -	Construction industries
	Melia dubia	I	10-15	Veneer industries
	Albizia richardiana	I	30-	Pencil industries, phytotoxic effects
	Tectona grandis	I	20-30	Furniture industries
	Pterocarpus santalinus	I	20	Component of incense (Red sandalwood)
	Dalbergia latifolia	I	60-	Furniture, Premier timber pecies, (Rosewood)

Minutes of Discussion on TBGP

As seen in Table 5.2, trees for NTFP are found in private forests, Poramboke Forests, Community Forests, panchayat lands, PWD tanks, and JFM areas.

In addition, tree species for NTFP including TFP trees found in those forested areas were listed by the TNFD as follows:

Amla,	Baheda,	Bamboo,	Belpatri,	Ber,
Desibabool,	Imli,	Jamalgota,	Jamun,	Kachnaar,
Neem,	Paras,	Pepal,	Rudraksha,	Semal,
Shisham,	Sitabal,	Pungan,	Nelli,	Eluppai,
Manipungan,	Achan,	Naval,	(Redsanders),	Neemathi,
Velvel,	Nimboo,	Mahua,	(Tamarind),	(Thornless bamboo),
(Casuarina),	(Teak),	(Melia-dubia),	(Tamarind),	Mahogany

() are listed as Trees for TCPL.

5.5. Three State Companies of the Forestry Sector in the Supply Chain in TFP

In the supply chain of TFP, which include sawn timbers, timbers and woodchips for pulp, and timbers for MDF woodchips, there is a possibility that timbers from TAFCORN are assumed to significantly affect supply and demand balances and unit prices of timber resources in the state of Tamil Nadu. Furthermore, since the companies produce their timber resources from state owned forest lands, the management policies of TAFCORN and ARUS Rubber Corporation have to follow the forestry policy and plan, which are currently biodiversity-conservation centred.

As commercial companies, the first priority of the state companies is profit-centred, though their management policy must satisfy government policies as well. Accordingly, the management status and quantity comprehension of their forest resources shall be reviewed whether their management policies such as their resource production, selection of tree species, resource utilisation and so on, follows the government forest policies in the Study.

5.6. Urban and Peri-urban Forestry

Tamil Nadu is one of the most urbanised states in India, with more than 48% of the population living in the urban areas.

Although Tamil Nadu is 700 km long and narrowly shaped, as shown in the schematic cross section of Figure 5.1, there are typical landscapes in various parts of Tamil Nadu where a series of landscapes continue from the biodiversity habitat areas to the rural areas connected to the biodiversity habitat areas and then leading to the peri-urban area in the east-west direction. In that landscape, TBGP has increased forest coverage and formed forest resources at the primary village, which is the midpoint connecting the biodiversity habitat and the urban area. The development of the value supply chains of forest products is for connecting the forest resources to the urban area and using them more effectively to improve livelihoods in those villages.
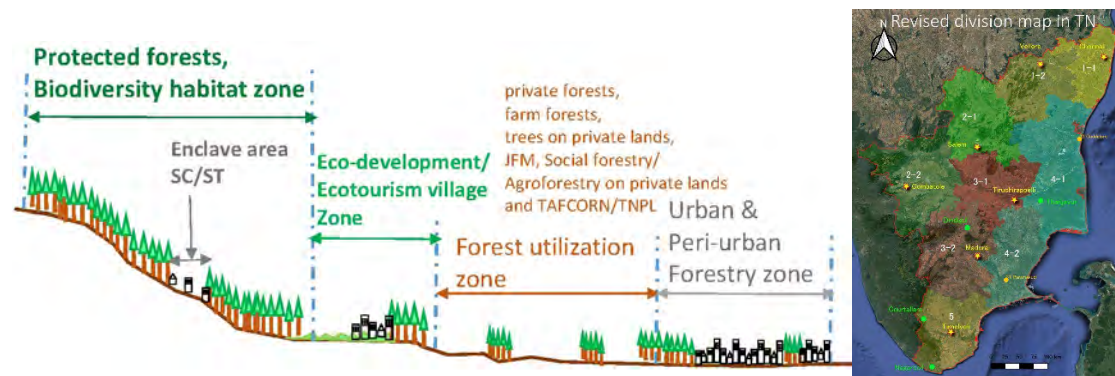
Figure 5.1: West-east Landscape to Connect Biodiversity Habitat Area to Urban and Peri-urban Forestry Zone in Tamil Nadu

As seen in Table 5.1, TBGCP is planned to be a continuation of TBGP components, which are Biodiversity conservation and Natural resource increasing base. As the second components in TBGP, TNFD has successfully provided 79 million seedlings and planted them in TCPL through division offices and Extension Centres in 32 districts all over the state of Tamil Nadu. These activities have been implemented mainly in primary villages.

In TBGCP, TCPL activities are planned to extend to urban and peri-urban forestry to increase natural resources thoroughly in the landscape to connect from the biodiversity habitat areas to the urban area.

TNFD-defined the main activities of urban and peri-urban forestry include:

- Increasing forest resources outside the forest areas in urban and peri-urban, which are the main residential areas for humans;
- Introducing tree planting as alternatives to agricultural crops that decline in production due to drought that is intensified by climate change in agricultural lands in urban areas; and
- Alleviating the environment of human settlements, which deteriorates because of climate change, through the functions of eco-systems such as forests.

In TCPL activities in TBGP, institutions and techniques have been developed, such as seedling production in nurseries, forest extension process, and extension centres set up in 32 districts. In the urban and peri-urban forestry activities of TBGCP, those institutions and techniques will be directly utilised although modifications are required depending on differences of forestry activities in rural villages and urban and peri-urban areas.

5-8

Chapter 6.   Ecotourism and Ecodevelopment

6.1.   Ecotourism

6.1.1.   Legal and Policy Frameworks

6.1.1.1. Central-level Legal and Policy Frameworks

(1)   Definitions of Ecotourism

Today, tourism in India has significant potential given the country's rich culture and heritage, ecological variety, and terrains and places of natural beauty. Tourism is also a potentially large employment generator, besides being a significant source of foreign exchange. Ecotourism is a form of tourism involving visiting fragile and relatively untouched natural areas, intended as a low-impact alternative to conventional commercial mass tourism.[51] In India, the definition of ecotourism by The International Ecotourism Society (TIES) is commonly adopted; i.e., 'responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education (2015)'. Education is meant to be inclusive of both staff and guests.[52]

(2)   Ecotourism Policy and Guidelines, 1998

The Ministry of Tourism, Government of India issued the Ecotourism Policy and Guidelines, 1998, drawing from international guidelines[53] prepared by tourism industry associations and organisations.[54] The policy approach is environmental protection for sake of profits with four principles. These are: i) the importance of community involvement, thereby rural economic development; ii) minimising conflicts between tourism development and local livelihood; iii) the compatibility of tourism development with the local environment and socio-cultural characteristics; and iv) integrated land-use and inter-sectoral planning with commensurate expansion of public services.

(3)   Guidelines for Ecotourism in and around Protected Areas, 2011

The government's Ministry of Environment and Forests issued the Guidelines for Ecotourism in and around Protected Areas in 2011 (hereinafter the "Guidelines"), which are applicable to any PA, whether rural or urban, including National Parks, Wildlife Sanctuaries, community reserves, conservation reserves, sacred groves, or pilgrimage spots located within PA and forested areas. The Guidelines lay down the following six principals of ecotourism.

  i)   Adopt low-impact tourism that protects the ecological integrity of wilderness areas and secures wildlife values of the destination and its surrounding areas;
  ii) Highlight the heritage value of India's wilderness and PAs;
  iii) Build environmental and cultural awareness and respect;
  iv) Facilitate the sustainability of ecotourism enterprises and activities;
  v)   Provide livelihood opportunities to local communities; and
  vi) Use indigenous, locally produced, and ecologically sustainable materials for tourism activities.

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[51] India Brand Equity Foundation (IBEF) (2021). *Ecotourism: A Model to Reboot Tourism.* https://www.ibef.org/ blogs/ecotourism-a-model-to-reboot-tourism (accessed on 30 May 2021).
[52] The International Ecotourism Society (TIES) (2021). *What Is Ecotourism?* https://ecotourism.org/what-is-ecotourism/ (accessed on 30 May 2021).
[53] These are: i) Guidelines for the development of National Parks and Protected Areas for Tourism of the UN WTO; ii) PATA Code for Environmentally Responsible Tourism; iii) Environmental Guidelines for the World Travel and Tourism Council (WTTC); iv) The Himalayan Code of Conduct prepared by the Himalayan Tourism Advisory Board; and v) Ecotourism Guidelines by the International Ecotourism Society.
[54] Equations (2007). *Ecotourism as a Market-based Conservation Scheme.* https://www.scribd.com/document/30325500/ Ecotourism-as-a-Market-Based-Conservation-Scheme (accessed on 31 May 2021).

The Guidelines emphasise the importance of synergy and collaboration amongst the stakeholders for the implementation of the directives and guidelines, and provide the roles and responsibilities of the state governments, PA managements, tourist facilities/tour operators, temple/pilgrimage boards, local communities, and the public/visitors. As for the state governments, a state-level ecotourism strategy is required to be developed to ensure the following issues.

i) Wilderness conservation in ecologically sensitive landscapes;
ii) Local community participation and benefit-sharing;
iii) Sound environmental design and use of locally produced and sustainable materials;
iv) Conservation education and training;
v) Adequate monitoring and evaluation of the impact of ecotourism activities; and
vi) Capacity building of local communities in planning, providing, and managing ecotourism facilities.

6.1.1.2. State-level Legal and Policy Frameworks

The TNFD developed the Tamil Nadu Ecotourism Policy 2017, incorporating the basic tenets of the above-mentioned Guidelines. The vision and key objectives of the policy documents are provided as follows.

Vision[55]

- To create ecotourism opportunities for strengthening the conservation of the rich natural and cultural heritage of Tamil Nadu and enhancing sustainable livelihoods of the dependent communities.

Objectives[56]

i) To identify, promote, and develop natural areas as ecotourism destinations;
ii) To develop ecotourism on each site based on carrying capacity and to regulate the influx of visitors within the threshold level to preserve the sanctity of site;
iii) To promote ecofriendly infrastructure in conformity with the guiding principles;
iv) To facilitate partnerships between all stakeholders to develop, promote, and maintain ecotourism sites;
v) To create livelihood opportunities and share benefits with the local communities for their support of conservation;
vi) To build the capacity of all stakeholders in interpreting the natural and cultural attributes of the sites, develop hospitality ethics, and to provide quality visitors' experience;
vii) To evolve site specific codes of conduct for visitor behaviour and sustainable tourism;
viii) To promote nature conservation through education, creating awareness and enhancing visitors' learning experience for conservation; and
ix) To develop monitoring and evaluation protocols for periodical assessment of the impact of ecotourism on forests, wildlife, and communities, and to gain insight on visitors' satisfaction.

The state's Ecotourism Policy also regulates the 'guiding principles' as the basis for ecotourism development, including: i) the involvement of local communities for empowerment and socio-economic uplift (community-based ecotourism); ii) management planning processes; iii) the conservation of cultural and traditional diversity; iv) conformity with the legal frameworks; v) the development of infrastructure with the least impact on natural resources and local culture; vi) partnership and co-operation with all of the stakeholders; vii) monitoring and evaluation systems; and

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[55] Tamil Nadu Forest Department (2017). *Tamil Nadu Ecotourism Policy 2017*. Tamil Nadu Forest Department, Chennai.
[56] Ibid.

viii) awareness building of youth and capacity building of local communities and forest staff. Furthermore, the 'strategy' has been outlined in conformity with the 'guiding principles' and to achieve the 'objectives'.

6.1.2. Current Conditions of Tourism and Ecotourism in the State of Tamil Nadu

6.1.2.1. Tourism

Tamil Nadu State is well renowned for its temple towns and heritage sites (including five UNESCO declared World Heritage Sites), monuments, forts, hill stations, waterfalls, national parks, beaches, local cuisine, natural environment, and wildlife.[57] There are 14 types of tourism categorised by the state's Tourism Department. These are: i) Leisure tourism; ii) Pilgrimage tourism; iii) Heritage tourism; iv) Adventure tourism; v) Cruise tourism; vi) Rural tourism; vii) Responsible tourism; viii) Business tourism; ix) Medical tourism; x) Ecotourism; xi) Culture tourism; xii) Educational tourism; xiii) Sports tourism; and xiv) Allied tourism.[58]

The government of Tamil Nadu listed 47 places as having tourism importance, of which the most famous tourism locations are Madurai, Rameswaram, Mahabalipuram, Ooty, Kodaikanal, Kancheepuram, Kanyakumari, Thanjavur, and Chidambaram.[59]

A large number of domestic and international tourists visit different places of interest in Tamil Nadu State. This trend can be affirmed by the data, as the state was ranked first in domestic tourist visits in 2014,[60] 2015,[61] 2016,[62] 2017,[63] and 2018,[64] and in foreign tourists in 2014, 2015, 2016, 2018, and 2019.[65,66] The number of tourists had been stable between 2014 and 2017, at 328 to 345 million in domestic tourist visits and 4.7 to 4.9 million in foreign tourist visits, but those figures were boosted to nearly 500 million domestic tourists and seven million foreign tourists in 2019. However, although there is not yet any data available, a significant decrease in the number of tourist visits is anticipated due to the COVID-19 epidemic from 2020 onward.

6.1.2.2. Ecotourism

(1)   Ecotourism Target Area

The state of Tamil Nadu has a great potential for the development of ecotourism initiatives, especially in view of its cultural and natural diversity.[67] Ecotourism in the state of Tamil Nadu is currently managed by two state governmental departments, the Forest Department and Tourism Department, and the actual management of ecotourism in each category of PA is demarcated as follows.

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[57] Tourism, Culture and Religious Endowments Department (2019). *Tourism Policy Note 2019-2020*. Government of Tamil Nadu.
[58] Tamil Nadu Tourism (2021). *Types of Tourism in Tamil Nadu*. http://www.tamilnadutourism.org/TN-Overview.html (accessed on 10 June 2021).
[59] Basariya, S. R. and Ahmed, R. R. (2019). "The Influence of 'Adventure Tourism Activities' in Promoting Tourism Business in Mountain Stations". *African Journal of Hospitality, Tourism and Leisure*, Volume 8, No. 2, pp. 1-10.
[60] Ministry of Tourism (2015). *India Tourism Statistics at a Glance 2014*. Government of India, New Delhi.
[61] Ministry of Tourism (2016). *India Tourism Statistics at a Glance 2015*. Government of India, New Delhi.
[62] Ministry of Tourism (2017). *India Tourism Statistics at a Glance 2017*. Government of India, New Delhi.
[63] Ministry of Tourism (2018). *India Tourism Statistics at a Glance 2018*. Government of India, New Delhi.
[64] Ministry of Tourism (2019). *India Tourism Statistics at a Glance 2019*. Government of India, New Delhi.
[65] Ministry of Tourism (2020). *India Tourism Statistics at a Glance 2020*. Government of India, New Delhi.
[66] It was second place for domestic tourist visits in 2019 and for foreign tourist visits in 2017.
[67] Basariya, S. R. and Ahmed, R. R. (2019). "The Influence of 'Adventure Tourism Activities' in Promoting Tourism Business in Mountain Stations". *African Journal of Hospitality, Tourism and Leisure*, Volume 8, No. 2, pp. 1-10.

Table 6.1: Organisation-wise Management Demarcation of PAs

	Protected Area	Forest Department	Tourism Department
National	Tiger reserve	X	
	Wildlife sanctuary	X	
	National park	X	
	Reserve forest	X	
	Bird sanctuary		X
	Conservation reserve		X
	Elephant reserve		X
International	Biosphere reserve		X
	Ramsar site		X

However, according to the Tamil Nadu Ecotourism Policy 2017, activities which the Tourism Department is already doing in the areas where the Forest Department should control will be allowed to be run by the Tourism Department, except those in the core areas.

(2)   Key Stakeholders and Roles and Responsibilities

There are various key stakeholders related to ecotourism development and management in the state of Tamil Nadu, as indicated in the table below with their roles and responsibilities.

Table 6.2: Roles and Responsibilities of Key Stakeholders for Ecotourism

Stakeholders	Level	Roles and Responsibilities
TNFD	State	- Implement the policy and create a special purpose vehicle in the form of the State Ecotourism Board (SEB); - Deliver the vision and the objectives of the Ecotourism Policy mainly in Protected Areas and other forest areas.[68]
SEB	State	- Strive to combine both nature-based and cultural tourism in a complementary way within the context of environmental and socio-cultural sustainability; - Promote ecotourism development and management that emphasises the 'sense of place' that is unique to each destination; - Ensure the involvement of viable community-based models of ecotourism by making sure that the 'community' is well-defined and incrementally empowered to eventually become self-sustaining; - Steer ecotourism in the state and take policy decisions for the promotion and development of ecotourism; - Approve management plans that shall be developed for every ecotourism site/destination.
Ecotourism Management Society (ETMS)	District	- Promote, manage, and regulate ecotourism sites.
Ecotourism Management Committee (ETMC)	District	- (will be integrated into Ecotourism Federation)
Ecotourism Federation	Division	- (Merged with ETMC) - Facilitate the development of ecotourism by ensuring implementation of the ecotourism guidelines and management plans, coordinate with the other stakeholders, and monitor the allocation of funds and revenue generation.

(3)   Ecotourism Planning

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[68] Tamil Nadu Forest Department (2017). *Tamil Nadu Ecotourism Policy 2017*. Tamil Nadu Forest Department, Chennai.

A 'management plan' shall be developed for every ecotourism site/destination, with detailed strengths, weaknesses, opportunities, and threats (SWOT) analysis, maintaining a fine balance between conservation and tourism. In addition, the 'ecotourism plan' shall be made as an integral part of the management plans of respective PA.[69]

(4) Capacity Building

Ecotourism management can be improved by developing the capacity of the stakeholders, including the local communities. The SEB plays an important role in providing them with training opportunities.[70]

(5) Support from Donors

The following two projects are recognised as Externally Aided Project (EAP) schemes: i) the TBGP and the Biodiversity Conservation and Rural Livelihood Improvement Project (BCRLIP).

6.1.3. Review of Ecotourism under TBGP

The subcomponent 'Community-based ecotourism (CBET)' has been promoted under the component of 'Ecologically Sustainable Development (ESD)', together with the two other subcomponents of 'Ecodevelopment activities' and 'Ecologically sustainable development for tribal villages' (Figure 6.1).
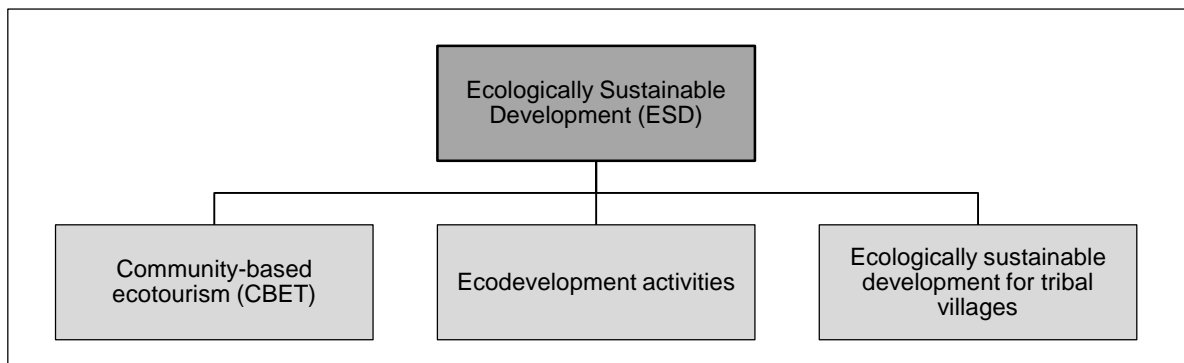
Figure 6.1: Structure of Component ESD under TBGP

(1) Target Sites

There were 25 CBET sites identified and supported by TBGP (Table 6.3). Out of these 25 sites, five are located in/around wildlife sanctuaries and seven other sites in/around reserve forests.

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[69] Ibid.
[70] Ibid.

Table 6.3: Ecotourism Site Features

No.	Circle	District	Division	Protected Area	Site Name	Destination	Site Features	Attraction/Activity	Facilities
1	Vellore	Vellore	Vellore	Thellai Reserve Forest (RF)	Goddaru Waterfalls (Amirthi)	Amirthi Mini Zoo	Waterfalls, Amirthi Mini Zoo, Natural trail path to tribal village, Singiri Kovil Narasimma Swamy Temple, Padavedu Renguambal Temple, Thirumalai Kodi Golden Temple	Wild animal and bird watching, cultural tourism	Rest house, eco-hut, dormitory, trekking shed, interpretation centre
2			Tirupattur	Jawadhi RF	Anguthai Jonai Waterfalls (Angutha Chunai falls)	Foot hill of Inner Jawadhi RF	Waterfalls	Trekking, bird watching, cycling	Eco-hut, interpretation centre, watch tower, toilet
3		Tiruvannamalai	Tiruvannamalai North	Veerappanur RF	Jamunamarathur Bheeman Waterfalls	Veerappanur RF near Komutteri Village	Waterfalls (rainy season)	Boating, forest stay, nature camping, trekking	Rest house (4 suites), van, telescope
4	Viluppuram	Viluppuram	Kallakurichi		Kaviyam Megam Waterfalls	Kaviyam Waterfalls in Kaviyam Village , Megham Waterfalls in Parigam-vellimalai Ghat Road	Waterfalls	Trekking, bathing	Eco-hut, dormitory,
5		Cuddalore	Cuddalore		Pitchavaram	5 km from Killai railway station	Mangrove forests, brackish canals, turtle breeding beach	Bird watching	Eco-hut, interpretation centre,
6	Dharmapuri	Krishnagiri	Hosur	Cauvery North Wildlife Sanctuary (WLS)	Aiyur	Aiyur	Eco-awareness centre, bamboo forests	Trekking, boating, tribal village visit, eco-camping, wildlife watching	Ecotourism centre, watch tower, bungalow, glass house, bamboo huts, dormitory, eco-tent, van, camp fire
7	Salem	Salem	Attur	Belur RF	Mayambadi	Pachamalai Hills	Waterfalls	Trekking, wildlife watching, nature camping, boating	Eco-hut, trekking shed
8				Jadayagoundan RF	Anaivari Muttal	Anaivari Odai and Anaivari Pool	Hills, bathing pool	Trekking, bathing, nature camping	Eco-hut, trekking shed, camping
9			Salem		Karadaiyur Kaveri Peak		Shervaroy's Hills, Yercaud Lake, Karadiyur View Point	Trekking, bird watching, camping	Eco-hut, camping
10				Attur Ghat RF	Vazhukkuparai	Attur Ghat RF	Waterfalls	Trekking	Rest house
11		Namakkal	Namakkal		Agaya Gangai Aruvi-Kolli Hills	12 km from Semmedu	Hills, temple, botanical garden	Trekking	Eco-hut, interpretation centre, trekking shed
12	Tiruchirappalli	Tiruchirappalli	Tiruchirappalli		Keelakarai	Keelakarai village in Pachamalai Hills	Pachmalai Hill Station, waterfalls, medicinal gardens	Trekking	Eco-hut, interpretation centre
13	Trichy	Nagapattinam	Nagapattinam WL	Nagapattinam WLS	Kodiakarai	Point Calimere WL Sanctuary, Kodiakarai Village	Shervarayan Temple, Chola Light House,	Bird watching, turtle watching, beach walking	Rest house (3)
14	Coimbatore	Nilgiris	Nilgiris North		Longwood Shola and Kodanad		Shola Forest	Trekking, wildlife watching, nature camping	

No.	Circle	District	Division	Protected Area	Site Name	Destination	Site Features	Attraction/Activity	Facilities
15			Nilgiris South		Avalanchi	25 km from Ooty	Cauliflower Shola, Bhavani Amman Temple, Lakkidi View Point		Rest house (2), trekking shed (20 beds), van
16					Cairnhill School Mund	Cairnhill School Mund	Shola Forests, Grass lands	Trekking, eco-meditation, bird watching, nature camping	
17	Dindigul	Dindigul	Kodaikanal		Kumbakarai Waterfalls				
18			Kodaikanal WLS	Kodaikanal WLS	Mannavanur	Mannavanur	Grassland with lake	Trekking, boating (coracle),	Dormitory, camping
19	Madurai	Madurai	Madurai	Sirumalai RF	Kutladampatty Waterfalls	Samathuvapuram	Madurai Meenakchi Amman Koil, Thirumalai Nayakar Mahal	trekking	Hotel, private lodge, hospital
20		Theni	Megamalai WL	Megamalai WLS	Chinna Suruli	Near Kombaithozhu Village	Waterfalls,	Trekking	Eco-huts, watch tower, interpretation centre
21			Theni		Top Station	Kurankani, 30 km from Bodi	Grasslands with Shola forests	Trekking, view point, jungle stay	Eco-huts, trekking shed, natural trails, watch tower
22	Virudhunagar	Virudhunagar	Srivilliputhur WL	Srivilliputhur WLS	Sasthakoil	Sasthakoil	Waterfalls, Nanjadai Thavirthuliya Swamy Temple, Ayyanarkoil Temple	Trekking, bathing, nature camping, wildlife watching	Eco-hut, watch tower, interpretation centre cum anti-poaching shed
23					Kovilar Dam	Kovilar Dam	Dam, Saduragiri Sundaramahalingam Temple	Trekking, wildlife watching, nature camping	Trekking shed, watch tower, interpretation centre, van
24	Tirunelveli	Kanyakumari	Kanyakumari		Zero Point at Pechiparai	Pechiparai Dam	Dam, Irattai Aruvi Waterfalls, medicinal plant garden, ARC Rubber Plantation and factory	Trekking, boating, bathing, bird watching,nature camping	Eco-hut, eco-shop, trekking shed, interpretation centre
25					Kalikesam		Kaliamman Temple, Kali Temple,	Trekking, bathing, wildlife watching, nature camping, coracle riding, cycling	Eco-lodge, Eco-hut, eco-canteen, eco-shop, camping, interpretation centre

Source: 1) TNFD (Unpublished). Eco-tourism site. http://www.tbgp.org/data/Eco-Tourism-Sites2.pdf (accessed on 18 April 2021)
2) TNFD (Unpublished). Newsletter Vol.1, Issue 1 – September 2012. Tamil Nadu Biodiversity Conservation and Greening Project
3) TNFD (Unpublished). List of Activities Carried Out in Eco Tourism Sites under TBGP

(2)   Process

The major process taken for promoting the CBET consisted of eight actions as follows.[71]

   i)   Procure contractors/partners and conduct state-level workshop;
   ii)   Assess socio-economic infrastructure of villages and opportunities for ecotourism based on natural and cultural heritage;
   iii) Visit candidate sites, assess potential ecotourism activities, and identify opportunities for synergy within clusters of sites;
   iv)   Develop ecotourism strategies for clusters of sites, with feasibility studies of target sites and synergies between sites;
   v)   Constitute ecotourism SHGs in the absence of Ecodevelopment Committees (EDCs) or Village Forest Committees (VFCs);
   vi)   Develop business plans for ecotourism enterprises, including skills training programmes;
   vii) 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 and safety, etc.);
        d) Revolving funds; and
   viii) Develop village ecotourism charters as benchmark for participatory monitoring of the sustainability of interventions.

(3)   Achievements

The major achievements of the CBET can be summarised as follows:

   • INR 0.1 million was provided as seed money to each of the 25 ETMCs by utilising the unspent amount under Component 1.1.7.[72]

   • These are all community-based ecotourism projects managed by the local community which are living on the fringes of the forests. Their income has increased due to the development of ecotourism. Around 4.3 million tourists visits the above sites in a year.[73]

The activity-wise achievements of the TBGP are presented in a table below:

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[71] Japan International Cooperation Agency (JICA) (2010). *The Preparatory Survey on Tamil Nadu Biodiversity Conservation and Greening Project, Final Report*. JICA.
[72] TNFD (unpubl.). Progress Status Report for the quarter ending 31,12,2020 (Ref. No. TNGB 7/4415/2016).
[73] TNFD (unpubl.). Cause result data and information request.

Table 6.4: Ecotourism Related Activities Carried out under TBGP

No.	Circle	District	Division	Site Name	Reception cum interpretation centre	Eco-hut	Trekking shed	Toilet	Watch tower	Trekking trail	Facility for eco awareness camps	Waterfall improve.	Computer and acces-sories	Office equipment and exhibits	Camping equipment	Boat	Coracal	Publicity awareness creation
1	Vellore	Vellore	Vellore	Goddaru Waterfalls (Amirthi)	X	X	X	X		X	X		X	X				X
2			Tirupattur	Anguthai Jonai Waterfalls (Angutha Chunai falls)	X	X	X	X	X	X	X	X	X	X				X
3		Tiruvannamalai	Tiruvannamalai North	Jamunamarathur Bheeman Waterfalls		X	X	X		X	X		X		X			X
4	Viluppuram	Viluppuram	Kallakurichi	Kaviyam Megam Waterfalls		X	X	X	X	X	X	X	X		X			X
5		Cuddalore	Cuddalore	Pitchavaram	X	X		X		X	X		X	X	X	X	X	X
6	Dharmapuri	Krishnagiri	Hosur	Aiyur	X	X	X	X	X	X	X	X	X	X	X			X
7	Salem	Salem	Attur	Mayambadi		X												
8				Anaivari Muttal	X		X	X	X	X	X	X	X	X	X		X	X
9			Salem	Karadaiyur Kaveri Peak		X												
10				Vazhukkuparai	X		X	X	X	X	X		X	X	X			X
11		Namakkal	Namakkal	Agaya Gangai Aruvi-Kolli Hills	X	X	X	X		X	X		X		X			X
12	Tiruchirappalli	Tiruchirappalli	Tiruchirappalli	Keelakarai	X	X		X		X	X		X	X	X			X
13	Trichy	Nagapattinam	Nagapattinam WL	Kodiakarai	X	X	X	X	X	X	X		X	X	X			X
14	Coimbatore	Nilgiris	Nilgiris North	Longwood Shola and Kodanad	X	X		X	X	X	X		X	X	X			X
15			Nilgiris South	Avalanchi		X												

No.	Circle	District	Division	Site Name	Activity													
					Reception cum interpretation centre	Eco-hut	Trekking shed	Toilet	Watch tower	Trekking trail	Facility for eco awareness camps	Waterfall improve.	Computer and accessories	Office equipment and exhibits	Camping equipment	Boat	Coracal	Publicity awareness creation
16				Carinhill School Mund	X			X	X	X	X		X	X	X			X
17	Dindigul	Dindigul	Kodaikanal	Kumbakarai Waterfalls	X	X	X	X	X	X	X		X	X	X	X	X	X
18			Kodaikanal WLS	Mannavanur														X
19	Madurai	Madurai	Madurai	Kutladampatty Waterfalls	X	X	X	X		X	X	X		X	X			X
20		Theni	Megamalai WL	Chinna Suruli	X	X	X	X	X	X	X	X	X	X				X
21			Theni	Top Station		X	X	X	X	X	X		X		X			X
22	Virudhunagar	Virudhunagar	Srivilliputhur WL	Sasthakoil		X												
23				Kovilar Dam	X		X	X	X	X	X		X	X	X			X
24	Tirunelveli	Kanyakumari	Kanyakumari	Zero Point at Pechiparai		X												
25				Kalikesam	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Source: TNFD (Unpublished). List of activities carried out in ecotourism sites under TBGP

6.2.   Ecodevelopment

6.2.1.   Evolution and Initiatives of Ecodevelopment

Ecodevelopment as a strategy to improve the conservation status of PA is now an accepted policy of the government of India. It finds mention in the National Wildlife Action Plan (NWAP) of 1983 as one of its foremost objectives, and advocates the development of appropriate management systems for PA, with due regard to the needs of the local people and their support and involvement.[74] The perspectives of ecodevelopment has influenced the national forest conservation policy today, as its principles were formally accepted as part of the National Forest Policy 1988.[75]

One of the definitions of ecodevelopment is 'a site-specific conservation-friendly package of measures for rural development and use of natural resources by local people to help PA conservation through community participation', and more simply, 'a tool for participatory management of PAs.[76] The aims of ecodevelopment strategy are outlined by the WB as i) to improve the capacity of PA management to conserve biodiversity effectively, ii) to involve local people in PA planning and protection, iii) to develop incentives for conservation, and iv) to support sustainable alternatives to the harmful use of resources.

The India Eco-development Project (IEDP), funded by the WB (through the Global Environmental Facility (GEF)), was the first project in which ecodevelopment was implemented nationwide, though the WB had financed five forestry projects with biodiversity conservation components that included village ecodevelopment investments associated with PA.[77] The IEDP was initiated as a five-year pilot project to run from 1997 to 2002 and to cover seven PA and peripheral villages within a 2 km radius of each PA boundary. The PA were located in different bio-geographic regions: Ranthambore in Rajasthan, Pench in Madhya Pradesh, Periyar in Kerala, Palamau in Jharkhand, and Buxa in West Bengal, all of which are tiger reserves, and Gir in Gujarat and Nagarahole in Karnataka, which are both national parks. Tigers were the flagship species in all of the project areas except in Gir National Park, which supports the only surviving wild populations of Asiatic lions, which served as the flagship species in place of tigers.[78] During the course of the IEDP, the following activities were carried out under the component of Village Ecodevelopment: i) Conducting participatory micro-planning and providing implementation support for micro-plans in ecodevelopment villages; ii) Implementing reciprocal commitments that foster alternative livelihoods and resource uses, to be financed by a village ecodevelopment program, with specific measurable actions by local people to improve conservation; and iii) Special programs for additional joint forest management, voluntary relocation, and supplemental investments for special needs.[79] Out of seven target sites, Periyar Tiger Reserve is considered to have attained the most successful outcomes.

6.2.2.   Review of Ecodevelopment Activities under TBGP

As already stated, there are three subcomponents under the component of Ecologically Sustainable Development (ESD). These are: i) Community-based ecotourism (CBET); ii) Ecodevelopment (ED) activities; and iii) Ecologically sustainable development (ESD) for tribal villages. Since the activities for 'ESD for tribal villages' have similar objectives and actions, they shall be regarded as one activity

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[74] Rao, Kishore (1998). "India's Protected Areas Ecodevelopment Strategy: Working with Local Communities". *Environments; Waterloo,* Volume, No. 1.

[75] Gurukkal, R. (2003). *The Eco Development Project and the Socio-economics of the Fringe Area of the Periyar Tiger Reserve: A Concurrent Study*. Mahatma Gandhi University, Kottayam.

[76] Bhardwaj, A.K. (2021). "Ecodevelopment Strategies for Biodiversity Conservation and Community Livelihoods".   http://   webline.co.in/cf/ecodevelopment-strategies-and-livelihood-dr-a-k-bhardwaj.pdf (accessed on 18 June 2021).

[77] The World Bank (1996). *India Ecodevelopment Project: Project Document*. The World Bank, Washington.

[78] Gubbi, S. (2006). *Tiger Habitats and Integrated Conservation and Development Projects: A Case Study from Periyar Tiger Reserve, India*. Wildlife Conservation Society.

[79] The World Bank (2007). *India Ecodevelopment Project: Project Performance Assessment Report*. The World Bank, Washington.

with the ED activities.

(1)   Target sites

Table 6.5: Target Sites and Locations of ED Activities (TBGP)

Subcomponent	No. of Villages	Location
ED activities	30	Situated either on the fringes of Sathyamangalam WLS, Kanyakumari WLS, and Srivilliputhur WLS, or within a 5 km radius of the boundary of a reserve forest (RF) forming part of an Elephant Reserve (ER).
ESD for tribal villages	33	Located around RFs that are part of Nilgiris-Eastern Ghats ER and Nilambur-Silent Valley-Coimbatore ER. Certain tribal villages located near PFs in Kallakurichi and RFs in Vellore divisions are included.

(2)   Process

The major process taken for promoting the two subcomponents of the ED activities and ESD for tribal villages consisted of nine actions as follows.[80]

- i)   Holding state level workshop;
- ii)   Orient communities on the scope and purpose of Project (TBGP);
- iii)   Train field staff teams to design and facilitate participatory processes using appropriate tools;
- iv)   Facilitate participatory planning of ecodevelopment plans;
- v)   Constitute EDCs and their Executive Committees;
- vi)   Facilitate study tours to expose EDCs to other successful VFCs/EDCs/SHGs;
- vii)   Prepare ecodevelopment plans, addressing socio-economic and ecological requirements and opportunities including skill training;
- viii) Implement 'Eco Big Oil Payday 2' development plans; and
- ix)   Participatory assessment of impacts of interventions.

(3)   Achievements

The major achievements of the ED activities and ESD for tribal villages can be summarised as follows.

- Baseline socio-economic and forest dependency surveys were conducted. Community development activities like a multipurpose community hall, drinking water facilities, a gravel road, retaining wall, VFC building, solar light, the improvement of roofs for tribal houses, supply of farm equipment, maintenance of toilets, a threshing floor, and liquefied petroleum gas (LPG) supply have been conducted. SHGs have been formed benefiting women. Micro-credit has been distributed to the SHGs and individuals to take up income generation activities.[81]

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[80] TNFD (2021). Tamil Nadu Biodiversity Conservation and Greening Project. *Eco-development Activities in Villages Abutting Pas Apply Now or ERs in 30 Villages*. http://www.tbgp.org/eco-development-activities.html (accessed on 10 June 2021).
[81] TNFD (unpubl.). Cause result data and information request.

Chapter 7.   Institutional Arrangement

Chapter 7 discusses (1) the information technology of the TNFD, focusing on GIS and MIS, (2) the monitoring and evaluation system, and (3) the institutional arrangement of the TNFD.

7.1.   Information Technology of TNFD

The Information Technology (IT) Wing of the TNFD was established in 1996 at the forest headquarters in Chennai. Initially, funding was provided from the Swedish International Development Cooperation Agency (SIDA) project. The main objective was the adoption of IT tools for the smooth dispensing of office work. Computer systems were procured first for the forest headquarters and then for field offices. The accounting sections were the first to use the personal computers for accounting purposes. A billing application was developed to prepare standardized bills at different field offices and head offices. However, computers were provided for all sections of different offices to make office work easier. The funds were provided occasionally from state budgets, different finance commissions, and Official Development Assistance (ODA) projects to strengthen the IT infrastructure. Currently, the IT Wing is headed by an officer with the rank of APCCF at the forest headquarters and supported by an officer with the rank of DCF (IT). The IT Wing consists of the Geomatics Centre (hereinafter the 'Centre') and MIS Centre.

7.1.1.   Technical Capacity in GIS

(1)   Geomatics Centre

The Centre at the Principal Chief Conservator of Forests Office in Chennai was established under the TAP 1 with funding from the JBIC in 2000. The Centre operates with active technical cooperation from the National Remote Sensing Centre (NRSC) in Hyderabad, Telangana State, and the FSI in Dehradun, Uttarakhand State.

The Centre has three units: (1) the Map and Image Library; (2) the Analysis Lab; and (3) Training.

The Centre is managed by a dedicated team of GIS personnel trained in India and abroad, including the International Institute for Aerospace Survey & Earth Observation (ITC) from the Netherlands, the NRSC, and the FSI for handling projects related to forestry and GIS. There are about seven staff members. The Centre's manpower availability is shown in Table 7.1.

Table 7.1: Human Resources of the Centre (as of July 2021)

S.No	Designation	Sanctioned Post	People in Position	Vacancy
1	Additional Principal Chief Conservator of Forests (IT)	1	1	0
2	Deputy Conservator of Forests (GIS)	1	0	1
3	Senior System Manager	1	0	1
4	Forest Range Officers	4	0	4
5	Forester	2	5	0
6	System Analyst	1	0	1
7	Assistant Programmer	1	1	0
8	Data Entry Operator	1	0	1

Source: Prepared by the Study Team based on a questionnaire survey of the Geomatics Centre

The Centre is equipped with necessary workstations, GIS, and image processing software for its analysis work. Available facilities are shown in Table 7.2.

Table 7.2: GIS/Remote Sensing Software and Hardware Available at the Centre (as of July 2021)

Name	Quantity	Remarks
Erdas Imagine	4	Remote Sensing software
ArcGIS (10.5)	5	GIS software
Windows Workstation	8	
Plotter	2	
Scanner	0	
Printer (Multi-functional device)	2	
Differential Global Positioning System (DGPS)	0	

Source: Prepared by the Study Team based on a questionnaire survey of the Geomatics Centre

The sanctioned budget and expenditure in fiscal years 2016 to 2020 are summarised in Table 7.3. For fiscal years 2018-2019 to 2020-2021, the relevant information is not available to date.

Table 7.3: Budget and Expenditure of the Centre

FY	Allocated Budget (in Lakhs)	Expenditure (in Lakhs)
2016-2017	3.96	3.96117
2017-2018	10.23	10.23
2018-2019	-	-
2019-2020	-	-
2020-2021	-	-

Source: Prepared by the Study Team based on a questionnaire survey of the Geomatics Centre

The vision and mission of the Centre is to strengthen field-based applications of remote sensing and GIS by making use of the latest Information and Communication Technology (ICT), contributing to the planning, monitoring, and evaluation of projects implemented, and providing a decision support system to the planners and policy makers of the TNFD.

The foremost activity undertaken by the Centre is the preparation of a digital database of administrative units, which is the basis for decision-making. The database is updated immediately upon getting authenticated data from the divisions. A special drive in this regard was initiated in September 2018.

The objectives of the Centre are as follows.

- Forest administration database creation and update, including the digitisation of designated forest boundaries;
- District Forest Atlas preparation;
- Creation of database at cadastral level ('Beat maps') for field officials;
- Mapping vegetation and vegetation change analysis using high resolution satellite imagery;
- Mapping Eco Sensitive Zones for Protected Areas;
- Annual forest fire burnt area assessment ('Fire sensitive Beat maps');
- Daily fire alerts using Moderate Resolution Imaging Spectroradiometer (MODIS) data from the Suomi National Polar-Orbiting Partnership (SNPP) during the fire season; and
- Preparation of work plan maps.

As for methodologies developed, approaches to GIS analysis have been indigenously developed under the following.

- Database creation of forest administration;

- Digitisation, coding convention, and image classification;
- Accuracy assessment, generation of statics, and data retrieval;
- Forest fire risk mapping and modelling;
- Coastal zone vegetation mapping;
- Vegetation change detection and analysis; and
- Wildlife habitat mapping.

The main data layers and maps currently available at the Centre are shown in Table 7.4.

Table 7.4: Data Layers and Maps Available at the Centre (as of July 2021)

No	Name	Coverage	Remarks
1	1:50,000 scale Survey of India (SOI) topographic map	State	- Basic data for database creation. - The entire area of Tamil Nadu is covered in 221 sheets of maps.

2	Administrative boundary (District, Division, Range and Beat)	State	- All 220 data sheets were edge matched, attributes checked with adjacent sheets, and reference attribute data sheets prepared. All 220 data sheets were scanned and digitised. For each district, the digitised sheets were merged, polygons created, and attributes assigned based on reference attribute data sheet.
			Details of vector layer information (in numbers) available:
			    Revenue Districts: 38
			    Forest Divisions: 45
			    Forest Ranges: 217
			    Forest Beats: 1,499
			    RF Blocks: 2,344
			    RL Blocks: 323

3	Reserved Forests (RF) boundary/ Reserved Lands (RL) boundary	State	- Boundaries of RF blocks, which were available on SOI topographic maps, were digitised following the boundaries given on topographic maps. - Boundaries of RF blocks and RL, which were not available on topographic maps and other administrative units like Division/Range/Section/Beat, were digitised based on the data provided by District Forest Officers/Wildlife Wardens/Deputy Directors on tracing film (with reference to a 1:50,000 scale SOI topographic map) or Global Positioning System (GPS) coordinates. - In 2019, the Honourable Chief Minister announced under Rule 110 on the floor of the Legislative Assembly a project called the 'DGPS Survey of Notified Forests of Tamil Nadu', under which the boundaries of RF and RL will be surveyed with the latest technology of DGPS/Total Station (TS), depending on the circumstances to create more accurate database.
4	Forest cover/ Forest types	State	- The state of Tamil Nadu has reported the extent of Recorded Forest Area (RFA) as 22,877 km^2, which is 17.59 % of its geographical area. Of this, 20,293 km^2 is RF (88.70 %), 1,782 km^2 is Protected Forest (PF) (7.79 %), and 802 km^2 is Unclassed Forest (UF) (3.51 %). As per the Indian State Forest Report 2019: - Forest Cover in Tamil Nadu is 26,364.02 km^2, which is 20.27 % of the state's geographical area. In terms of forest canopy density classes, it has 3,605.49 km^2 under Very Dense Forest (VDF), 11,029.55 km^2 under Moderately Dense Forest (MDF), and 11,728.98 km^2 under Open Forest (OF). - Tree cover in Tamil Nadu has been estimated at 4.830 km^2. Tree cover in Tamil Nadu has increased by 159 km^2 compared

No	Name	Coverage	Remarks
			to the previous assessment.
			- Trees outside Forests (TOF) refer to tree resources found outside of forests as defined in government records. The extent of TOF in Tamil Nadu is 13,605 km^2.
			- First, a preliminary field visit was conducted in the region of the study, and then a satellite image of IRS-P6 LISS-3 pertaining to the year 2006 has been classified based on the Champion and Seth (1968) [82] classification system. The classified map has been checked and verified based on ground points collected from area of the study.
			- Classification: Tropical wet evergreen forest; Tropical semi-evergreen forest; Tropical dry evergreen forest; Tropical thorn forest; Tropical moist deciduous forest; Tropical dry deciduous forest; Sub-tropical hill forest; Montane wet temperate forest; Littoral and swamp forest; Eucalyptus, cashew and casuarina; Wattle; and Water.
			Designated Forests: https://www.forests.tn.gov.in/app/webroot/img/document/NF-1.jpg
			Forest Type Groups: https://www.forests.tn.gov.in/app/webroot/img/document/FTG-2.jpg
			Protected Areas: https://www.forests.tn.gov.in/app/webroot/img/document/PA-3.jpg
5	Afforestation areas	State	- Forest area treated under the TAP 2.
6	Eco-Sensitive Zone for each Protected Area	State	- Based on data provided by Wildlife Wing.
7	Fire sensitive beats	State	- Based on a study on spatial and temporal analysis of decadal MODIS fire data.
8	Fire incident areas	State	- Based on MODIS Rapid Response System – Web Fire Mapper.
9	Fire vulnerable zones	State	- Prepared by the Geomatics Centre based on the study 'GIS Based Multi Variable Analysis to Assess Forests' Vulnerability to Fire'.
10	Reservation areas and conservation areas	State	- Includes National parks; Conservation areas; Tiger reserves; Elephant reserves; Birds sanctuaries; Wildlife sanctuaries; and Biosphere reserves.
11	Ecotourism sites	State	- Point data based on data provided by the Tamil Nadu Biodiversity Conservation and Greening Project (TBGP).
12	Wildlife conflict sites	State	
13	Mangrove mapping	State	
14	Water bodies, marsh & wetlands	State	- Includes: Water bodies; Prioritised wetlands; and Littoral & Swamp Forests.
15	Tanks and reservoirs	State	- Includes: Reservoirs and tanks; and Lakes and ponds. - Based on SOI data.
16	Roads	State	- District roads.
17	Rivers	State	- Based on SOI vector layer prepared by the Geomatics Centre.
18	Villages	State	
19	Cities	State	- Major cities vector layer prepared by the Geomatics Centre.

[82] Champion, Harry George, and Seth, Shiam Kishore. 1968. *A Revised Survey of the Forest Types of India.* Delhi, Manager of Publications.

No	Name	Coverage	Remarks
20	Population (Census 2011)	State	

Source: Prepared by the Study Team based on a questionnaire survey of the Geomatics Centre

The database is updated immediately upon getting authenticated data from division/circle offices.

There are around 180 satellite images, shown in Table 7.5, available in the Centre.

Table 7.5: Satellite Imagery Available in the Geomatics Centre (as of July 2021)

No.	Name	Type	Coverage	Remarks
1	IRS P6 Advanced Wide Field Sensor (AWiFS)	Multi-spectral	Part of Tamil Nadu	- Used for fire burnt area assessment.
2	STUCOOGTV	Multi-spectral	Duddalore District	- Used for evaluation of massive tree planting programme in the district of Duddalore (project study)
3	STUCOOGTV	Multi-spectral	Tamil Nadu	- Used for fire vulnerability study.
4	Resource 2 AWiFS	Multi-spectral		- Used for fire study.
5	IRS 1D LISS 3	Multi-spectral	Tamil Nadu	- Used for analysis work.

Source: Prepared by the Study Team based on a questionnaire survey of the Geomatics Centre

Using the above-mentioned data and software, and other relevant equipment, the Centre is currently responsible for the following specific activities.

- Preparation of GIS based working plan maps,
- Mapping of departmental resources like division offices, range offices, check posts, nurseries, timber depots, forest extension offices and research centers,
- Updating of forest administrative boundaries as per recent reorientation of areas,
- Updating of forest fire alerts in GIS database and coordinating with field units for ground verifications and mitigation,
- Assessment of forest fire burnt area and fire zone mapping,
- Updating of the forest offence database and assessment of vulnerable zones and hotspots,
- Digitization of gazette notifications and paper maps on reserve forests and reserve lands,

To sum up, a lot of data and maps are currently available. Because of the data restriction policy, basically data cannot be shared with outsiders, including the study team of the TBGCP (hereinafter "the Study Team"). At the same time, data generated at the TNFD can be shared with the Study Team, while data generated by agencies outside of the TNFD and shared with the TNFD only for specific purposes cannot be shared with the Study Team. In the TBGP, an expert from the study team of the TBGP worked at the Centre and made a direct request to the designated staff to generate the necessary maps on site.

(2)   Other GIS Facilities

The TNFD has set up GIS facilities at the circle level and territorial division level offices, including two GIS labs at Tamil Nadu Forest Academy (TNFA) in Coimbatore and Tamil Nadu Forestry Training College (TNFTC) in Vaigai Dam. The GIS labs at Coimbatore and Vaigai Dam are used for the purpose of training. The circle and division level offices are provided with the GIS software, hardware, GPS, and data layers necessary for their management work. Though it was reported that the division level offices were provided with GIS software during the year 2011-12, the work record for GIS data processing at these offices could not be found during this preparatory study for the TBGCP. In the circle level offices, the Junior Drafting Officers (JDOs) and Senior Drafting Officer

(SDO) handle GIS operations, while data entry operators and biologists handle the GIS operations in some division level offices. The field survey is carried out by implementing officers such as foresters and forest guards. In some cases, the GIS maps of plantation sites are also prepared by newly recruited foresters using a source GIS application. The major GIS activities performed at field offices are as follows:

- Maps of the planation sites;
- Maps of civil works;
- Maps required for the issue of No Objection Certificates (NOCs);
- Maps of tree felling sites;
- Maps of encroachments sites;
- Maps of wildlife poaching sites;
- Maps of land diversion sites; and
- Project/scheme-related maps

(3)   GIS Training

In the past, the Centre provided GIS training to a total of nearly 1,000 field staff members including rangers, foresters, and forest guards on different topics such as the use of GPS for field surveys, digitization, digital image interpretation, and thematic map preparation. Currently, however, the activities relevant to training are completely entrusted to the TNFA in Coimbatore and the TNFTC in Vaigai Dam.

The persons deputed to the Centre had completed trainings at national or international institutes like the Indian Institute of Remote Sensing (IIRS) in Dehradun, the NRSC in Hyderabad, Indian Institute of Survey and Mapping in Hyderabad, FSI in Dehradun, ITC Netherlands, IIT Bombay, Anna Institute of Management, the Centre for Survey Training and Research, and the Anna University in Chennai. The staff (five foresters) currently deputed to the Centre completed various short-term training courses at different institutes. The details of training themes and institutes are shown in Table 7.6.

Table 7.6: Details of Training Themes and Institutes

Sl.	Training Themes	Training Institutes	Duration	Persons trained	Year of Training
1	DGPS Survey, Land Information System and Total Station	Indian Institute of Survey and Mapping, Hyderabad	4 weeks	4	2020, 2021
2	Remote Sensing Application for Land Resources Management	National Remote Sensing Centre, Hyderabad	12 days	1	2019
3	Remote Sensing & GIS Technology and Applications	Indian Institute of Remote Sensing, Dehradun	3 weeks	2	2020
4	Application of Drones/DGPS in Forest Survey and Demarcation	FSI, Dehradun	5 days	5	2019, 2020
5	QGIS and Its Application in Forest Resources Assessment	FSI, Dehradun	1 day	4	2020
6	Training Program on Modern Surveying Using GPS, DGPS and Total Station	Centre for Survey Training and Research, Anna University, Chennai	2 weeks	1	2021
7	Cybersecurity for Organisational Habits	Anna Institute of Management	3 days	2	2020
8	Cybersecurity Awareness	Tamil Nadu State Data Centre (TNSDC), Electronics Corporation of	1 day	1	2021

		Tamil Nadu (ELCOT), Perungudi, Chennai			
9	Workshop for QGIS	Spoken Tutorial, IIT Bombay	5 days	4	2020

(4) GIS Use in the TBGP

In the TBGP, maps were prepared using GIS for all types of project interventions. For instance, the GPS coordinates of project intervention sites were collected by field officers such as foresters and forest guards. Some thematic maps were prepared using collected GPS point and track data. These map layers and their attribute data were added to an integrated MIS-GIS software (GIS web application) platform. The base forest administrative layers and forest area layers were provided by the TBGP. The data and coordinates uploaded in the GIS application by the field offices are monitored at the Project Management Unit (PMU). As a result, map layers like plantation areas, the locations of wetlands, critically endangered species, critical habitats, national parks, sanctuaries, protected areas, the movement of wildlife, crop raids, causality, ecotourism sites, ecodevelopment sites, and infrastructure became available for division/range offices and also through the GIS web application, which was developed by a private vendor through the TNeGA.

7.1.2. Technical Capacity in MIS

(1) MIS Centre

The MIS Centre is a branch of the IT Wing of the TNFD. It was established in 2000 to address the IT requirements of the TNFD. The Tamil Nadu Forest Department Management Information System (TNFMIS) is operated and maintained by the MIS Centre at the office of the PCCF in Chennai.

1) Objectives of the MIS Centre

The objectives of the MIS Centre are shown below.

- To reduce the duplication of tasks and efforts;
- To achieve timely access to consistent and accurate data;
- To improve communications across departments and levels; and
- To provide fast and efficient services to both governmental offices and the public through capacity building of the staff

2) Functions of the MIS Centre

The MIS Centre has five main functions: (1) Computerization and maintenance; (2) Website development and maintenance; (3) Software development and maintenance; (4) Video conferencing; and (5) Networking through the Tamil Nadu State Wide Area Network (TNSWAN) and Wi-Fi. These main functions of the MIS Centre are examined below.

a. Computerization and Maintenance

Computers were provided in 2001 and have been used since then at TNFD headquarters and at its local offices, including division and range level offices. The MIS Centre plays a key role in providing and maintaining computers for the smooth functioning of office work. Computer servers with proper applications are installed and utilized for MIS and GIS software applications. The TNFMIS web application, with five main modules and nineteen submodules, was installed in a local server for the purposes of online data collection, storage, and retrieval. The integrated GIS web application and Financial Management and Accounting System (FMAS) of TBGP was also installed in the local server at the Geomatics Centre.

At the same time, the regular maintenance of IT products after the expiration date of their warranty period is conducted by the MIS Centre. A hardware maintenance agency engaged through the Electronics Corporation of Tamil Nadu (ELCOT) takes care of major hardware failures.

b.   Website Development and Maintenance

A comprehensive website for online presence and public awareness has been hosted exclusively for the TNFD. Initially, the website was developed and maintained by the National Informatics Centre in 2005. In order to make the TNFD website more interactive and useful, it was redesigned with additional features like a quickly loading home page, compatibility with major internet browsers/mobile devices with Android/iOS, and a secured administrative portal with a content management system. The website shows various aspects of the department's functions, policies, and laws (e.g. acts and rules pertaining to the TNFD, eco-tourism, and research and education), with relevant illustrations and FAQs.

c.   Software Development and Maintenance

The MIS Centre has developed the TNFMIS, with work provided by private vendors hired through the ELCOT. The TNFMIS application has five main modules and nineteen submodules. The MIS Centre designed the data forms for each module, the dataflow process, and the database in coordination with the vendor hired for development of the MIS web application. The MIS Centre is also responsible for the operation, maintenance, and troubleshooting of the TNFMIS application.

Besides the MIS application and the TNFD website, the MIS Centre also assisted the development of separate web pages/web applications created to facilitate the process of recruitment of frontline staff such as foresters, forest guards, forest guards with driving licences, and forest watchers through the Tamil Nadu Forest Uniformed Services Recruitment Committee (TNFUSRC) and online applications for the issue of permits for tree felling and tree transit. This type of digital solution was developed under the e-governance or the Ease of Doing Business (EODB) strategy to ensure transparency and time-bound action. Regarding the development of specific web applications, private vendors were hired through the ELCOT.

d.   Video Conferencing

Multi-point video conferencing facilities have been installed at several locations to accommodate online/virtual meetings between head offices and all circle and division level offices. The video conferencing facilities were installed and have been operated and maintained under the supervision of the MIS Centre.

e.   Networking through TNSWAN & Wi-Fi

The TNFD has an agreement with the IT department of the government of Tamil Nadu State to access the dedicated internet connectivity of the TNSWAN. Internet facilities had been provided to different offices ranging from the headquarters to range level offices. The Local Area Networking (LAN) and Wi-Fi facility has been established at the headquarters. Support for uninterrupted internet service is provided by the MIS Centre. Currently, the internet networking facility is directly managed by the TNeGA.

(2)   Operational MIS in TNFD

1)   TNFMIS

a.   Overview of the TNFMIS

The TNFD has a huge physical information base, which it updates regularly. The information is related to forest, plantations, protection, wildlife, human resource, administration, finance, project related activities, products and services, research and extension, public utilities, and other relevant

information at different offices and in different locations. Accessing these data is a critical but time-consuming process. Due to inappropriate storage facilities and procedures, the risk of losing valuable information can become a major concern. To secure this valuable information base, IT tools need to be utilized in an efficient manner. The efficient use of IT tools plays a vital role in planning, management, and monitoring in forestry, especially to increase the speed of administrative work, productivity, efficiency, transparency, accountability, and decision-making.

Figure 7.1 illustrates an overview of the existing TNFMIS. First, the field data are prepared at range offices in offline formats, reports, etc. Second, the data are verified at division level offices and uploaded in the MIS application. Third, circle level offices can access the data available on the MIS. Finally, the MIS Centre monitors the progress, validates the data, and operates and maintains the application.
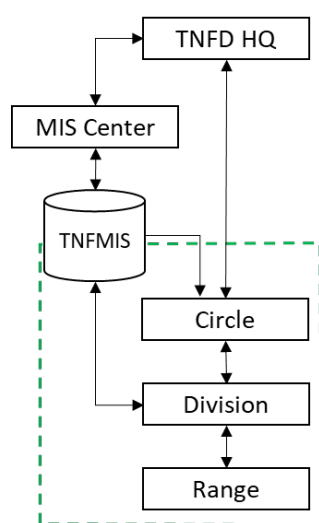
Source: Based on interviews with the TNFD

Figure 7.1: Overview of the TNFMIS

The TNFMIS application was developed to integrate planning, implementation, monitoring, assessment, and reporting through the systemic collection, storage, and retrieval of data. The TNFMIS application will use a computer-based communication network to make forestry information readily accessible to all stakeholders and improve administrative work in government offices. The TNFMIS has the facility to collect data directly from division and range offices. The applications have five main modules and nineteen sub-modules, as shown in Table 7.7:

Table 7.7: Modules and Sub-Modules in TNFMIS

No.	Main Module	Sub-Module	Description
1	Stores and Infrastructure Management System	i. Vehicle Purchase and Distribution ii. Arms and Ammunition Purchase and Distribution iii. Article Purchase and Distribution	The objective of the Stores and Infrastructure Management System is to be a part of the integrated administrative system to automate stores and infrastructure management.
2	Plantation Management System	i. New Plantations ii. Annual Report iii. Sales Report	A plantation is a large artificially established forest grown for sale. Crops grown on plantations include fast-growing trees (often conifers), cotton, coffee, tobacco, sugarcane, sisal, some oil seeds (notably oil palms), and rubber trees.

No.	Main Module	Sub-Module	Description
			This system is used to capture the particulars of social forestry plantations raised, the number that has survived, plantation maintenance costs, and the date of enumeration, height, girth, and year of felling.
3	Natural Forest Management System	i. Forest / Lease Info ii. Diverted Land iii. Compensatory Afforestation Fund Management and Planning Authority (CAMPA) Land iv. Calamities	Natural forest originates from the original forest cover which consists of naturally immigrant tree species. This system is used to capture the details of natural forest plantations, including a database of forest vegetation types, forest cover, RF/RL details, watershed details, natural calamities, etc.
4	Forest Working Plan Management System	i. Upload ii. Plan control Entry / Prescription / Report iii. Track Status iv. Downloads	There has been a long tradition of documented planning. These plan documents are called "Working Plans". Working Plans are prepared for the management of natural forest areas for a period of ten years. Normally, a forest division is the unit for the preparation of a Working Plan. The status of all of the Working Plans and their prescriptions in respect to all of the divisions will be monitored under this system.
5	Forest Vigilance Information System	i. Tapal Management ii. Tapal Tracking iii. Petition Management iv. Petition Tracking v. Generate Reports	This module is significant in the conservation of forests, especially with reference to encroachment and fire protection issues. The module will also have details on the working and status of Forest Protection Squads. The monitoring of petitions related to protection issues is conducted from the receipt of tapal through the submission of enquiry report.

Source: Prepared by the Study Team based on DPR & TNFD website

Though the TNFD started using the TNFMIS, it has not been effectively implemented at all office levels, including range offices. To strengthen the MIS Centre, a strong TNFMIS framework is required.

b.   Issues in TNFMIS implementation

Some possible issues regarding MIS implementation are given below.

- Shortage of staff: In the MIS, primary data are collected from range offices. Range offices, however, do not always have dedicated operators to enter the primary information into the MIS application.

- Lack of connectivity: The range offices are located in rural areas near forest areas and are not covered with high speed internet connectivity. Though many offices are connected with the TNSWAN, and the rest of the offices are provided with dongles and alternate internet connectivity, many offices are still outside of internet coverage areas.

- Limited IT infrastructure: The IT infrastructure at field offices is limited. PCs are usually used for urgent office work. The lack of a proper power backup system and timely maintenance service is also another major issue.

- Need for improvement of procedures: The data in the MIS application are entered by data entry operators at the division level, using the range office user ID and password. The entered data need to be verified by the officer concerned and finally submitted to a

data entry operator for approval to upload the data into the application. In this regard, the procedure and time schedule for entering the latest data need to be improved.

- Technical issues in MIS application: Due to the firewall and other maintenance issues in the server, the MIS application is sometimes not accessible for data upload and data retrieval.

- High dependency on paper work: The officers at the TNFD headquarters may feel more comfortable with paper-based reporting work. A reporting system based on the MIS application needs to be introduced efficiently to the existing work environment.

- Difficulties with time management because of regular protection and patrolling work: Field officers such as foresters and forest guards are usually busy with protection and patrolling work, and these officers cannot spare enough time to submit data to the MIS in a timely manner.

c.   Proposed Activities for the TNFMIS

Considering the issues mentioned above, four activities are proposed to further strengthen the TNFMIS. These are: (1) Applications development; (2) Data centre establishment; (3) Improvement of communication network and real-time monitoring facilities; and (4) Capacity building on ICT.

c.1.   Applications Development

New applications need to be developed to strengthen the TNFMIS framework:

- Wildlife management system;
- Forest protection and management system;
- Forest offence management system;
- Forest financial management system;
- Human resources and personnel management system;
- Library resources management system;
- Progress report management system; and
- E-services management system

c.2.   Data Centre Establishment

A data centre designated for the deployment of a database infrastructure to accommodate future user traffic consisting of departmental users and the public is the first requirement for implementing the TNFMIS. Adequate infrastructure can further promote the department's e-governance initiatives. The database framework will be constantly operated to provide seamless services to the users.

c.3.   Improvement of Communication Network and Real-time Monitoring Facilities

The field offices that do not have internet connectivity due to the non-availability of an Internet Service Provider (ISP) need to be connected first to have seamless access to the TNFMIS framework. As needed, an alternate mode of internet accessibility needs to be explored and provided.

c.4.   Capacity Building on ICT

The full-fledged implementation of the TNFMIS will provide a new work platform/alternate working environment to approximately 30,000 employees at various levels of the TNFD. It is necessary to improve the skills of the manpower for the successful implementation of the TNFMIS. Training needs for various categories of employee need to be identified based on the type of work and role assigned to them.

2)   TBGP MIS

TBGP also developed an MIS application (TBGP MIS), with work provided by a private vendor hired through the ELCOT, for data collection, storage, and retrieval. Figure 7.2 illustrates the overview of the TBGP MIS. First, the field data are prepared at Forest Extension Centres (FECs) and range offices in offline formats, reports, etc. Second, the data prepared at ranges are verified at division level offices and uploaded in the TBGP MIS application. Third, the data prepared at the FECs are directly uploaded in the TBGP MIS application at the FECs. Fourth, circle level offices can access the data available on the TBGP MIS application. Finally, the PMU monitors progress, validates the data, and operates and maintains the application through the private vendor.
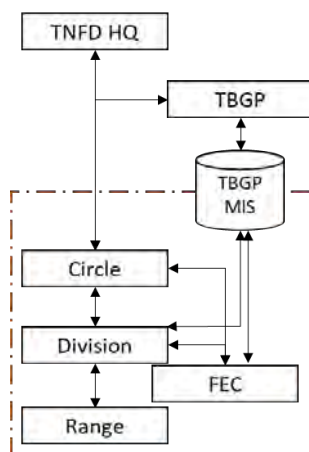
Source: Based on interviews with the TNFD

Figure 7.2: Overview of the TBGP MIS

The TBGP MIS is an integrated application of the MIS-GIS and the FMAS. The range wise data in the TBGP MIS application is uploaded by the data entry operators at division level offices and FECs. The TBGP MIS application covers all of the activities in different components such as biodiversity, ecodevelopment, tree cultivation, capacity development, and civil works, and the sub-modules cover detailed activities under these components (Table 7.8). The TBGP MIS application also has a report section to view a summary of data entry.

Table 7.8: Modules and Sub Modules Available in the TBGP MIS

Component	Module	Sub-Module 1
Biodiversity	Wetland Management	Inventorization of Flora and Fauna
		Avian Fauna
		Monthly Bird Visit
	Critically Endangered	List of Species (Endangered Flora)
		Immunization of Livestock
	Improve Critical Habitats	Monitoring Invasive Species
		Base-Line Survey
	Guindy National Park	Improve Water Storage Capacity
		Base-Line Survey
		Monitoring of Emergent Species
	Vallanadu BB Sanctuary	Improve Water Storage Capacity
		Base-Line Survey
		Monitoring Of Emergent Species
	Other Protected Areas	Improve Water Storage Capacity
		Base-Line Survey
	Resource Protection (FPE)	Fire, Encroachment, and Poaching
	Resource Protection (RF)	Resource Protection (RF)

	Human Wildlife	Elephant Migration
Ecodevelopment	Socio Economic & Forest Dependency	Forest Dependency
		Alternative Livelihoods for Forest Dependents
	30 Villages	Capacity Building for Field Staff
		Community-based Organisation
		Study Tours for EDC
		Community Development Work
		Income Generation Activity through MC and RF
		Name of SHG
	33 Villages	Capacity Building for Field Staff
		Study Tours for VFC/SHG
		Community-based Organisation (CBO)
		Income Generation Activity through MC and RF
		Name of SHG
	Community-based Ecotourism	Capacity Building for Stakeholders-Forestry Staff
		Capacity Building for Stakeholders-Other Members
		Community-based Ecotourism (Infrastructure Detail)
	Employment Creation in CBET	Employment Creation in CBET
Tree Cultivation	Tree Cultivation	Monitoring of Seedlings
		Selection of Models by Farmers
		Monitoring Result of Individual Site
Capacity Development	Capacity Development	Training Conducted for Capacity Development
		Scheduled Training Program
	Civil Work	Civil Work

The existing TBGP MIS application needs to be strengthened with additional features, such as an interactive dashboard, activity calendars, alert notifications, and progress indicators, and be utilized by various officers for different purposes. Local officers need to use the TBGP MIS application for uploading data and preparing reports, while officers such as managers and administrators need to use the TBGP MIS application for planning, progress tracking, and the monitoring of activities.

(3) Other Relevant Agencies in the MIS

1) Tamil Nadu e-Governance Agency (TNeGA)

The TNeGA is a state-level nodal agency under the Department of Information and Technology in the government of Tamil Nadu for the support of all e-Governance initiatives of the state. TNeGA is implementing various e-governance modules in association with the state departments for easy and time-bound delivery of citizen services. The TNeGA has implemented G2C projects such as e-District, Common Service Centres (CSCs)/the e-Sevai Centres in Rural and Urban areas, Capacity Building (CB) in ICT & Tools, Tamil Nadu Geographical Information System (TNGIS), State Resident Data Hub (SRDH), and State Services Delivery Gateway (SSDG).

The state government of Tamil Nadu has a vision of delivering all citizen services offered by various departments in one single window platform under e-Sevai services. To achieve this vision, the TNeGA has prepared a DPR in consultation with the TNFD. The DPR shows a list of government-to-citizen (G2C) online services and applications to be developed for the TNFD, including fourteen government-to-government (G2G) and nine government-to-business (G2B) online services and applications. The TNFD has approved the development of twelve G2C and four G2B online services and applications. These twelve G2C and four G2B applications will be hosted on the e-Sevai portal shortly, while the development of other modules is in process.

2) Electronics Corporation of Tamil Nadu (ELCOT)

The ELCOT is a public sector undertaking (PSU) of the government of Tamil Nadu to provide

assistance for the development of electronics in the state. The ELCOT is a primary procurement agency for electronics and IT products and services. The ELCOT has also established a total of eight IT Special Economic Zones (SEZs) in different cities of the state and created IT infrastructure, including the TNSWAN, Tamil Nadu State Data Centre (TNSDC), Disaster Recovery Centre (DRC), and a cloud environment. The TNFD is closely associated with the ELCOT for the strengthening of IT infrastructure. All IT hardware, software, and services are procured through the ELCOT, and the private vendors for the development of the website, MIS, and citizen services portals were also hired through the ELCOT.

7.2. Monitoring and Evaluation

7.2.1. Overview of Current Monitoring and Evaluation

The TNFD has a standard process for the monitoring of all activities. At the forest headquarters level, the APCCF (Protection, Vigilance and Wildlife Crime Bureau (PV & WCB)) monitors the protection of forests and wildlife, intelligence, and crime records, as well as the functions of all forest protection teams in the state. The FMAS section functioning under the APPCF (PV & WCB) conducts an annual review. Such matters as the illicit felling of trees, the cultivation of ganja, the occurrence of fires, encroachment, the illegal transportation of sand, and the poaching of wild animals are the major focus of monitoring. In addition, at the state level, the Geomatics Centre also conducts the scientific monitoring of selected plantation sites using remote sensing technology.

At the field level, field officers such as range officers and foresters are fully responsible for the plantations and for other activities. The field officers need to monitor 100% of intervention activity, while officers like the Assistant Conservator of Forests (ACF) is responsible for monitoring 50% of intervention activity and the District Forest Officer (DFO) is responsible for monitoring 10% of intervention activity through field inspection. Higher-level officers are also involved in field inspection at selected sites. The protection staff, such as forest guards and watchers, also have special responsibility for monitoring. The activity-specific registers are maintained at range offices and beat offices. The observations made on inspections are recorded in these specific registers. Comments or remarks given by higher officials have to be implemented by field officers, and compliance reports also need to be maintained for future reference.

Besides the aforementioned activities at headquarters and at the field level, several thematic studies are conducted in association with resource organisations or institutes from time to time in order to monitor and measure the status of forest cover, wildlife, biodiversity, forest soil health, and forest fires. At the same time, the TNFD also implements different monitoring and evaluation schemes supported by the central government and the state government along with externally aided projects. All of these schemes have a different monitoring and evaluation mechanism to monitor the progress and quality of activities.

Each project has a monitoring and evaluation structure with a specified PCCF as the head of the monitoring component of the project. The TNFD has its own monthly review mechanism in which each district/division follows a monthly reporting format for the status of all the activities along with the financial status with respect to the corresponding activity. The respective DFO of each district also monitors the respective range offices' activities through inspections without advance notice, receives monthly updates regarding the assigned activities, the status of monthly financial statements, and reconciliation statements. The key activity of range offices is protection, and they get their daily updates from their team of foresters. The range officer heads the range for which the officer conducts physical monitoring on a regular basis and updates the DFO on a priority basis apart from their weekly and monthly reports. The foresters are field staff members who conduct daily monitoring of their allocated areas and report the conditions back to the range officer.

Further, at present, the Research Wing is also working closely with the FEC by involving the centres

in demonstration activities, which is monitored and reported directly to the State Forest Research Institute. Although the work conducted by the FECs is monitored by the DFO, the FECs report their activities to respective CF in circle offices. Their budgets are approved by circle offices, and the status are monitored are evaluated by circle offices. The TNFD does not have a designated wing exclusively for monitoring and evaluation, while the TBGP has assigned an exclusive PCCF for monitoring project activities.

7.2.2. Monitoring & Evaluation Framework in the TBGP

The TBGP has a robust monitoring and evaluation framework which covers monthly review meetings, monthly and quarterly progress reporting, the financial management and accounting system, integrated GIS-MIS web application, statutory audits, internal audits, baseline surveys, mid-term evaluations, end-term evaluations, thematic and impact assessments studies, participatory monitoring, activity registers, and photo and video documentation. The TBGP developed a project implementation structure wherein monitoring flow exists between the PMU, Divisional Management Unit (DMU), Field Management Unit (FMU), and Project Management Consultant (PMC). Major features of the framework, including the flow of information at various levels, are discussed below.

The High Level Executive Committee (HLEC) is the highest body responsible for the TBGP. The PMU works under the HLEC, providing technical and programmatic inputs to the HLEC. DMUs and FMUs report to their respective CFs. FMUs are responsible for field level implementation of all of the activities with the support of various committees such as EDC, VFCs, and SHGs.

A logical framework is being developed and referenced during the monitoring process, where impact assessment is being conducted, followed by the tracking of indicators, sustainability plans, and process documentation. Both qualitative and quantitative indicators are developed in the log-frame, which will help the project in measuring and monitoring the inputs and outputs of the project, and impact evaluation through outcome indicators.

TBGP project implementation at the ground level is largely dependent on VFCs, SHGs, EDCs, and Farmer Interested Groups (FIGs). Hence, there is a strong need to adopt a monitoring and evaluation system to ensure that the outputs are produced and delivered in a timely manner as scheduled. The TBGP also follows an approach, called Process Monitoring and Learning, which will help monitor project processes where SHGs and FMUs develop the indicators.

A comprehensive web-enabled MIS system is to be developed along with the reporting formats at different levels to track the inputs and outcomes of the TBGCP. All of the data are collected and incorporated from the field level at the FEC in the MIS.

The FMUs monitor the activities of EDCs, VFCs, and SHGs through a Micro Plan, Annual Operation Plan, and Monthly Action Plan. At the level of EDCs, VFCs, and SHGs, the Executive Committee reviews their activities every month and plans for the next month. During the review, existing gaps should be suggested and monitored. At the FMU level, meetings of the Executive Committee of EDCs and VFCs are organised to review all of the activities. The FMUs also physically inspect the field, review documents, and interact with members. The FMUs also support the EDCs in preparing their monthly plans and submit monthly reports to the DMUs.

The DMUs compile the report of responsible FMUs and prepare a monthly progress report and submit it to the Project Director (PD) at the PMU, who confirms the report's contents and then submits a Quarterly Report/Action Plan to the Chief Project Director (CPD). The TBGP also proposed Annual Review meetings at both the state and DMU levels, as well as similar review meetings conducted by both DMUs and FMUs at the level of EDCs, VFCs, and SHGs.

7.3.   Institutional Arrangement

Institutional arrangement is an important part of an organisation for achieving the objective of a future project through the systematic and timely implementation of proposed activities. In the TBGCP, it was envisaged that the outcomes of the activities of the TBGP would be taken forward along with marine biodiversity conservation and combating forest land and wildlife habitat degradation, as well as climate change measures. The TBGCP is to be fully implemented by the TNFD and its field level units. The institutional setup of the TNFD is as follows:
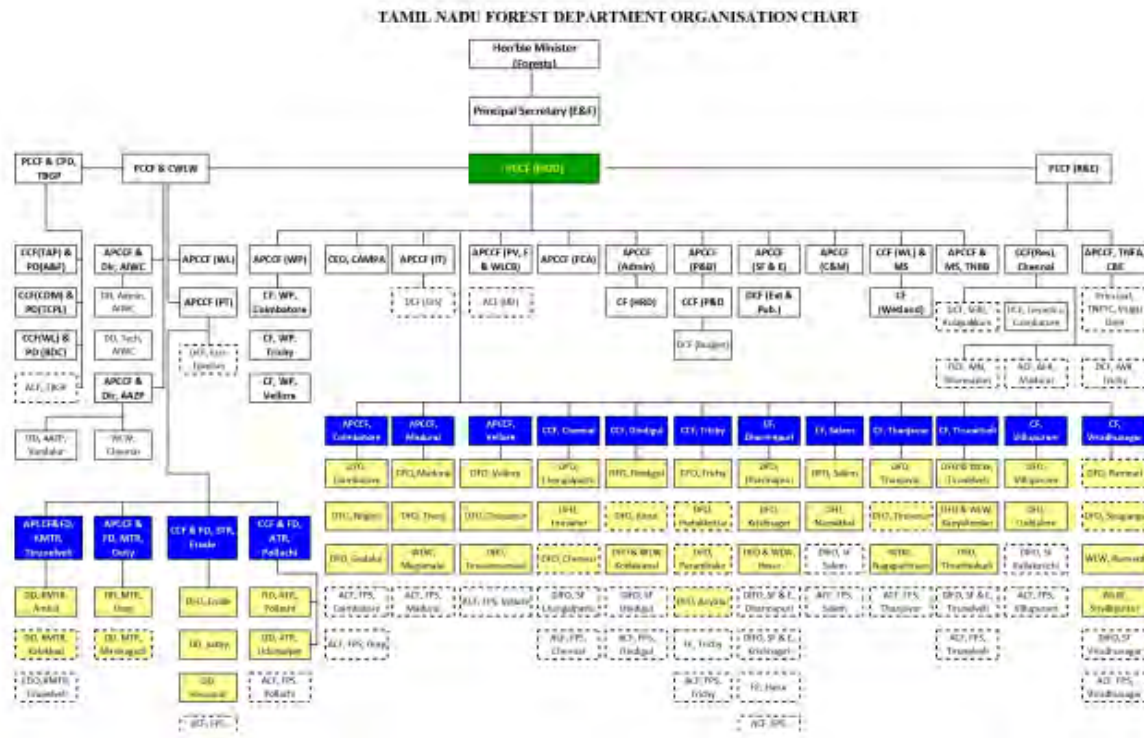
Source: TNFD website

Figure 7.3: Organisational Chart of the TNFD

The TNFD is headed by the PCCF (Head of Forest Force), with forest department headquarters located in Chennai. At the headquarters level, the TNFD has four main divisions, including territorial, wildlife, research and extension, and projects. The territorial division of the TNFD mainly deals with protected and reserved forests, while the wildlife division deals with wildlife, sanctuaries, protected areas, wildlife conservation areas, zoos, and national parks. At the same time, the research and extension division deals with all research, education, and training programmes, while the projects division deals with all central and state sponsored projects, including externally aided projects.

The TNFD has 45 territorial division offices, 16 functional division offices, 14 forest protection squads, 215 territorial range offices, 160 functional range offices, 471 section offices, 836 special sections, and 1,374 beat offices. The three divisions, territorial, wildlife, and research and extension, have separate field offices at the division, range, section, and beat levels. The numbers of ranges under each division are shown below (Table 7.9). In the table, blank cells indicate that the information is unknown within the Study.

Table 7.9: The Numbers of Ranges under Each Division

Sl. No.	Category (Territorial/Wildlife/R&E/Project)	Division	Range
1	Territorial	45	215
2	Functional	16	160
3	Wildlife		
4	Research and Extension		

Source: Based on interviews with the TNFD

As of October 2021, the present status of the posts under various services in the TNFD is shown below (Table 7.10).

Table 7.10: Present Status of Posts under Various Services in the TNFD (October 2021)

Sl.No	Category	Permanent	Temporary	Total	Filled	Vacant
1	Indian Forest Service	82	6	88	62	26
2	Tamil Nadu Forest Service	49	58	107	62	26
3	Tamil Nadu General Service	22	10	32	23	9
4	Tamil Nadu Subordinate Service	2,943	4,175	7,118	5,464	1,654
5	Tamil Nadu Ministerial Service	702	521	1,223	1,021	202
6	Tamil Nadu General Subordinate Service	19	8	27	25	2
7	Tamil Nadu Zoo Subordinate service	34	185	219	130	89
8	Tamil Nadu Basic Service	415	273	688	316	372
9	Other Service in Tribal Schools	71	61	132	84	48
10	Deputation Posts in TNFD	14	107	121	47	74
	Total	**4,351**	**5,404**	**9,755**	**7,234**	**2,521**

Source: Based on interviews with the TNFD

For the implementation of work, the TNFD depends on field offices that are located in the ranges and beats. Table 7.11 indicates the name of posts and the numbers of present human resources in the field offices.

Table 7.11: Post Names and Human Resources in the Field Offices

Sl.No	Name of the Post	Sanctioned	On Roll	Vacant
1	Forest Range Officer	542	530	12
2	Forester	1,286	1,134	152
3	Forest Guard	2,454	2,026	428
4	Forest Guard with Driving Licence	340	141	199
5	Forest Watcher	1,629	1,035	594
	Total	**6,251**	**4,866**	**1,385**

Source: Based on interviews with the TNFD

The TNFD has many offices to manage the forest areas and wildlife within the state. The following chart shows the overall administrative setup of the TNFD:

Administrative Officer: Principal Chief Conservator of Forests

Additional Principal Chief Conservator of Forests

Chief Conservator of Forests

Conservator of Forests

Controlling Officer: Deputy Conservator of Forests

Assistant Conservator of Forests

Implementing Officer: Forest Range Officer

Forester

Protection Staff: Forest Guard

Forest Watcher
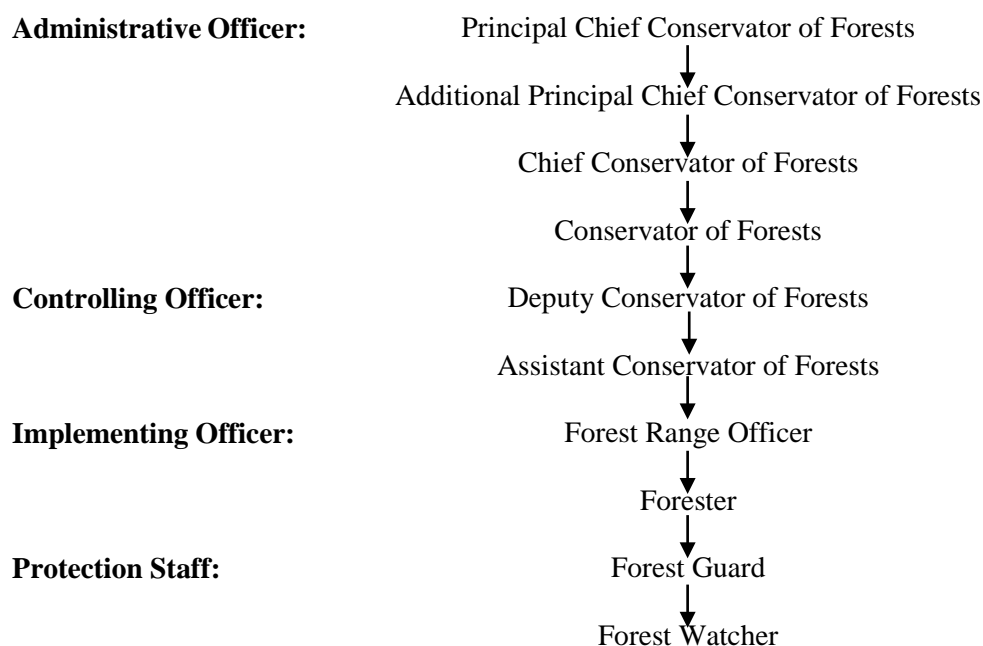
Figure 7.4: Administrative Setup of the TNFD

The capacity building of Indian Forest Service (IFS) officers, State Forest Service (SFS) officers, and forest rangers is mostly sponsored and conducted by the MOEFCC. According to the TNFD, however, the training quota given to the state is comparatively small, and therefore only a limited number of officers are able to have an opportunity to attend these trainings. The TNFD also has its own training school where SFS officers, range officers, foresters, and forest guards can receive relevant training.

The TNFA, which was established in 1912 in Coimbatore, is a premier institute for forestry education in India, where ACF and range officers from different state forest services are trained. The TNFA was the second Forest Rangers College in India and was established with the aim of meeting the increasing demands of trained foresters in the country.

The functioning pattern of TNFD field offices is shown in Table 7.12:

Table 7.12: Functioning Pattern of Field Offices in the TNFD

Unit	Headed by	Controlling Authority
Division	DFO/Dl.FO/WLW/ACF	Circle
Range	Forest Range Officer	Division
Section	Forester	Range
Beat	Forest Guard/Forest Watcher	Section

Source: Based on interviews with the TNFD

In the following section, the main features of different offices are discussed.

1)   Forest Circles in the TNFD

The TNFD can be divided into 12 territorial circles that spread over three different geographic regions, namely the Northern, Southern, and Central regions. Apart from territorial circles, the TNFD also has constituted another six wildlife circles that cover the wildlife divisions of the state. Apart from a total of 18 such circles, the TNFD has an internal separate Research and Training Wing. The circles under the TNFD are headed by an IFS officer with the rank of CCF, and the divisions under the circle are headed by DFOs who are responsible for reporting to the CCF. Circles mostly perform managerial work and support divisions in implementing the work. In cases of wildlife divisions/circles headed by a field director who has the rank of CCF, the relevant divisions are headed by deputy directors. A

detailed list of territorial and wildlife circles is given below (Table 7.13).

Table 7.13: Names of Circles and Their Categories

Sl	Name of the Circle	Category (Territorial (T)/Wildlife (WL)
Northern Region		
1	Chennai Circle	T
2	Dharmapuri Circle	T
3	Vellore Circle	T
4	Villupuram Circle	T
Southern Region		
1	Dindigul Circle	T
2	Madurai Circle	T
3	Virudhunagar Circle	T
4	Tirunelveli Circle	T
Central Region		
1	Thanjauvur Circle	T
2	Trichy Circle	T
3	Salem Circle	T
4	Coimbatore Circle	T
Wildlife Divisions/Circles		
1	Arignar Anna Zoological Park	WL
2	Advanced Institute for Wildlife Conservation (Research, Training and Education), Vandalur	WL
3	Anamalai Tiger Reserve – Pollachi	WL
4	Mudumalai Tiger Reserve (MTR)	WL
5	Sathyamangalam Tiger Reserve (STR), Erode	WL
6	Kalakad Mundanthurai Tiger Reserve (KMTR)	WL

Source: Based on interviews with the TNFD

2)   **Structure of District Forest Office**

The brief organisational structure of the district forest offices is given in Figure 7.5. These are headed by officers with the rank of DCF. The Forest Extension Division/Centre, enforcement offices, and range offices are placed under the district forest offices. FECs are headed by officers with the rank of ACF, whereas the enforcement offices and range offices are headed by a forest range officer. Enforcement offices are placed in some sensitive areas at central locations throughout the state. These teams help to protect wildlife and forest products from illegal transport and capture. Range offices are also placed under the district forest offices, followed by section offices, beat offices, and watchers, in that order.
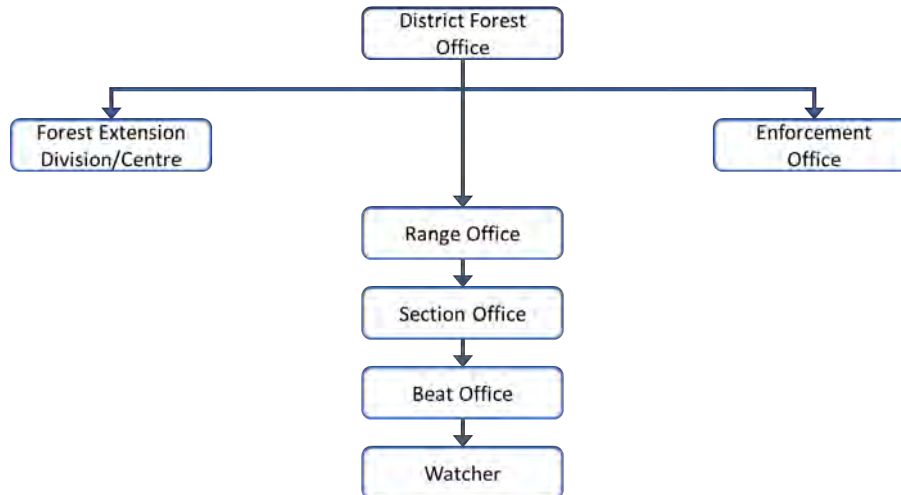
Figure 7.5: Organisational Structure of the District Forest Office

Activities include:

- Protection;
- Monitoring of poaching;
- Man and animal conflict;
- Watershed management;
- Plantation targets;
- Protection activities conducted by frontline staff at ranges; and
- Implementation of any government scheme

3)   Organisational Structure of the Forest Extension Centre

The FEC is headed by a forest extension officer with the rank of ACF. Under this officer, a team of one range officer, one forester, and one watcher is formed. The forest extension officer reports to the DFO, and functions related to projects are reported to the relevant circle office. The FECs receive targets from various projects as well as the TNFD regarding plantations. The main activities for which the FECs are responsible include:

- Raising of the targeted saplings;
- Agroforestry;
- Awareness creation in tree planting;
- Communication and publicity;
- Demonstration with support for research teams;
- Preparing the MIS through data collection;
- Submission of monthly progress and financial statements; and
- Maintaining beneficiary registers

The brief organisational structure of the FEC is shown in Figure 7.6.

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┌─────────────────────────────────┐
│  Forest Extension Officer (ACF) │
└─────────────────────────────────┘
                 ↓
┌─────────────────────────────────┐
│       Forest Range Officer      │
└─────────────────────────────────┘
                 ↓
┌─────────────────────────────────┐
│             Forester            │
└─────────────────────────────────┘
                 ↓
┌─────────────────────────────────┐
│             Watcher             │
└─────────────────────────────────┘
```

Figure 7.6: Organisational Structure of the FEC

4)   Organisational Structure of Forest Range Office

The range officer is the head of the Forest Range Office (FRO), supported by junior and senior assistants at the office administration level. The range officer also has foresters, forest guards, and watchers at each section and beat. The range officers are the frontline workers in the TNFD, and the activities of the range office include:

- Protection:
- Monitoring of poaching;
- Man and animal conflict;
- Watershed management;
- Collection of petitions from the public;
- Planting targets;
- Frontline staff in protection; and
- Implementation of government schemes

A brief organisational structure of the FRO is given in Figure 7.7.

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┌─────────────────────────────────┐
│       Forest Range Officer      │
└─────────────────────────────────┘
                 ↓
┌─────────────────────────────────┐
│             Forester            │
└─────────────────────────────────┘
                 ↓
┌─────────────────────────────────┐
│           Forest Guard          │
└─────────────────────────────────┘
                 ↓
┌─────────────────────────────────┐
│             Watcher             │
└─────────────────────────────────┘
```

Figure 7.7: Organisational Structure of the Forest Range Office

Chapter 8.   Review of the Detailed Project Report (DPR)

8.1.   Outline of the DPR

The Detailed Project Report (DPR) was prepared by the TNFD and submitted to JICA in 2019. This report consists of twelve chapters (Table 8.1).

Table 8.1: Composition of the DPR

Ch. 1	Introduction
Ch. 2	The Context
Ch. 3	The Proposal (TBGCP)
COMPONENT I: Biodiversity Conservation	
Ch. 4	Introduction
Ch. 5	Wild Life Ex-situ Conservation
Ch. 6	Eradication and Invasive Alien Species
Ch. 7	Mitigation of Human Wildlife Conflict
Ch. 8	Ecotourism
Ch.9	Forestry and Wildlife Research
COMPONENT II: Increasing the Natural Resource Base	
Ch. 10	Urban and Peri-urban Forestry
COMPONENT III: Combating Forest Land and Wildlife Habitat Degradation, by Eco Development Activities, Soil and Water Conservation	
Ch. 11	Combating Forest Land and Wildlife Habitat Degradation, by Soil and Water Conservation
COMPONENT IV: Institutional Capacity Development	
Ch. 12	GIS and Management Information System (MIS)

8.2.   Methodology of the Review

Prior to this preparatory study (the Study), the DPR was initially examined as a part of the domestic work done in Japan in order to understand the overall picture of TBGCP. After a series of discussions with the TNFD and other relevant agencies, the DPR was reviewed again based on outcomes from the Study to date, and the following themes were further examined: (1) Biodiversity Conservation; (2) Increasing the Natural Resource Base; (3) Combating Forest Land and Wildlife Habitat Degradation, by Eco Development Activities, Soil and Water Conservation; (4) Institutional Capacity Development: and (5) JICA funded TAP 1 and 2 and TBGP.

8.3.   DPR Review

8.3.1.   Chapter 4

Chapter 4 is composed of the issues, objectives, activities, and plans related to marine ecosystems. Coral, seagrass rehabilitation, dugong, and sea turtles are described in terms of rehabilitation and protection after an explanation is given about improvement practices for wildlife wealth. The improvement of wildlife wealth is related to all other ecosystems; the following practices are listed from the viewpoints of the four dimensions of human, biological, habitat, and management (Table 8.2).

Table 8.2: Practices to Improve Wildlife Wealth

Dimension	Practices
Human	Harnessing of the sentiments of tribal and forest dwellers in wildlife management while ensuring livelihood security

Biological	Wildlife Ex-situ Conservation
	Understanding of lesser known diversity for conservation gain
Habitat	Improvement of wildlife habitats by extending and strengthening areas wherever required and ensuring the connectivity of habitats
Management	Management of wildlife resources at the landscape level with better inter-state coordination

Source: TNFD 2019

(1)   Marine ecosystem

Tamil Nadu has a long coastline of about 1,076 km, covering 13 coastal districts (Tiruvallur, Chennai, Chengalpattu, Viluppuram, Cuddalore, Nagapattinam, Thiruvarur, Thanjavur, Pudukkottai, Ramanathapuram, Tuticorin, Tirunelveli, and Kanyakumari). The Gulf of Mannar (Ramanathapuram, Tuticorin) for coral reefs, Vedharanyam and Muthupettai (Nagapattinam) for mangroves, Pichavaram (Cuddalore) for mangroves, and Pulicat Lake (Tiruvallur), which is India's second largest brackish water lagoon, are identified in Tamil Nadu as ecologically important areas.

a.   Coral rehabilitation

The MOEFCC has already started implementing coral rehabilitation activities in the degraded area since 2008 in the Gulf of Mannar, which is one of the major coral reef areas in India (Table 8.3). The reef areas were declared a Marine National Park in 1986. The total reef area is 110 km^2, but due to mining and destructive fishing activities, about 30 km^2 of area has already been degraded.

Table 8.3: Coral Rehabilitation

	Items
Location	Gulf of Mannar
Activities	● Survey and assessment of degraded reef areas
	● Construction of artificial substrates
	● Coral transplantation following standardised techniques
	● Monitoring and maintenance
	● Interpretation/ecotourism through the creation of a corallarium

Source: TNFD 2019

b.   Seagrass

The coasts of the Gulf of Mannar and Palk Bay are rich in seagrass beds. A recent survey reported that the seagrass areas of Palk Bay and Gulf of Mannar are 209 km^2 and 101 km^2, respectively. The seagrass beds are degraded mainly because of destructive fishing practices and shore-based pollution and developmental activities, leading to sedimentation. Seagrass rehabilitation has been implemented on a small scale (Table 8.4).

Table 8.4: Seagrass Rehabilitation

	Items
Location	Gulf of Mannar and Palk Bay
Activities	● Survey and assessment of degraded seagrass areas
	● Construction of PVC substrates
	● Seagrass transplantation following standardised techniques
	● Monitoring and maintenance
	● Awareness creation, publicity, and community patrolling

Source: TNFD 2019

c.   Dugong

The TNFD conducted a species conservation action plan for dugongs in Palk Bay during TBGP in five districts: Ramanathapuram, Pudukkottai, Thiruvarur, Thanjavur, and Nagapattinam. Various activities have been done, as indicated in Table 8.5.

Table 8.5: Dugong Protection

	Items
Location	Palk Bay
Activities	• Assessment of seagrass habitats in Palk Bay • Creating awareness amongst fishermen through folkfore programmes • Enhancement of the capacity of the TNFD by way of training forest personnel • Enhancement of protection of the animals by way of engaging anti-poaching watchers. Inter-departmental co-ordination from the Coast Guard, Fisheries Department, Marine Practice, District Administration, local police, etc. • Regular patrolling by field protection staff • Carrying out of seagrass transplantation works in degraded areas • Education of local fisherman communities on the importance of, and awareness program about, sea cow and seagrass conservation • Development of Android-based mobile application for the granting of rewards/compensation to fishermen

Source: TNFD 2019

d.   Sea turtles

Five species of turtles are found in Tamil Nadu. The Tamil Nadu coast is known to be a dense nesting ground for olive ridleys and a part of the migratory corridor that moves toward Odisha. Turtle nesting areas so far have been identified on the coasts between Tranquebar and Pazhayaru, Mamallapuram and Chennai, Point Calimere and Nagapattinam, and Kanyakumari and Trichendur. In recent years, there has been a decline in sea turtles migrating to Indian waters. The once abundant sea turtle population in the Gulf of Mannar has dwindled due to poaching for meat and eggs, habitat disturbance, and incidental catch. There has also been a reduction of nesting areas. Turtles die mostly due to incidental catch or being caught live for meat. Major conservation and management works have been conducted only during the past few years under the funding support of TBGP. Table 8.6 shows activities in sea turtle protection.

Table 8.6: Sea Turtle Protection

	Items
Location	Palk Bay
Activities	• Awareness camp for local fishermen • Conducting stakeholders workshop • Fishermen youth and adult engagement as sea turtle watchers • Establishment of permanent hatchery • Fishermen engagement as hatchery watchers • Erection of information boards • Capacity Building Training for field staff • Printing of publicity material like caps, t-shirts, pamphlets, etc. • Supply of fuel for patrol vehicles like boats and jeeps and for the hiring of boats • Provision for engaging sea turtle watchers • Provision for hatchery watchers • Supply of gadgets like torches, protective gear, and other anti-poaching equipment • Monitoring and documentation • Rewards for fishermen for rescue and release • Multimedia publicity and interpretation • Creation of temporary outpost • Research and monitoring

Source: TNFD 2019

8.3.2. Chapter 5

Chapter 5 deals with wildlife ex-situ conservation. Wildlife in this chapter means all undomesticated creatures, including birds, insects, plants, even microscopic organisms. Upon the understanding of the importance of education on wildlife conservation, the building of the Advanced Interpretation Centre and Pre-Historic Park is proposed at Arignar Anna Zoological Park (Table 8.7). Arignar Anna Zoological Park was built 34 years ago with an area of over 602 ha in Reserve Forest in Vandalur, Chennai. It is one of the largest zoos in Southeast Asia in terms of area. Arignar Zoological Park exhibits around 2,500 wild animals of nearly 180 species, which comprise mammals, birds, and reptiles. It is known as a successful ex-situ conservation/education centre helping to create awareness amongst people about wildlife conservation.

Table 8.7: Proposed Components in Advanced Interpretation Centre

Components	Specifications
Wildlife Auditorium	Auditorium with seating capacity of 300 people to educate larger numbers of people in an effective manner through films
Advanced Interpretation Centre	Interactive display with modern and integrated display models
Pre-Historic Park	Displays the history of animal evolution from the Cretaceous, Jurassic, Triassic, and Mesozoic eras
Rehabilitation Centre with Quarantine	Suitable environment for rescued animals Rehabilitation of rescued animals from across the state

Source: TNFD 2019

8.3.3. Chapter 6

Chapter 6 deals with the eradication of invasive alien species. The invasion of alien plant species is recognised as the second worst threat on the whole ecosystem. They have invaded and affected native biota in virtually every ecosystem type in all regions. *Prosopis juliflora* is one such weed occupying most of the plain forest areas and, in some locations like Sathyamangalam Tiger Reserve, it distributes with *Lantana*. The floral community, including grass, is altered by invasive alien plant species, affecting the feeding behaviour of fauna. Therefore, the removal of weed species in PA and non-protected areas is regarded as part of human-wildlife conflict mitigation activities, especially around the PA and other wildlife rich territorial regions of Tamil Nadu.

This problem attracted attention at the judicial level. Consequently, the Hon'ble Madurai Bench of the Madras High Court ordered the removal of invasive species throughout the state of Tamil Nadu. Being an issue that has attracted a high amount of public attention, the TNFD formulated the eradication program focusing on the PA and Elephant Reserves (Table 8.8).

Table 8.8: Eradication of Invasive Alien Species

	Items
Location	Protected Areas and Elephant Reserves
Divisions	Nagapattinam, Srivilliputhur WLS, Sathyamangalam, Megamalai WLS, Kodaikanal, Dindigul, Coimbatore, Dharmapuri, Erode, Hosur, Gudalur, and Tirunelveli
Area of eradication	3,000 ha
Period	Over six years (2012-13 to 2016-17)
Activities	Removal of invasive alien species by uprooting, followed by restoration using appropriate native or indigenous trees species
Monitoring	Impact of removal after four years - An increase of wildlife use area - New recruits of grass and native fodder species - Natural regeneration of native food plant for grizzled giant squirrel

Source: TNFD 2019

8.3.4. Chapter 7

Chapter 7 deals with the mitigation of human-wildlife conflict. A force of over 1,000 anti-poaching watchers was allocated during TBGP. Protection mechanisms were strengthened and habitat development works through various schemes were executed. The enrichment of forest habitat and change in land use patterns in forest fringe habitats are attributable to human-wildlife negative interaction (HWNI). HWNI means not only physical impact like the loss of human life, property, crop damage, and injuries, but also mental impact such as fear, anxiety, and a lack of sleep.

The TNFD has installed various mitigation measures against HWNI. Solar powered electric fencing systems were installed around the forest from 2005 to 2010 and elephant proof trenches were dug on forest fringes from 2010 onward. Infrared early warning systems were also installed in conflict prone areas. In order to prevent wildlife from straying out of forest areas in pinch periods, artificial drinking water sources in the forests were constructed and percolation ponds were developed. Fodder plantations were intermittently created, which resulted in success. Invasive alien species were removed on a small scale. Carnivore capture tools such as trap cages have also been developed in various divisions. Anti-depredation squads were established in divisions such as Coimbatore, Gudalur, and Hosur for day-to-day management of stray animals. Carnivore capture tools such as trap cages have also been developed in various divisions. Compensation mechanisms were continuously streamlined to ensure quick dispensation. Besides these, a number of recent innovative approaches for HWNI were planned (Table 8.9).

Table 8.9: Recent Innovative Approaches for Human-Wildlife Conflict

Approaches	Specifications
Rapid Response Teams (RRTs)	Established in Coimbatore, Gudalur, Nilgiris, Dharmapuri, and Tirunelveli. Each unit has been provided with manpower, vehicles, and equipment to deal with emergency situations happening with tigers, leopards, and elephants.
Community information network for elephants	Established in the Valparai area of Anamalai Tiger Reserve with the help of the Asian Nature Conservation Foundation (ANCF). Early warning systems coupled with information dissemination mechanisms using mobile phones.
Conflict management information system	Developed in Coimbatore Division in partnership with Osai, an NGO. This system is a tool for conflict mapping and interpretation.
Photo profiling of elephants	Developed in Gudalur Division with the help of an NGO, Shola Trust. This profiling is for the identification of each and every elephant from unique features for the monitoring of them.
Project Kaliru	This project has been implemented in Coimbatore Division since 2016. This project has sought to acquire community participation in conflict mitigation and to deal with human perspectives and capacity in coping with conflict mitigation.
Solar hanging wire fence systems	This system was developed in Coimbatore to increase resistance to elephant damage, with the aims of securing corridors and habitat improvement.

Source: TNFD 2019

Based on the activities conducted in TBGP, the objectives (Table 8.10) and practices (Table 8.11) of HWNI for TBGCP are summarised in Chapter 7.

Table 8.10: Objectives of TBGCP

	Items
Objectives	To reduce the HWNI for the conservation of wildlife. To provide safety for the lives and livelihoods of communities in interaction with wildlife. To enhance the capacity of communities in dealing with such negative interactions.

	To promote the acceptance and tolerance level of communities towards such wildlife interacting negatively.
	To study the biological aspects of negative interactions such as ranging behaviors and temporal changes in interactions through scientific methods.
	To enhance the quality of wildlife habitats by improving foraging and water resources with a view toward reducing present day and future negative interactions.
	To enhance the capacity of the TNFD to deal effectively with such negative interactions.
	To develop protocols and a set of tools for dealing with such negative wildlife interactions.
	To develop comprehensive management plans to assist field managers.

Source: TNFD 2019

Table 8.11: Practices to Cope with HWNI

Dimension	Practices
Biological	A set of interventions based on the natural behavioral ecology of mega populations. The target is to understand species interactions over a temporal scale through the next ten tools. 1. Protocol created by an advisory committee 2. Population survey 3. Radio collaring/DNA sampling 4. Photo profiling of individual problem animals/groups 5. Monitoring of identified migratory routes 6. Daily conflict mapping of elephant movement with sex, age, group composition, and type of feeding 7. Half-yearly transect analysis of critical NWHI forest beats 8. Engaging wildlife biologists in selected NWHI divisions 9. Monitoring of selected water bodies 10. Engagement of nodal NGOs for assisting data compilation and analysis
Habitat	Forest habitats and their capacity to nurture wildlife mega-population with three targets; 1. Augmentation of fodder and forbs in wildlife areas 2. Augmentation of pinch period water availability 3. Habitat Connectivity Management
Human	Perspectives over HWNI and capacity of communities to cope directly and indirectly coming into negative interactions with the following four targets; 1. Enhancing Community Tolerance Level 2. Developing Community Information Network 3. Developing Community Interaction Permanent Platforms 4. Stakeholders Abatement Support
Management	Enhancement of organisational capacity and development of organisational framework and tools to plan, execute, and monitor efficient mitigation measures with the following six targets; 1. Improving infrastructure 2. Developing and strengthening barriers 3. Development of Conflict Management Plan 4. Developing Standing Operating Protocols 5. Capacity Building of Officers and Staff 6. Providing financial autonomy at the division level

Source: TNFD 2019

8.3.5. Chapter 8

This chapter focuses on development in ecotourism, specifically 'Community-based ecotourism' (CBET). The TNFD has proposed two major CBET areas: i) a Gene Pool Garden in the Gudalur Forest Division of Nilgiris District; and ii) four sites in the less-visited the Eastern Ghats. The four CBET sites include existing ones which need improvement. The main focus is to attract more tourists

to the Eastern Ghats with the aim of reducing tourist flow to the Western Ghats, as a high volume of tourists has negatively impacted wildlife in the Western Ghats.

Contents summarised in the DPR are sorted out as follows.

(1)　　Genepool Garden in Gudalur (Nilgiris District)

Table 8.12 shows the overview of the Genepool Garden in Gudalur, Nilgiris District.

Table 8.12: Overview of the Genepool Garden in Gudalur, Nilgiris District

Item		Description
Objectives		Strengthening biodiversity conservation through ecotourism in Genepool Garden, thereby contributing to the harmonised socio-economic development of tribes in order to thwart the spread of left-wing extremism in Tamil Nadu.
Location and area		Genepool Garden is a tropical garden located in Nadugani Village near Gudalur Town and Ooty Hill Station in Gudalur Taluk in Nilgiris District. It is situated at an elevation of 900 m MSL and has an area of 242.14 ha.
Management structure		An ecodevelopment committee (EDC) comprised of tribes was formed and registered under the Societies Registration Act in 2017. A memorandum of understanding (MOU) has been signed between the EDC and the TNFD. The roles and responsibilities of the EDC and TNFD are stipulated in the MOU.
Activities		
	1) Construction of infrastructure	i) Reception cum interpretation centre; ii) Eco-huts; iii) Tree houses; iv) Trekking shed; and v) Eco-friendly toilet complex.
	2) Improvement of infrastructure	i) Water supply facilities; ii) Parking area; and iii) Other existing infrastructure.
	3) Purchase of equipment and materials	i) Office equipment and furniture; ii) Equipment and exhibits for the Interpretation Centre; iii) Vehicles for carrying tourists and water transportation; and iv) Setting up of zip line and other adventure activities.
	4) Other	i) Waste management mechanism; and ii) Publicity, awareness creation, interpretation, and documentation.

(2)　　Four Circuits in Eastern Ghats

Table 8.13 shows the overview of four circuits in Eastern Ghats.

Table 8.13: Overview of the Four Circuits in Eastern Ghats

Item		Description
Objectives		Attracting more tourists to the Eastern Ghats with the aim of reducing tourist flow to the Western Ghats, as a high volume of tourists has negatively impacted wildlife there.
Location		i) Kurumbapatti – Yercaud; ii) Aiyur- Denkinekottai – Hoganekal Waterfalls; iii) Kollimalai – Medicinal Plant Conservation Area – Akash Ganga Waterfalls – Yelagiri Hills; and iv) Yelagiri – Amirthi – Jamunamarathur – Bheeman Waterfalls – Kullar Caves.
Activities		
	1) Development of ecotourism sites	i) Development of ecotourism designation; ii) Creation of entrance arch; iii) Eco-shop with seed money; and iv) Purchase of generator for camp.
	2) Development of ecotourism products	i) Creation of website; ii) Promotion and marketing; iii) Exposure visit; iv) Purchase of equipment; v) Engaging facilitator for smooth conduct of ecotourism and guides/helper; vi) Purchase of mini-bus, bolero camper and fuel, and maintenance charges; and vii) Creation of children's play area with things.

8.3.6.   Chapter 9

Chapter 9 deals with research on the forestry and wildlife sectors.

8.3.6.1. Forestry Research

(1)   Development of Urban Forestry Models and Techniques

In forestry research, focus has been put on the development of afforestation and planting techniques in urban and peri-urban forestry areas. Forestry around urban areas involves planting in diverse areas, namely in residential areas, plots, avenues, roads, sewage drains, wastelands, dumps, mine spoils, industrial effluents, domestic and industrial wastes, dumps of all natures that have highly degraded, and sometimes in toxic soils. In order to achieve effective planting and afforestation in conditions where previously afforestation activities have not been experienced, the development of a viable Urban Forestry Model has been planned. In the model, the following planting techniques are included:

- Production techniques for taller plants;
- Transplanting techniques for common urban tree species, including identification techniques for those species;
- The development of phytoremediation models for different effluent systems of industrial districts; and
- The development of eco-parks and biodiversity parks in various urban ecosystems.

(2)   Enhancing and Prompting Tree Improvement

For the last many decades, candidate plus trees have been identified in various agro-climatic zones in Tamil Nadu and are being recorded. Some of the promising trees are raised as seed stands and further into seed orchards. It has been required that these identified candidate trees be assembled in suitable central nurseries in all districts. Seed stands and clonal propagation units will be established as per the requirements of the district. These units will be developed and the field staff of the division will be intensively trained in vegetative propagation and nursery techniques. The following activities are proposed:

- Establishment of Hi-Tech Central Nurseries with clonal propagation chambers, hedge/ stools (or stool beds), and clone establishment of important species;
- Genetic combining for high demanding species in all districts; and
- Assembling planting material like hedges, seedling seed orchards, clonal seed orchards, and seed stands to ensure the supply of quality planting material.

(3)   Capacity Building and Training for Extension Personnel

This capacity building and training will be held to help field staff enhance their capability to deal with quality planting materials with techniques to maintain and utilise them effectively in their field sites. To do that, permanent training centres in each district will be established.

(4)   Bio-Productivity Enhancement

In order to increase the productivities of the forest and bio-resources, it will be expected that farmers follow the guidance and market intelligence of the TNFD and farmers will acknowledge fair prices of their products from the platform of the market intelligence. Hence it is pertinent to take up the following activities.

- Development of an e-platform for market intelligence on timbers to conduct online sales and tenders without the involvement of middle men; and

- Developing Forest Utilisation units in Salem, Courtallam, Dindigul, Thanjavur, and Nagercoil for seasoning and wood treatments for preservation and value addition

In well-established timber markets, seasoning kiln and timber treatment plants will be established. Facilities for utilising the same on a payment basis will be developed.

- Various seasoning protocols and treatment schedules for lesser known timber species and less popular timbers will be tested in their properties, and several seasoning protocols and treatment schedules will be developed; and
- Developing a Money Yield Table for important tree species for important trees like teak, *Melia*, *Ailanthus*, neem, vagai, and *Gmelina*.

(5)   Conservation of CR/EN/DD TAXA in the Wild

Many studies have been undertaken on threated plants and animals, including extensive field surveys during the project term of TBGP. It was then required to prioritise species, especially in the case of 'Data Deficient' (DD) species, to be candidates to be Critically Endangered (CR) and/or Endangered (EN) species. In TBGCP, recommendations will be expected based on the assessment of red-listed categories by understanding the dynamic of populations and formulating conservation strategies. The following procedures have been planned on the following.

- Reassessment of threatened plants in the state of Tamil Nadu in the study of endemic and threatened species through a Conservation Assessment and Management Plan (C.A.M.P.) workshop to develop a plan and design to address the conservation and monitoring of endemic and threatened taxa;

- Conducting representative sampling for the populations of CR, EN, and Vulnerable (VU) species, collecting and maintaining propagules/seeds for the propagation of CR/EN/VU species, removing invasive species such as wattle, *Eupatorium*, *Lantana*, *Acacia*, and *Eucalyptus* from where they have reported from the Study; and

- A strategic conservation management plan to be conducted based on population studies for all endemic and threatened species, which include:

  A) Vegetation management plan such as forest succession strategies on areas under forest fire, and areas that were subjected to continuous biotic pressure;
  B) Knowledge integration by combining local knowledge in operational and management plans;
  C) Replacement of monoculture plantations with native trees; and
  D) Promoting shola grass restoration programs.

Training and capacity building through continuous training programs and workshops are planned on the following.

- Sustainable development of medicinal plants, NTFPs, and 'Rare & Threatened Species' at the state level;

- Nature awareness programs are to be conducted to promote a massive drive in sensitising local communities regarding forests' role in their livelihood and enhancing quality of life;

- Interpretation centres are to be developed at identified localities, which should consist of photo-guided text for important plants and animal species specific to the region along with the support of a nature trail in the tourism zone;

- Internal technical training for field staff by knowledgeable resource persons on the identification of important forest plants, identified by the Study, nursery techniques, and other conservation-related issues; and

- Creation of a pictorial field guide of threatened and endemic taxa with their distribution for conservation and protection activities.

The establishment of technical and research programmes, mainly to focus on biodiversity conservation, eco-restoration of degraded forests, invasive species, ground water, and weed control for the management of ecological attributes for medicinal plants, NTFPs, and Rare &Threatened Species in the forest. Research programmes include:

- Building up forest nurseries to procure the stalks of seedlings of threatened and endemic plants at each District Project Management Unit (DPMU); and

- Technical development of the restoration of savannahs like a habitat for biodiversity conservation in Vallanadu Blackbuck Sanctuary.

Operation work plans for conservation programs for CR/EN/VU species shall rely on raw data on the population and dynamics of each species. The following activities are then planned.

- Provision of platforms for quadrat data analysis and spatial data analysis by GIS are planned by the PCCF and Chief Wildlife Warden (CWLW) where management plans and operational working plans are made.

- Establishment of a demo garden along with interpretation centres or research centres to assemblage in respect of 'Rare', 'Endemic', and 'Threatened' plants of taxonomical, medicinal, trade, cultural, and conservation significance.

8.3.6.2. Wildlife Research

There are number of issues regarding wildlife conservation in the state of Tamil Nadu, such as human-wildlife conflict, the death of wild animals caused by accidental traffic/rail accidents and disease, the extinction of endangered species, overpopulation of some herbivore species, the inadequate handling of wildlife crime investigations, and inadequate wildlife monitoring in custody analyses of wildlife crimes. Effective wildlife research is therefore highly needed to cope with these problems. Wildlife research is of increasing importance in recent years, so the Advanced Institute for Wildlife Conservation (AIWC) was established at Arignar Anna Zoological Park in Vandalur, Chennai. The AIWC has the following six objectives (Table 8.12).

Table 8.14: Objectives of AIWC

	Objectives
1	Research to aid the survival and recovery of species and their habitats and to ensure the health and well-being of animals in captivity and in wild.
2	Exclusive breeding programs through the establishment of separate captive breeding centers.
3	Training of future generations of conservationists and high level wildlife specialists and scientists.
4	Working on solutions and providing recommendations for human-animal conflicts.
5	Development of advanced training on zoo management and captive breeding.
6	Advanced veterinary facilities for zoo animals.

Source: TNFD 2019

Along with the AIWC, the following three centres have been operating approved by the state government.

1)   Centre for Animal Care Science

Animal care sciences, including disease management and conservation ecology concerning animal biology, are the major work of the Centre for Animal Care Science (CACS). The CACS will develop standardised protocols for animal care of important species of the state of Tamil Nadu under ex-situ and in-situ conditions, and protocols for the mitigation of human-wildlife and ecological conflicts. The CACS will also take-up sociological studies including community participation and public perception on conservation.

2)   Centre for Conservation Education

The major focus of the Centre for Conservation Education is developing specific programmes and learning resources for stakeholder requirements. It will also create a database of accredited resources for various programmes. The work will mostly focus on such places as zoos, ecotourism sites, and tiger reserves.

3)   Centre for Wildlife Forensic Sciences

The core activity of the Centre for Wildlife Forensic Sciences (CWFS) is related to forensic work like developing protocols for the collection and preservation of biological samples, including the collection and preservation of biological samples of various species that are illegally traded in and from India, which will form a repository of reference samples required for the identification of unknown biological samples sent to laboratories for identification. The CWFS will also focus on developing techniques and protocols in facilitating investigations in wildlife crime cases, to encourage the use of forensic techniques in wildlife crime and population investigations, surveys, and legal actions, and on establishing a network of officials from TNFD and other wildlife crime stakeholders, offering a central contact point for information and action, and developing and disseminating field oriented research relevant to wildlife forensics. Capacity building of the frontline field staff of the TNFD and other stakeholders, establishing training courses in all aspects of wildlife forensics, co-ordination of wildlife forensics at national and international levels, and knowledge sharing between reputed organisation and laboratories will be thrust areas.

There are some requests for conducting various experiments and investigations, since the AIWC is not yet equipped with facilities to deal with the above-mentioned issues. The development of human resources like scientists, senior research fellows, researchers, lab technicians, and research assistants is also a concern pertaining to labs. In this regard, purposes and facilities for strengthening the components of the AIWC are described in Table 8.13.

Table 8.15: Requested Components and Items for the AIWC

Components	Objectives
1. Strengthening and Consolidating Infrastructure	- Establishment of the Analog and Digital Library, a digital auditorium and advanced training rooms for hands on exercises, AIWC campus facilities - Upgrading the Research Labs with equipment and software tools - Setting up of a workshop for 3D Model Preparation (conservation and education)
2. Enhancement of Inter-disciplinary Wildlife Research	- Establishing wildlife forensic studies including advanced DNA-based investigations for terrestrial and marine species with a focus on wildlife crime investigation and population monitoring - Aiding animal care science studies at captive and field levels - Wildlife policy research and development - Research work on species recovery with a special focus on marine species - Studies on ecology and the habitats of migratory terrestrial and marine species
3. Capacity Building and Knowledge	- Capacity development for knowledge based conservation practices. - Hands-on training for TNFD officials at multiple levels, scientists,

Sharing	veterinary assistant surgeons and researchers - Knowledge development and sharing through workshops, symposiums, seminars, and conferences for field personnel and other stakeholders at the state, national, and international levels - Publications of research findings as scientific papers, journals, newsletters, monographs, and books - Development of the Data Diagnostics and Analytics Centre for centralised database development, management, and analytical capability

Source: TNFD 2019

The Analog and Digital Library includes the installation of book racks, creation of study space, interior work (wall panelling, false roofing, and centralised air-conditioning), a digital library, and data dissemination hardware. The Digital Auditorium and Advanced Training Rooms will provide experiments and exercises with a capacity of 200 seats. In addition to these, the setup of a hall with audio-visual aids such as a digital light processing projector for seminars, conferences, and workshops, is in the planning stage. An upgrade of AIWC campus facilities is also planned. The upgrade includes building security measures (closed circuit television (CCTV)), e-eye surveillance, smoke and fire safety alarms, fire extinguishers, in-house communication systems (intercom, public address system, a biometric system, and air-conditioning for labs and workspace), lifts for transit between various centres and laboratories, and heavy, high-end diagnostic instruments in various research centres. A new facility for 2D/3D model preparation has also been proposed, through which the creation of lively sculptures and signage with conservation messages for display in PA and zoos of Tamil Nadu is the aim.

Utilizing the components/facilities described above, the AIWC has plans to conduct activities within the following scopes (Table 8.14) at three target areas, Point Calimere, Ramanathapuram, and Sathyamangalam. The centre at the Point Calimere Wildlife and Bird Sanctuary in Nagapattinam District will conduct studies on wet land birds, the role of disease in declining bird populations, and the environmental challenges facing urban and sub-urban birds. The centre at Ramanathapuram will conduct studies on marine biodiversity in the Gulf of Mannar, with special reference to marine mammal conservation. The centre at Sathyamangalam will conduct studies on the terrestrial ecosystem of the Western Ghats and associated large felines, and the mega-herbivore population and its conservation.

Table 8.16: AIWC Target Areas

Scope	Content
1. Forensic studies	- Development of molecular tools for wildlife crime scene management - Standardisation of validated forensic procedures - Development of a reference repository of biological samples
2. Animal care sciences	- Differential disease diagnosis - Advanced veterinary care - Mitigation of human-wildlife conflict
3. Informative work	- Documentation and creation of a database on good practices in wildlife and conservation ecology - Institutional networking and collaborative research in the field of wildlife and ecological conservation - Dissemination of scientific extension programme and learning resources

Source: TNFD 2019

At the AIWC, forensic studies utilise molecular tools such as DNA profiling and sequencing for species identification, since the illegal hunting of wildlife is a serious concern for wildlife conservation in India. Animal care science activities will be conducted for captive and wild species. Animal translocation, veterinary care, rehabilitation, and the hand-rearing of orphaned animals are the core components of animal care sciences taken up by this centre. Besides these, disease diagnostics, therapeutics and the management thereof, the development of protocols for the mitigation of human-wildlife conflicts, the establishment of a database of good practices in wild

animal and veterinary care, and ambulatory veterinary care for wild animals will be conducted at the AIWC. Informative work includes capacity development for officers and researchers, hands-on training for forest officials, knowledge development and sharing, and publications of research work.

The most perplexing problem in accommodating advanced methods of wildlife management and providing more flexible means for the conservation of wildlife is attributable to the failure of established management structures. The necessity and use of wildlife policy has been underestimated. A wildlife policy would be an explicit national policy or a part of a national nature conservation strategy or a component of a national development plan. The AIWC intends to establish a management body in collaboration with other departments and agencies, e.g., the MOEFCC, the World Wildlife Fund (WWF), and the Wildlife Institute of India (WII).

The AIWC will work on the issues of reproductive physiology, habitat study, and the study of associated species, embryo biology, animal behaviour, and conservation breeding. Furthermore, the AIWC will focus on endangered species recovery programs, which will adopt a multi-pronged approach that includes conservation research, technology aided management support, training and capacity building of the implementing agencies, monitoring of populations and habitats, stakeholder sensitisation and mobilisation, and the mitigation of threats in priority habitats. Endangered species recovery programs have set goals at ensuring the long-term persistence of these species in the wild through multi-stakeholder partnerships, so that the conservation contribution of the local community is recognised and incentivised.

8.3.7. Chapter 10

Chapter 10 focuses on the greening of urban and peri-urban areas that are landscape interface areas between town and country, or the rural-urban transition zone. The Tree Cultivation Outside Forests (TCOF) component of TBGP has generated profound impacts in rural areas, especially for the creation of a massive tree resource base outside of the forests. The impacts made by increased nature resources accordingly can be expected to be made by biodiversity conservation as well. Tamil Nadu is one of the most urbanised states in the country, with about 48% of its population living in urban areas. In TBGCP, such impacts are accordingly expected to extend to urban and peri-urban areas in the state of Tamil Nadu. The DPR proposed to adopt the following strategy for urban and peri-urban forestry (Table 8.15).

Table 8.17: Recent Innovative Approaches for Urban and Peri-urban Forestry

Approaches	Specifications
Urban and Peri-Urban Forestry activities in all districts in the state of Tamil Nadu	Urban and Peri-Urban Forestry - Creating publicity to beneficiaries about the intention of the government of Tamil Nadu to supply and plant seedlings on their lands/on their premises totally free of cost - Designated offices/officers with all contact/communication information will be announced -The seedlings will be tall, about 8 feet (about 2.44 m) in height to achieve higher survival rate. The seedlings will be raised in 35*40 cm bag sizes for planting - On non-farm lands and 16*30 cm bags sizes for planting on farmlands - Records will be maintained after planting and the information will be fed into a database to provide all details up to the individual tree level - The operation will be in all districts in the state of Tamil Nadu, conducted by the division management unit base Strategies - Catalysing a tree growing movement with a focus on urban and peri-urban areas - An inclusive demand driven approach making tree planting material and plantation services available to anybody on demand

	- An <u>award/reward system</u> will be taken up to increase the performance of survival rate of planted seedlings. Awards will be given in the third year after planting - Preparatory work will be taken up in the first year, planting in the next four years, and rewards/awards will be distributed from the forth to sixth years from TBGCP commencement - <u>Forestry Extension-driven expansion of tree cover outside forests</u> - Therefore <u>Extension Centres are to be revitalised/strengthened</u> so as to serve as hubs of integrated multimodal service delivery providing both offline and online support - Extension Centres are to be revitalised by infrastructure renovation, provision and upgrading equipment, vehicles and personnel, the raising of demonstration plots, the setting up of tree parks and arboretums, the establishment/improvement of modern central nurseries and green energy installations - Extension Centres are to be strengthened by recurring publicity and awareness activities, activating Tree Growers Societies, maintenance of the centres, nursery raising, improvement of skills, and training and engagement of contractual staff through outsourcing - Extension Centres will upgrade nursery operations by strengthening infrastructure, paraphernalia, and staff to support tree growing owners on plantation management and marketing plans

Source: TNFD 2019

On top of the above activities of the urban and peri-urban forestry, it is planned to develop a function to supply the information of value and supply chain of NTFP resources in Extension Centres in 32 districts, especially to encourage the economic viability of JFM to correct the currently insufficient and inefficient traditional and intermediaries' explosive value chains of NTFP. Extension Centres are also expected to have the functions of managing supply chains from the non-destructive collection of NTFPs, processing, packaging, and storage in order to establish sustainable value chains in the whole state through Extension Centres in 32 districts.

8.3.8. Chapter 11

Chapter 11 focuses on the issues of combating forest land and wildlife habitat degradation by eco-development activities and soil and water conservation. Forest and wildlife habitat degradation are caused by a number of events in Tamil Nadu, rain water run-off, drought, soil erosion, over-exploitation, and over-grazing. In order to reverse the degradation process, the DPR has proposed to adopt the following strategy (Table 8.16).

Table 8.18: Recent Innovative Approaches for Human-Wildlife Conflict

Approaches	Specifications
Eco-development activities in the Eastern Ghats and ITDP villages	<u>Eco-development</u> - Capacity building among tribal youth by imparting training such as vehicle driving, Agricultural clinic, areca nut plates, and the rearing of honeybee combs - Provision of free LPG connection to tribal families - Skill development for tribes, driving, and provision of licences - Training on basic computer knowledge for tribal youth - Training on tailoring for tribal women - Training on dairy management for tribes - Training on poultry farming (one-week training) - Training on honey collection and beekeeping, cultivation of mushrooms, piggery, and animal husbandry for tribes <u>Soil and water conservation measures</u> - Reclamation and improvement of Tribal Lands through the construction of stone wall masonry to avoid soil erosion, recharging groundwater, and the improvement of agricultural output (Eastern Ghats) - Stone paving of paths, steps, and community utility areas in Tribal Villages (Eastern Ghats) <u>Preservation of traditional knowledge of tribal and local people</u>

	- Conduct of Natuvaidyar conference at Jammunamutthur, Kollimalai, Kalrayans, Yercaudand, and Kallakurich
	Heritage conservation
	- Conservation of historical heritage sites (Kullar Caves, Gudiyam Caves)

Source: TNFD 2019

8.3.9. Chapter 12

Chapter 12 discusses institutional capacity development focusing on GIS, MIS, management plan development cells, working plan preparations, strengthening mobility, infrastructure development, staff cost, and monitoring and documentation. From the total outlay of TBGCP, it is expected that of all of the interventions, TBGCP aims at especially strengthening manpower and mobility (e.g., the procurement of new vehicles and the maintenance of existing vehicles), infrastructure development (e.g., the construction of various facilities), and monitoring and documentation.

8.4. Concluding Observations

Of all of the chapters and annexures of the DPR, those that were particularly reviewed based on the preparatory study to date were those relevant to such themes as: (1) Biodiversity Conservation; (2) Increasing the Natural Resource Base; (3) Combating Forest Land and Wildlife Habitat Degradation, by Eco Development Activities, Soil and Water Conservation; (4) Institutional Capacity Development; and (5) JICA funded TAP 1 and 2 and TBGP.

Chapter 9.   Identified Issues from the Preparatory Study to Date, and the DPR

9.1.   Green Infrastructure/Biodiversity Conservation

In the Aide Memoire, issued on 28 October 2020 during the JICA contact mission, value addition into the forestry and biodiversity sector was requested. The objective of TBGP was set on biodiversity conservation. TBGCP shall contribute to the mitigation of environmental, social, and economic issues in Tamil Nadu through the methods that have already been practiced/proved effective in TBGP, and the newly added approaches. Biodiversity conservation activities have not been implemented in a proper way in the Eastern Ghats regardless of area's importance in terms of rich biodiversity. TBGCP is thus being requested to mitigate socio-economic issues such as human-wildlife conflict or escalated damage caused by natural disasters related to climate change through the improvement of eco-system services by biodiversity conservation. Local people including ST are highly dependent on forest resources for their livelihood in this region. Therefore, it is also necessary to support their livelihood improvement activities.

9.1.1.   Marine

The following issues for the coastal zones of Tamil Nadu State have been stated by the TNFD (Table 9.1). Specific issues for seagrass, dugong, and sea turtles mentioned in the DPR are summarised in Table 9.2, Table 9.3, and Table 9.4, respectively.

Table 9.1: Issues Regarding the Coastal Zones of Tamil Nadu

Dimension	Issues
Human	● Use of destructive netting practices ● Decreasing livelihood opportunities for coastal communities due to declining fishery resources ● Lack of communication, education, capacity, and public awareness
Biological	● Lack of preparedness to mitigate the impact of natural disasters, including a robust early warning system, evacuation strategies, etc.
Habitat	● Degradation of habitats and loss of marine biodiversity ● Siltation of mouths of estuaries and lagoons ● Intrusion of saltwater in underground freshwater aquifers ● Chronic and acute erosion along the coast ● Disposal of untreated effluents from industries especially in medium- and small-scale industries ● Solid waste and run off from dumping grounds ● Pollution of coastal waters due to disposal of untreated sewage from cities, towns, and villages
Management	● Data pertaining to coastal management are scattered in bits and pieces ● Sectoral approach to management leading to inter-sectoral conflicts ● Vulnerable to natural disasters including cyclones, surges, etc.

Source: TNFD 2019

(1)   Seagrass/seaweed

The decline of seagrass cover is occurring in all seagrass species in the Gulf of Mannar and Palk Bay. Seagrass beds are important habitats and also vital food sources for endangered marine mammals like (*Dugong dugon*) and sea turtles. Hence, the population of all 14 seagrass species should be increased. However, preference should be given to common species such as *Cymodocea serrulata*, *Thalassia hemprichii*, and *Syringodium isoetifolium*, since this would increase overall seagrass cover and subsequent associated biodiversity, including the fish population.

Viable techniques for the cultivation of commercially important native red algae like *Gracilaria* spp.,

Kappaphycus spp., and *Gelediella* spp. have already been developed by the Central Salt & Marine Chemicals Research Institute (CSMCRI, an institution of the government of India's Council of Scientific & Industrial Research). Brown algae is sufficiently available in the Gulf of Mannar. However, there is no established technology for *Sargassum* spp. or *Turbinaria* spp., which are currently harvested from natural seaweed beds.

Considering the above issues, TBGCP needs to treat seagrass cultivation under the supervision of experts. Dr. S.K. Gupta of the WII has worked on this topic for decades. Collaboration with the WII will thus be adequate to create a proper approach based on scientific knowledge.

Figure 9.1 illustrates seaweeds and seagrasses that exist in the Tamil Nadu State.
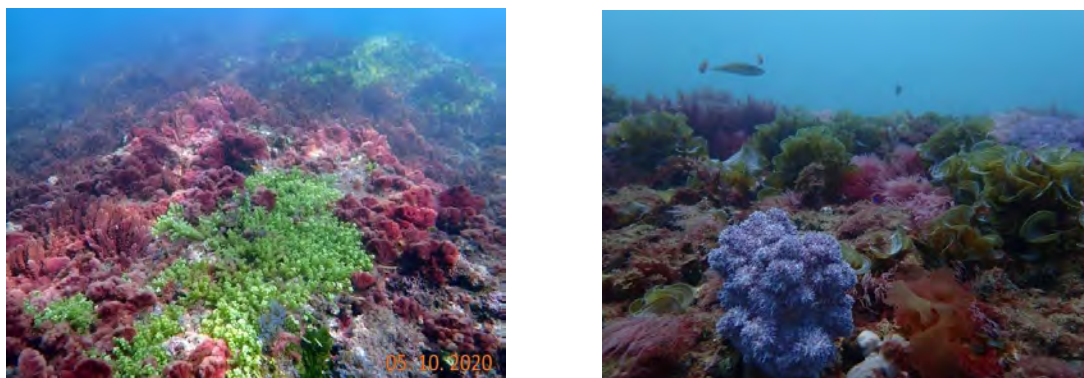
Source: "Seaweeds and seagrasses", provided by Ms. Mita Banerjee, TNFD

Figure 9.1: Photos of Seaweeds and Seagrasses in Tamil Nadu

At the same time, Table 9.2 shows issues regarding seagrass rehabilitation from the viewpoints of human and habitat dimensions.

Table 9.2: Issues Regarding Seagrass Rehabilitation

Dimension	Issues
Human	Bottom trawling by mechanised trawl boats
Habitat	Shore-based developments leading to sedimentation
	Coastal pollution

Source: TNFD 2019

(2)   Dugongs

Dugongs are currently listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as being vulnerable to extinction. In India, dugongs have been given the highest level of legal protection and are listed under Schedule I of the Indian Wildlife Protection Act, 1972.

Several reasons have been reported for dugongs being threatened. Fishery activity is the main factor as a reason for threats from humans. Dugongs get entangled in fishing nets and injured by boat propellers (Table 9.3). Dugongs are still hunted for its meat, oil, and tusks as the traditional custom.

Dugong habitats and distribution have shrunk to two regions in India, one from Rameswaram to Kanyakumari in the Gulf of Kachchh, Gujarat, and another from Rameswaram to Thondi in Palk Bay - Gulf of Mannar, Tamil Nadu. TBGP conducted a questionnaire survey on Palk Bay and estimated the population to be around 41-126.

Table 9.3 shows issues regarding dugong protection.

Table 9.3: Issues Regarding Dugong Protection

Dimension	Issues
Human	• Entanglement in fishing nets (gill nets such as sangili valai, thrirukkai valai, and salai valai) • Poaching for meat • Propeller injury
Habitat	• Habitat loss (seagrass beds) and degradation of seagrass • Pollution (solid waste disposal, sewage, and waste water disposal from aqua farms)

Source: TNFD 2019

(3) Sea turtles

Five species of marine turtles are found in the Indian Ocean: the green sea turtle (*Chelonia mydas*), the hawksbill (*Eretmochelys imbricata*), the loggerhead (*Caretta caretta*), the olive ridley (*Lepidochelys olivacea*), and the leatherback (*Dermochelys coriacea*). The olive ridley, green sea turtle, and loggerhead are listed as endangered in the IUCN Red List of Threatened Species, while the hawksbill and the leatherback are listed as critically endangered at the global level. All sea turtles are protected under Schedule I of the Wildlife Protection Act, 1972. Tamil Nadu should be given higher priority in sea turtle conservation programs as it harbors all five species in India.

Table 9.4: Issues Regarding Sea Turtle Protection

Dimension	Issues
Human	• Poaching of turtles for meat and eggs and extensive fishing and incidental catch • Disposed fishing lines and nets • Beachfront lighting
Habitat	• Loss of nesting habitats due to the growing coastal population and changes into human establishments over time • Invasion of *Prosopis juliflora* to the nesting sites of the green sea turtle • Indiscriminate planting of *Casuarina* trees on the beach • Road construction up to being adjacent to high tide lines (HTL) • Compaction of sand at nesting sites caused by the movement of cattle, vehicles, and humans

Source: TNFD 2019

9.1.2. Invasive Alien Species

The following approach is scheduled by the TNFD for the invasive alien species problem (Table 9.5), considering the fact that 60,000 ha of area have already been invaded by alien species. Since the invaded area is so large, the TNFD has a plan to eradicate alien species at 5% of the total area in five years.

Table 9.5: Eradication of Invasive Alien Species

	Items
Target areas	Nearly all over the state, focusing mainly on important wildlife habitats and biodiversity hot spots Specific districts/reserved areas selected for eradication are those follows, (1) Virudhunagar, (2) Coimbatore, (3) Dharmapuri, (4) Anamalai Tiger Reserve, (5) Mudumalai Tiger Reserve, (6) Madurai, (7) Dindigul (8) Salem, (9) Tirunelveli, and (10) Sathyamangalam tiger reserve in Erode.
Period	5 years
Expected extension	2,400 ha (annually 500 ha of *Lantana* and 100 ha of *Prosopis*)
Target species	*Prosopis juliflora*, *Lantana camara*
Aims to identify	Characteristics of *Prosopis juliflora* and *Lantana camara* as an

	invasive species Management options Priorities and methods for monitoring, control operations, and restoration
Objectives	To remove/control invasive alien species and increase the area under native flora vegetation To promote the regeneration and growth of indigenous plants To increase the fodder area available for wildlife To conserve the rich biodiversity of PA and non-protected areas To improve wildlife habitat by restoring the original vegetation of the area and thereby bring back micro-resilience to enhance species richness To mitigate human-wildlife conflicts arising out of the non-availability of fodder reserves by enriching fodder availability within the forests

Table 9.6 summarizes the issues regarding eradication of invasive alien species.

Table 9.6: Issues Regarding Eradication of Invasive Alien Species

Problems	Issues
Extensive area of invasion	60,000 hectares of forest area in Tamil Nadu is under invasion by alien plant species. The TNFD therefore proposes to: - Concentrate on protected and non-protected forest areas where wildlife population is significant - Include the Western Ghats and Eastern Ghats where human-animal conflict issues are significant
Proposed methodology	*Lantana* - Physical removal by slashing plants - Removal should be during the rainy season as well as before fruiting - Cutting near ground level is not effective - Complete uprooting is economic and promising - Young stands in the treated area for next three years to ensure better establishment of natural vegetation *Prosopis juliflora* (and wattle) - Counting number of trees and recording diameters - Cutting at ground level and complete removal by uprooting - Stack removed roots upside down - Volume assessment and disposal of removed trees and roots - Recruited and/or emerged secondary weeds in subsequent years will be manually uprooted during and immediately after the rains. This operation will be carried out for at least three years to ensure the complete eradication of *Prosopis* and establishment of grass and indigenous species in the area.
Nursery preparation	Nurseries will be prepared for indigenous/native fodder species
Evaluation of eradication activities	The periodic exchange of ideas and information about ground situations between the TNFD, stakeholders, field scientists, and reputable academicians to document the outcome of restoration activities
GIS and Remote Sensing	GIS and Remote Sensing application will be used to review the results of this evaluation
Utilisation	The sale of cut wood materials will be allowed to village level organisations to motivate them and to gain their co-operation towards the conservation of nearby forest areas

Source: TNFD 2019

TBGCP will adopt the methods which were shown to be effective in TBGP, 'complete uprooting' and the 'introduction of indigenous species'. Before implementing these in TBGCP, monitoring on the results induced by these methods shall be carried out, because the same method varies its effect depending on the location where the method is applied and on the time the method is conducted. A sufficient number of datasets allows us to understand the conditions for the method to work well in eradiating alien species through statistical analysis. Moreover, this will also lead to the improvement

of the removal method and reduction of cost.

9.1.3. Mitigation of Human-Wildlife Conflict

INR 5.00 crore per year is spent on providing compensation and an average of 60+ human deaths take place per year. Many incidents other than human death that occur on a daily basis have not been reported. The number of interactions with wildlife is thus considered to be at least three to five times greater. The economic cost of the problem has been reported, but the social dimensions and dynamics of the communities towards such interactions have not yet been estimated. Tolerance of the communities towards problem species is reported to have fallen drastically over the years, while conflict with TNFD staff and the abuse of staff have been reported. Demonstrations, dharnas, road rokos, and in some cases the burning down of forest vehicles have been reported in the past in conflict prone zones.

Tamil Nadu has historically been accorded top priority for the conservation of faunal and floral biodiversity with 5 National Parks, 15 Wildlife Sanctuaries, 15 Bird Sanctuaries, 2 Conservation Reserves, 4 Tiger Reserves, and 3 Biosphere Reserves. Through JFM and TBGP, habitat cover and forage have definitely improved, resulting in sustaining a healthy wildlife population. Despite recording appreciable stability in wildlife populations through the various conservation efforts of the TNFD, human-wildlife interactions still remain a serious threat to the future of wildlife conservation in the state of Tamil Nadu. Habitat is the critical issue for the mitigation of human-wildlife conflict. A multi-dimensional approach is therefore proposed (Table 9.7). As regards habitat research, collaboration with academic institutions/NGOs will be helpful. Ministry of Environment and Forests enacted an Elephant Task Force (ETF) in 2010 to review the existing policy of elephant conservation in India and formulate future interventions. ETF was one of the finest policy proposals for human-elephant conflict with progressive recommendations. ETF acknowledged that the lack of community participation in the programmes was the primary reason for a failure in conflict mitigation strategies. Taking into account such a recognition, elephant reserve-level research is required to move forward to solve the human-wildlife issue.

Table 9.7: Issues Regarding Human Wildlife Conflict

Dimension	Issues
Habitat	Improved habitat cover and forage have definitely resulted in sustaining a healthy wildlife population in the state of Tamil Nadu. However, economic growth and intensive agricultural practice convert forest fringe farmlands to non-agricultural use.
Multi-dimensional approach	● Habitat research ● Habitat connectivity management ● Capacity development of community or strengthening of management infrastructure

Source: TNFD 2019 and Aide Memoire 2020

9.2. Increasing Natural Resource Base

9.2.1. Nursery and Planting for Urban and Peri-urban Forestry

An attempt at generating forest and tree coverage in urban and peri-urban areas is proposed as one of the missions in TBGCP to accelerate and sustain the pace of forestation in the state of Tamil Nadu. In Tamil Nadu, 48% of the population lives in urban areas; it is one of the most urban states in India. In TBGP, TCPL or TCOF were generated and ten million trees have been consistently planted every year since 2012 in all 32 districts (the number of districts at the time when TBGP started) in the state of Tamil Nadu, mainly targeting rural villages. The TCOF component of TBGCP has also generated profound impacts to reduce pressures on biodiversity habitat areas from forest resource utilisation, securing farmers against recurrent drought and the resultant agricultural crop loss, contributing to climate amelioration in rural areas, among other impacts. Generating tree planting has accordingly

been planned in urban and peri-urban areas as the succession of TBGP by using technical and institutional capacities in the TNFD built in TBGP. By promoting tree planting activities in populated urban and peri-urban areas, the tree growing movement is expected to be widely and profoundly catalysed in the whole state of Tamil Nadu by affecting the majority of the population living in urban and peri-urban areas.

(1)　　Strategy 1: Publicity/Campaign for Urban and Peri-urban Forestry

A great deal of publicity will be created to inform the general public and all potential stakeholders about the intention of the government of Tamil Nadu to supply and plant seedlings on their lands/on their premises. Designated offices/officers with all contact/communication information will be announced, whom the public can contact. The public, in turn, will have to inform these officers of their requirements and other details. Within a very short time, irrespective of the time of year, the field staff will carry out the necessary planting on their lands/premises.

(2)　　Strategy 2: Tall and Large Tree Seedlings for Implementation

Tall and large seedlings will be utilised, which are about eight feet (about 2.44 m) in height. The seedlings will be raised in 35*40 cm bag sizes for planting on non-farmlands and 16*30 cm bags sizes for planting on farmlands. By utilising the large seedlings, it is expected that everyone will be able to ensure the survival and growth of each and every seedling. The mortality rate is expected to be almost nil. To this extent, awards/rewards will be expected, too, in which beneficiaries will ensure to ensure the survival and growth of each tree. After planting, a GPS reading of each seedling will be taken. Records will be maintained after planting and the information will be fed into a robust database that will provide all details up to the individual tree level.

(3)　　Strategy 3: Free of Cost Planting and Reward System

Tree seedlings for urban and peri-urban forestry planting activities will be supplied to beneficiaries on their lands or on their premises totally free of cost. Seedlings will be provided with a pickup truck in which the driver and co-driver will ride in the cabin and the load deck will be loaded with seedlings. A TNFD's planting teams will carry out planting on a contract basis. The truck will have a mechanised crowbar/auger and another tool or two. The driver and co-driver to load the seedlings will drive to the place of planting, dig pits, and do the planting all by themselves.

A system of awards/rewards is suggested in place of incentives for surviving seedlings. An individual/farmer who has taken at least 100 seedlings will be eligible for the rewards. It has been proposed that the rewards will be based on the number of seedlings surviving and that the minimum reward will be INR 1,000, calculated at INR 10 per seedling. The maximum reward will be INR 25,000 for seedlings of 2,500 or more. Awards will be given during the third year. There will be five awardees per district. At an average of INR 15,000 per individual, the cost will work out to INR 72.00 lakhs. In TBGP, a system of incentives was created, though it no longer exists because under the system all farmers are given incentives regardless of survival rate — whether a farmer's rate was ten percent or 90 percent. Instead, the reward system has been planned to be applied in TBGCP.

(4)　　Strategy 4: Revitalising and Strengthening Forestry Extension

In order to expand tree cover outside of the forests, the reach and delivery of information on such things as government services, technical advice, seedlings for planting, and planting services, forestry extension services have a significant role in the operation. Equipment such as pickup and augers, staff, and infrastructure accordingly have to be improved. Typically, almost all of the centres are designed so as to have an office of the Forestry Extension Ranger, a central nursery, demonstration plots, and a training hall or auditorium for assembling the client population for conducting various programmes. It is necessary to revitalise and strengthen these facilities according to the new version, promoting urban and peri-urban forestry activities.

(5)   Strategy 5: Establishing and Improving Central Nurseries in Each District

Existing central nurseries at the Extension Centres presently do not have an adequate quality nursery stock of commonly grown tree species available all year for sale to meet the demand of the general public. Members of the public have often expressed disappointment on being told this during enquiries. A reason why state presence is required in the nursery sector is because, despite the proliferation of nurseries in rural and urban areas that the last decade has witnessed, nurseries in the private sector generally suffer from the following deficiencies.

- The germplasm of the seeds used is mostly substandard;
- The pricing of the seedlings is on the higher side; and
- The nurseries do not have competent staff to provide advisory services.

For reasons of resource constraints and the need for wider coverage described above, the establishment and improvement is proposed of central nurseries in each of the former (as of 2012) 32 districts of the state of Tamil Nadu. Instead of an addition of 137 new greenfield nurseries, the brownfield nurseries established under the 'Establishment of Central Nurseries in 32 Districts of the State of Tamil Nadu' scheme and the infrastructural facilities will be upgraded.

(6)   Strategy 6: Issues to be Discussed for TBGCP Formulation

In the TCOF in TBGP, nurseries were decentralised and seedlings were produced and provided in order to facilitate ease of access and logistics. The approximate average survival rate in the previous TCOF was 50%. In the present demands, especially in urban and peri-urban forestry, higher survival rates have been targeted, though it has been assumed that seedling quality will not be satisfied with the present management, techniques, and facilities if the TNFD follows the same methods as in TBGP. Accordingly, it has been proposed to update the facilities and techniques in the central nurseries to produce taller, larger, and higher-quality seedlings.

9.2.2.   Extension Centre Strengthening

(1)   Overview

In the urban and peri-urban forestry activities, operation processes include producing seedlings in nurseries attached with Extension Centres, providing the seedlings to beneficiaries, training and information dissemination on planting and planted tree maintenance activities, transporting seedlings to beneficiaries, and recording and monitoring all planted trees to secure the survival of planted trees. In these operation processes, the Extension Center in each district plays a vital role, especially on communication with beneficiaries. These functions and technical expertise for tree providing and planting activities have been developed mainly in rural areas in TBGP. However as tree providing and planting activities in TBGCP will be conducted in urban and peri-urban forestry, those technical expertise developed in TBGP cannot be utilized directly without any changes because of differences of social conditions and land capacities for planting between those two types of areas. Further, as described below in Section 9.2.3, the strengthening of the functions of the value and supply chains of tree and NTFP is planned in district Extension Centres as a new activity in TBGCP. Accordingly, to enable the Extension Centres to discharge the aforesaid functions, it is proposed to equip them with the necessary paraphernalia and staff. One hybrid utility vehicle to carry both men and materials, such as a camper or a similar vehicle, will be provided to each Extension Centre. Provision will also be made to engage a plantation manager or plant protection specialist with a degree in forestry to service all plantation-related queries or requests from the public at the back end.

(2)   Issues to Be Discussed for TBGCP Formulation

Presently, the strengthening of Extension Centres in each district is equally planned regarding their functions and budget provisions in the DPR. For more practical and efficient institutional and budgetary compositions, for more practical and efficient institutional and budgetary compositions,

Extension Centres shall be prioritised depending on the district situation and suitability to centre conditions according to regional strategies.

9.2.3. Value and Supply Chain Development

(1) Providing Services of Market and Value Chain Information in Extension Centres

There is a growing market which is characterised by the presence of private players lacking technical expertise or competence, who often resort to unprofessional and unfair practices. Market imperfections deter a large number of landowners from tree cultivation who like to grow trees on their land. These landowners are, however, unable to be involved in these activities personally and require some government support. It is assumed that government intervention can address this gap by delivering such things as tree plantations, management, including pest and disease control, fertilisation, and maintenance to the doorstep of interested people. After an assessment of the area and soil testing, discussion with the tree grower and profiling, a tree plantation management and marketing plan will be prepared, customising/tailoring it to suit the requirements of the individual tree grower.

(2) Value and Supply Chain

a. Value and Supply Chain Development for NTFPs

Supply chains of NTFPs collected from the forests have been recognised to be grossly inefficient due to the imperfections of the traditional market and the exploitative behavior toward the resource production side of the intermediaries. The government, however, can undertake market interventions to correct the anomalies and inefficiencies that the existing NTFP value chains suffer from.

Through the previous projects including TBGP, the promotion of NTFP-based livelihoods has been implemented to enhance the economic viability of Joint Forest Management Committees (JFMCs) as well as institutionalising JFM. Resources for NTFP have been grown in production areas during the previous projects. After the projects' supports taper off and finally come to an end, though government intervention in the market has presently not been prepared enough yet. Government intervention in the value and supply chain has been long demanded by the people who support the resource forests.

Government intervention may include: promoting skills/training in the non-destructive collection of NTFPs, preliminary handling protocol, transportation from the production sites to Extension Centres, employing JFMC members and SHGs, and the creation and development of brands to market the packaged value added NTFPs. For infrastructure, updates may include: places for undertaking processing, packaging and storage of the NTFPs in Extension Centres, or other new infrastructure.

b. Value and Supply Chain Development for TFPs

The marketing of the mature trees of the tree growers/farmers, standing or harvested, may be facilitated on an 'as is where is' basis. The felled trees need not be transported to the Extension Centre owing to logistic and other issues. The farmer/seller may be accorded the facility of getting a 'one stop or single window solution', meaning thereby that compliance with the regulatory regime, including felling, possession, and transport permissions, can be taken care of. Offers may be made to buy the tree products of the farmers at Minimum Support Prices (MSP) in the event of market prices falling below a given threshold level. In this way, a massive investment in warehousing and other infrastructural development will not be required. Various other marketing strategies, for instance, sales linked incentives for sales personnel or promotions, may be considered for driving sales. The TNFD hosts the link for tree growers to facilitate felling and transport of trees by getting permission through online application.

In each of the former 32 districts, corresponding to each Extension Centre, one District Tree and NTFP Marketing Society may be constituted, with the concerned Forestry Extension Officer as the Chairperson, the Forestry Extension Range Officer as the Member Secretary, and with VFC/JFMC Presidents, Presidents and General Secretaries of the Tree Growers Societies functioning in the districts as members. All district level societies so formed may be federated at the apex or state level into a State Tree and NTFP Marketing Society, which may be housed in and serviced by a dedicated division of TAFCORN.

9.3. Ecotourism and Ecodevelopment

According to the review of the DPR, the following issues have been identified to be crucial matters for the scope of work of TBGCP:

9.3.1. Ecotourism

(1) Identification of CBET Target Sites in the Eastern Ghats

As for the sites in the Eastern Ghats, the DPR specifies the names of four circuits[83] and locations (forest divisions). However, the names of the particular CBET sites are not clearly indicated, making site-wise review and planning difficult. In view of the situation that the Study Team members cannot get access to the area, it is advisable to specifically propose the target CBET sites.

(2) Clarification of CBET Activities in the Eastern Ghats

Whilst the CBET activities for the Gene Pool Garden are rather specifically indicated, those for the sites in the Eastern Ghats seem not to have been clarified. However, the cost has been estimated in a lump sum for the various activities under two categories of items: i) Development of ecotourism sites; and ii) Development of ecotourism products as described in Chapter 8. To prepare detailed activity plans as well as a cost estimate, each activity should be securely clarified in terms of necessity, specifications, quantity, unit cost, etc.

(3) Examination of Processes for CBET Development

As stated earlier, there are some processes that proceed CBET during TBGP. However, the DPR does not indicate clear and organised processes for the implementation of CBET development, particularly for the four circuits in the Eastern Ghats. Since the available information and data related to the achievements of TBGP are quite limited at the current stage, only possible way is to examine the implementation processes of the proposed project based on the processes adopted to TBGP.

(4) Reconsideration of Follow-up to Existing CBET Sites

It was reported by the TNFD that the ecotourism sites developed under TBGP had been very successful with active involvement of local communities, and that their income had increased.[84] Despite the fact that the information and data that can assess the achievements, problems, and challenges, is not yet available at this moment, it is expected that there is a need for some form of a follow-up to the existing CBET sites. Although this has not been covered by the DPR, it is worthwhile reconsidering the inclusion of this follow-up.

9.3.2. Ecodevelopment

(1) Determination of Target Villages

The DPR states that the target villages for ecodevelopment activities shall be those covered by the

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[83] Although the DPR mentioned that these are existing ecotourism circuits, it was confirmed that these are actually new ecotourism sites.

[84] TNFD (unpubl.). Questionnaire made prior to the Contact Meeting by the JICA Contact Mission of October 2020.

ITDP. Again, it was confirmed through discussions with the TNFD that the target villages should also be located in biodiversity conservation, including ecotourism areas and Soil and Moisture Conservation (SMC) areas in the Eastern Ghats. Taking these issues into account, the target villages should finally be determined. A total of 193 villages has been suggested in the DPR.

(2)   Review of Proposed Ecodevelopment Activities

The DPR proposes activities including various kinds of training, such as vehicle driving, computing, tailoring, dairy management, animal husbandry, beekeeping, mushroom cultivation, and free provision of a LPG connection. These proposed activities should be reviewed from experiences in TBGP, and from the perspectives of effectiveness and sustainability, as well as cross-cutting perspectives such as policy, technical, environmental, social and cultural, institutional and managerial, and economic and financial aspects.

(3)   Examination of Processes for Ecodevelopment Activities

Similar to the case of CBET development, the DPR does not clearly indicate the processes for the implementation of the ecodevelopment activities. Therefore, the implementation processes should be examined based on those adopted in TBGP.

9.4.   Institutional Capacity Development

9.4.1.   GIS and MIS

To begin, it appears that the structures of the main text in the DPR and the total outlay of TBGCP table do not match. To establish a clear linkage between these two items, the DPR needs to be reorganised when it is finalised.

In addition to the inconsistent structure of the DPR, the following issues were identified from the review of the DPR, as well as the Study up to date.

(1)   Need for More Detail Specifications and Usage Scenes

For GIS, the DPR discussed various data and tools such as high resolution satellite imagery and GIS software. It is highly possible that these data and tools will be effectively utilised for TBGCP activities. Although various use cases are described in the DPR, usage scenes of these technology appear overall to be general, and it seems that the required specifications and linkages with proposed activities for TBGCP are not well determined. For example, the spatial and temporal resolution of satellite imagery need to be determined in accordance with the target of monitoring activities. The coverage of satellite imagery also needs to be specified considering the scale of pilot activities. For TBGCP formulation, it is further required that the expected specifications will be discussed considering the proposed activities in detail.

(2)   Need for Introduction of New Potential Technology

The DPR describes different kinds of data and tools for TBGCP activities. It seems that the introduction of new technology and applications are limited in the DPR. Although the data and tools need to be determined based on the results of needs analysis, drones, for example, may be one potential technology in TBGCP. Drones can be utilised for some activities such as monitoring for plantations and human-wildlife conflicts because of their high spatial resolution and capability to capture photos in a timely manner. In this regard, after a current situation analysis about technical capabilities, drones may be also considered as one new potential technology.

(3)   Examination for Capacity of Local Offices and Communication
Infrastructure

Chapter 12 of the DPR is titled 'Institutional Capacity Development'. The discussions within this chapter are largely limited to GIS and MIS, including map preparation, database development, and spatial analysis. It may be required to strengthen institutional capacity of the TNFD from the viewpoint of human resource strengthening at different levels. In particular, it is assumed that technical capacities at local offices are quite limited, and even if the latest equipment is procured for local offices, sometimes the equipment is not sufficiently used due to limited knowledge and skills about the latest technology. At the same time, to effectively utilise the system, it is important to develop the environment and capacity at local offices. To establish a state-wide system for information management, it is necessary to ensure that local offices are well-covered by the communication network.

(4) Effective Outsourcing to Private Vendors

For GIS and MIS, the DPR indicates that TBGCP intends to outsource many activities to private vendors. Because the capacity/manpower of the TNFD can be limited because of other mandates, it is not realistic to train staff to work as developers or engineers. Therefore, it appears that outsourcing will be a good option to implement TBGCP smoothly. If applicable, it may be also effective to involve some TNFD officers so that they can understand the activities in the latter half of TBGCP considering the sustainability of TBGCP impacts.

(5) Need for Revising the Cost Table

The cost table shows that all expenses related to GIS and MIS are scheduled in the first three fiscal years. Although it is understandable that the majority of activities shall be completed at the early stage (the preparation phase) of TBGCP, monitoring and documentation work shall be continuously scheduled until the end of TBGCP. In this regard, the cost table needs to be revised accordingly.

9.4.2. Rest of Activities under Component D

In comparison with GIS and MIS, activities related to the management plan development cell, strengthening mobility, infrastructure development, staff cost, and monitoring and documentation are not described in the DPR. It appears necessary to discuss this component with the TNFD in detail to identify concrete activities, as well as their cost and schedule.

Chapter 10. Proposed Project Outline and Scope of Work

10.1. Project Rationale and Strategy

10.1.1. Problems to Be Addressed by TBGCP

The main problems that Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project (TBGCP) should deal with are as follows.

(1) Insufficient Proper Conservation of Wildlife Habitats

In Tamil Nadu, rapid population growth, economic development, and urbanisation in recent years have led to a rapid increase in the proximity of human activity areas and wildlife habitats. As a result, not only destruction of wildlife habitats, but also conflicts between humans and wild animals are getting severe. Furthermore, impacts of climate change and invasive alien species are exacerbating the situation; the ecosystem services, original disaster prevention and mitigation functions of these wildlife habitats have declined, and vulnerability to natural disasters such as tsunami, cyclones, soil erosion and landslides has increased.

(2) Undeveloped Livelihood Means/Economy in Areas around Habitats

In Tamil Nadu, there are not enough livelihood means to prevent residents from being overly dependent on forest and marine resources. Even in cases where a means of livelihood exists, it has not been established as a useful livelihood means because vocational training for residents has not been sufficiently provided. As a result, inhabitants in the vicinity of forests are forced to overuse forest and marine resources to earn a living. The problem of pollution and fragmentation from urban as well as industrial area development on certain wild ecosystems is also a serious threat to conservation of biodiversity. This causes the depletion or deterioration of forests, the deterioration of marine ecosystems, and even the destruction of wildlife habitats.

(3) Undeveloped Organisational Structure for Habitat Management

Tamil Nadu considers biodiversity conservation to be one of its most important issues, as declared in the State Forest Policy 2018. The state has actively worked to address this issue. However, the Tamil Nadu Forest Department (TNFD) does not have sufficient capacity to achieve this goal. Although various kinds of training were conducted for TNFD officers and field staff members during previous projects, these trainings were temporary, and a lack of understanding about the latest technology has emerged as a new issue. Moreover, not only are community participation and capacity building inadequate, but also the opinions of vulnerable groups (e.g. women, SC, and ST) are not reflected in the decision-making structure of the communities.

10.1.2. Relevance and Linkage with Government Policies

The proposed project (TBGCP) is consistent with the state government's development policy as well as the regional and central government's forest or climate change policies. They include (1) India's Nationally Determined Contributions (NDC) and view towards the climate change announced at Conference of the Parties (COP) 26, (2) Tamil Nadu Climate Change Action Plan, (3) three initiatives launched by the Tamil Nadu state, (4) the Tamil Nadu State Forest Policy 2018, (5) Biological Diversity Act 2002, and (6) the Green India Mission. The relevance of these policies and acts are examined below.

(1) India's NDC and Views Announced in COP26

The government of India has set eight goals as NDC goals for the years after 2020. In particular, there are two major quantifiable goals related to emission reduction and forestry, which are;

- To reduce the emissions intensity of its GDP by 33 to 35% by 2030 from 2005 level.
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.

Furthermore, at the Glasgow Summit in COP26, the government of India promised to reach the goal of net zero emissions or carbon neutral, which means a situation that the amount of greenhouse gases in the atmosphere will not increase, by 2070, and this is regarded as one of the five significant elements of India's climate action. On the other hand, India is also one of the few countries that refused to sign Glasgow's Forest and Land Use Leader Declaration, which aims at ending deforestation by 2030. In this regard, India requested that the word "trade" should be removed from the declaration because the declaration intends to connect trading activities with climate and forest issues.

(2)   Draft Tamil Nadu State Action Plan on Climate Change – 2.0

In order for Tamil Nadu to prepare their own climate change action plans that align with the India's National Action Plan on Climate Change released in 2008, MOEFCC requested the state to revise the existing Tamil Nadu State Action Plan on Climate Change (TNSAPCC). In the TNSAPCC, seven vulnerable sectors were identified. They include: 1) Sustainable Agriculture, 2) Water Resources, 3) Forests and Biodiversity, 4) Coastal Area Management, 5) Sustainable Habitat, 6) Energy Efficiency, Renewable Energy, and Solar Mission, and 7) Knowledge Management.[85] In response to the request, the existing TNSAPCC was revised, with technical support from the German Corporation for International Cooperation (GIZ), by reviewing impacts and risks of climate change that exist within the state and vulnerability of the state to climate change and examining the implementation status of the existing TNSAPCC. The state also reviewed the existing TNSAPCC focusing on various kinds of adaptation and mitigation measures considering the requirements for the achievement of India's NDC and needs for the preparation of new short- and long-term plans.

In 2019, the draft revised action plan on climate change of Tamil Nadu (Draft TNSAPCC 2.0) was prepared, and the state government planned to carry out total 199 projects in the above-mentioned seven key sectors by the year 2030. The proposed budget for executing this plan was estimated over INR 3.24 trillion.[86] On this action plan, in particular, following activities are proposed as measures for adaptation and mitigation.

- Mitigation Activities: To increase the forest cover both inside and outside notified forest areas through afforestation programmes as well as restoration of degraded forests, to enhance biodiversity conservation, management of forest fires and alien invasive species, and research component in forestry sector.
- Adaptation Activities: To enhance livelihood of the forest dependent people, wildlife protection, lower strata diversification, and to conduct capacity building on climate change for integrating climate change in forest ecosystem governance.

(3)   Three Initiatives Launched by the Tamil Nadu State

In addition to the TNSAPCC, to improve state's climate change resilience and protect its ecosystem, the government of Tamil Nadu also made an announcement to launch three initiatives with substantial budgetary allocation, including (1) Tamil Nadu Climate Change Mission, (2) Tamil Nadu Wetlands Mission, and (3) Tamil Nadu Green Mission. First, the main objective of the Tamil Nadu Climate Change Mission is to focus and take action on climate change adaptation and mitigation activities. Second, the Tamil Nadu Wetlands Mission aims mainly at ecological restoration of wetlands in Tamil Nadu as well as the conservation and management of them. Third, the Tamil Nadu Green Nadu

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[85] https://www.environment.tn.gov.in/tnsapcc
[86] https://www.environment.tn.gov.in/Document/tnsapcc/Front%20pages.pdf

Mission focuses on the enhancement of the forest and tree cover in the state from the current 23.27% to 33% through a carefully planned tree planting campaign over a period of 10 years.[87][88]

(4)   Tamil Nadu State Forest Policy 2018

The Tamil Nadu Forest Policy 2018 was released in compliance with the National Forest Policy of 1988. TNFD has outlined its objective of increasing forest cover from the present 21.76% to 33% of the geographical area of the country by 2030. The policy explains the various parameters related to forestry, its conservation and the development of people dependent on it, and the achievement of reforestation in more than 0.6 million hectares in the last two decades.

The policy focuses on an ecosystem approach to forest management by paying attention not just to trees but also to herbs, shrubs, and climbers. The policy also seeks the involvement of local tribal communities in protection, conservation, and wildlife management.

(5)   Biological Diversity Act, 2002

The Biological Diversity Act, 2002 consists of 12 chapters, which aim at the conservation of biological resources, managing their sustainable use and enabling the fair and equitable sharing with local communities of benefits arising out of the use and knowledge of biological resources. The act refers to three authorities, the NBA, the State Biodiversity Boards (SBBs), the BMCs, to regulate access to biological resources. These three authorities are provided with special funds and a separate budget to carry out any research project dealing with the biological natural resources of the country.

(6)   Green India Mission

The Green India Mission is one of eight missions under the National Action Plan on Climate Change (NAPCC). This aims to respond to climate change through a combination of adaptation and mitigation measures contributing to enhancing carbon sinks, to adapt vulnerable species/ecosystems to the changing climate and forest-dependent communities. Along with these aims, the objectives are set as follows: to increase forest cover on five million ha of forest/non-forest lands; to improve the quality of forest cover on another five million ha; to improve ecosystem services, including biodiversity, hydrological services, the provisioning of fuel, fodder, timber, and NTFPs; to increase forest-based livelihood income of about three million households; and to enhance annual CO_2 sequestration by 50-60 million tonnes by 2020.

10.2.   Project Objectives and Approach to Implementation

10.2.1. Project Objective

The objective of TBGCP is "to improve biodiversity conservation through habitat improvement of flora and fauna, afforestation and institutional capacity development, thereby contributing to the resilient socio-economic development in harmony with nature in Tamil Nadu."

10.2.2. Approaches

In order to deal with the problems and challenges described in the previous sections, TBGCP will be conducted under the following four technical policies.

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[87] The Government Order related to the Tamil Nadu Green Climate Company date on November 3rd, 2021.
[88] The presentation materials prepared by the government of Tamil Nadu.

(1) Conducting Surveys with an Emphasis on Ecosystem Conservation and the Use of Ecosystem Services

1-1: Examining regional project strategies

The area of Tamil Nadu is vast, and natural conditions and socio-economic conditions there vary greatly from region to region. In addition, there is specific regional uniqueness in the target areas of TBGP. Therefore, in order to optimise and improve the efficiency of survey planning and execution, the state will be tentatively divided into several major areas according to natural conditions, socio-economic characteristics, and the current situation in TBGP target areas. With this division, a draft project strategy and a project activity plan will be prepared. Drafts and activity plans will be revised each time at the investigation stage.

As well as the North to South divisions of the state, it can be recognised that there are West to East Landscape variations partly because of the topographic feature of the state in which mainly hilly undulations appear in the west side along the state boundaries, rather flat landscapes are widely stretched in the middle areas and then the landscapes continue up to the east coast side.

In addition to the natural conditions of the state, TNFD presently takes regional management system based on the division management units. In the system, there have been 32 district divisions based on the jurisdiction boundaries of the 32 districts in the State. (There are presently 38 Districts in August, 2021 and the Forestry divisions have been still applying the boundaries of the Districts at the year of 2009.) As the activities of Increasing Natural Resource base in TBGP, TCPL were mainly conducted in the rural areas in TBGP. The TCOF (Tree Cultivation Outside Forest: This is regarded as succession of TCPL) activities are expected to continue and extend to the urban and peri-urban areas based on the present 32 Division Management Units.
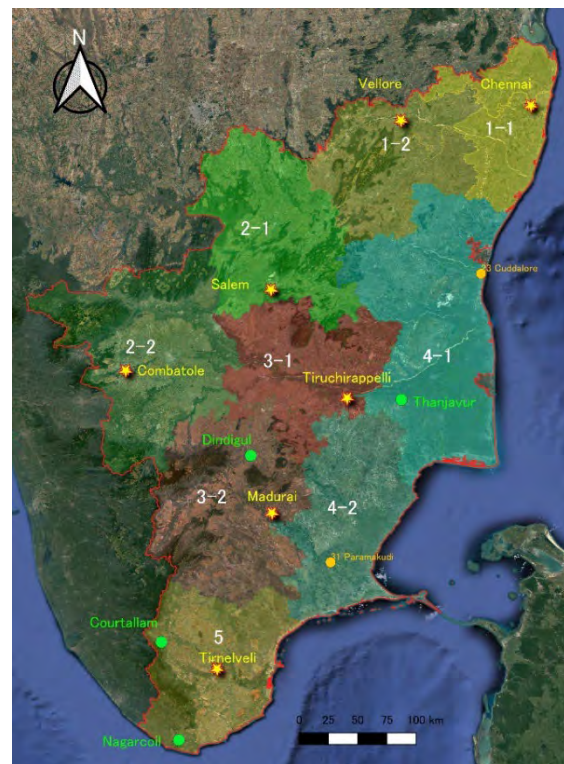
Figure 10.1: Nine Strategic Division Units for TBGCP

Based on those variations of South – North and West to East topographic, climatic and natural conditions, and also consideration of the institutional and administrative divisions of the forest and environmental management unit system, it can be suggested to divide the state into nine (9) as strategic division units of TBGCP as bellow maps:

In each division, the following conceptual land allocations can be envisaged for the land use and eco-system arrangement and relationships between biodiversity habitat areas/zones, eco-development/ecotourism zones, increasing natural resource base zone in rural areas and urban and peri-urban forestry areas/zones in TBGCP.
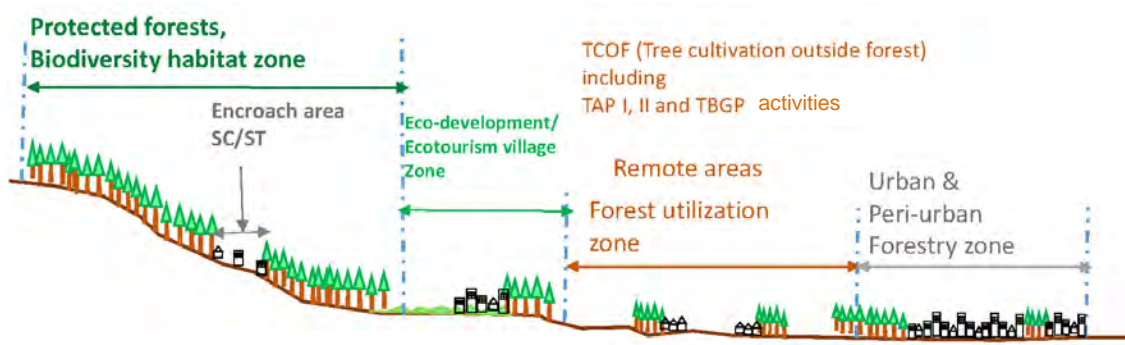
Figure 10.2: Land-use and Eco-system Conceptual Allocation in TBGCP

1-2: Strategic enhancement of ecosystem services

The purposes of TBGCP are the mitigation of conflict between wild animals and humans through the improvement of ecosystem services, the mitigation of cyclone and high wave damage through mangrove planting, disaster prevention effects such as the prevention of sediment runoff, and the improvement of water source recharge. In TBGCP, the introduction of green infrastructure and Eco-DRR concepts will be considered. For example, in green infrastructure, improving the quality of ecosystems through tree planting and the creation of protection fences for wild animals by hedging will be considered. In Ecosystem-based Disaster Risk Reduction (Eco-DRR), the planting of mangroves to improve disaster prevention functions based on the lessons learned from the damage caused by the storm surge in 2015 and 2017 will be considered. Ecosystems such as forests, farmlands, cities, and coasts have individual issues for each ecosystem, and these ecosystems are interconnected through the circulation of water and substances. Furthermore, some wild animals move across different ecosystems. Therefore, ecosystems will be examined not only individually but also over a wide-area. In addition, if necessary, spatial information technology will be applied for mutual connections between ecosystems.

1-3: Women's participation in decision-making processes, including planning

The gender mainstreaming strategy and action plan shall be prepared during the preparatory stage. The organizational structure of the PMU, DMU and RMU, as well as Ecodevelopment Committees, would be formulated, considering the above-mentioned strategies and action plan, and appropriate gender training shall also be prepared for all levels of project implementation units and stakeholders. In addition, the gender monitoring system shall be institutionalized in the Project.

(2) Review of TBGP Effects and Project Activity Proposals, and Reflect the Results in TBGCP

2-1: Review of biodiversity conservation methods of TBGP and proposal of effective methods

In TBGCP, conservation activities targeting various natural environments and species are planned. In addition, one of the objectives is to expand the achievements of TBGP. The TNFD will expand the outcomes of TBGP and overcome challenges, taking a multifaceted approach to conservation. This approach will include habitat connectivity management and community capacity building, in addition to regulatory and physical conservation environment maintenance. In TBGP, exotic plants such as lantana, mesquite, and black wattle were removed as one of the conservation activities, but since then other exotic species such as *Senna spectabilis* of the legume family have become a problem. It is necessary to verify the effects of extermination on biodiversity by monitoring and to continue measures against alien species. In TBGCP, the conservation methods implemented in TBGP will be further reviewed by incorporating biogeographical approaches and geostatistical methods that were not implemented in TBGP, and the effectiveness and sustainability of the conservation methods will

be verified. As the results of the processes, appropriate conservation methods will be introduced.

2-2: Selection of ecodevelopment activities and approaches for TBGCP with effective review of activities for livelihood improvement under TBGP

In TBGP, infrastructure development such as multipurpose halls, drinking water supply facilities, paved roads, retaining walls, Village Forest Committee (VFC) offices, and solar power generation was mainly supported. As their detailed results and impacts have not yet very clear, it is necessary to review how much they could have contributed to the improvement of local livelihoods.

On the other hand, in TBGCP, it is proposed to promote various items as ecodevelopment activities; e.g. automobile driving skills, IT, sewing, agriculture, pig farming, poultry farming, beekeeping, mushroom cultivation, and LPG distribution. These will target residents in the vicinity of forests who use natural resources such as forests. In TBGCP, these proposed activities should be assessed in terms of effectiveness and sustainability, as well as cross-cutting perspectives such as policy, technical, environmental, social and cultural, institutional and managerial, and economic and financial aspects, and should finally be determined for the implementation. In case that other activities that are not included in the proposal are raised by the target villages/hamlets, the TBGCP should sincerely pay attention to them and flexibly discuss the adoption of those activities.

Furthermore, in TBGCP, because vocational training is the main support content as stated above; however, it is anticipated that simply providing training opportunities to local residents usually cannot lead to improvement in livelihoods. Thus, it is imperative that the plan includes a range of support, such as the provision of minimal equipment that pertains to training, the formation of activity groups, the establishment of activity funds, technical follow-up, and monitoring and reviews.

2-3: Active introduction of marketing perspective

Marketing perspectives shall actively be introduced to activities that produce saleable products (such as sewing, agriculture, pig farming, chicken farming, beekeeping, and mushroom cultivation) as a new attempt. In addition, precise support shall be provided from the stage of the development of high value-added products through distribution and sales and further promotion methods. From this point of view, TBGCP will consider introducing the Smallholder Horticulture Empowerment & Promotion (SHEP) approach, which is being promoted by JICA in many countries. Also, a mechanism for cooperating with local NGOs shall also be discussed.

2-4: Analysis of industry based on distribution and quantity of forest products and forest resources, distribution routes

In the review of the results of TBGP and the Fact-finding Survey on Natural Resource Use (hereinafter the "Fact-finding Survey"), the types of forest products, distribution of resources, method of grasping the amount, and distribution route shall be confirmed and surveyed periodically at the implementing period of TBGCP. Understanding the amount of resources produced by TBGP is extremely important in terms of forest resource utilisation, evaluation of past TBGP activities, and planning of future activities. In addition, due to the form and number of JFM activities, and the breadth of their distribution, the total amount and changes in amount (growth amount) of each resource type should be estimated with statistical or simple quantitative grasping methods, whilst supplementing each with the current data management and database of TNFD; distribution maps of village forests with JFM schemes, privately-owned forests, and public forests; sampling surveys in the field (including a simple stock volume survey); and satellite images. By integrating this information, analysis shall be done on the availability of stock volume planted outside forest areas in TBGP in which areas, and how much is available, which will lead to the distribution of available resources now and in the future. In addition, for high-grade tree species such as teak and tree species

for specific purposes such as sawn timber and furniture, efforts will be made to grasp the distribution of and quantitative information on the tree species.

Regarding the production system of forest resources, the capacity of forestry companies commensurate with the amount of timber to be produced in the future, based on the future production amount, and environmental and technical problems in the current or future forestry operation method, are important factors to formulate the regional supply chains of forest products. Regarding forest products for which there is a great need both currently and in the future, the following information shall be collected by periodical and constant supply chain surveys: product forms (sawn timber, furniture wood, papermaking raw material chips, MDF raw materials, and plywood raw materials), their processors, final consumption areas (within the state, in other states, and overseas), the scale of the final buyer (whether or not to introduce a major trader, the possibility of doing so), the Japanese forestry industry, and the room for technology transfer from the timber industry.

Regarding distribution supply routes, the supply chain survey shall be initiated according to the scope of the assumed supply chain (Figure 10.3). The specific supply chain structure of forest products shall be clarified from the supply chain survey results. Above all, since intermediate processing plants play an important role in the supply chain (Figure 10.3), and information on their location, scale, species to be handled, and quantity is useful, special attention should be paid to the process.

2-5: Emphasis on quantitative data collection on Natural Resource Use of TBGP and TBGCP
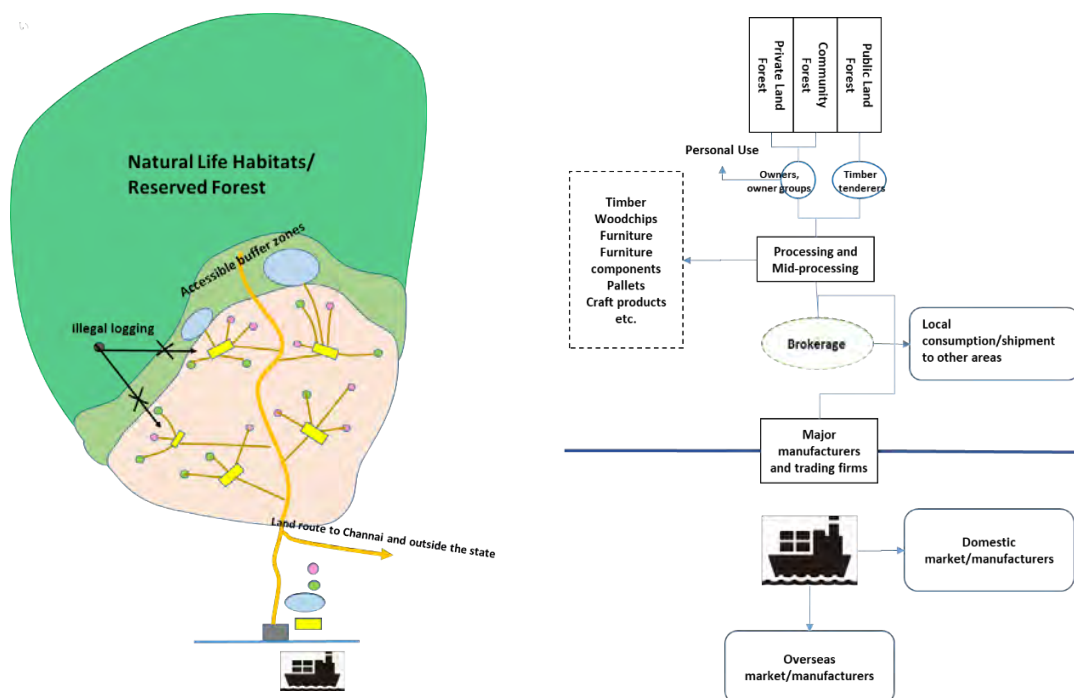
Figure 10.3: Indicative Supply Chain Map (Left) and Supply Chain Flow (Right)

The Fact-finding Survey was carried out at the sample sites (communities) that met one or more conditions as follows: i) proximity to PA; ii) existence of damage from wild animals; iii) existence of SC/ST communities; and iv) conduct of commercial plantation. The Fact-Finding Survey was planned to grasp biological habitats and the surrounding society and economy from both a bird's-eye view and a qualitative view, as well as to collect information on the amount and unit price of each process required for the development of the supply chain of forest products. In addition, since the target area of TBGCP is likely to be newly developed in the biological habitat of the central part of the state and the area where many forests are distributed, two or more sample sites shall be selected, each from TBGP target area and TBGCP target area.

In the context of the Climate Change regime, changes of eco-systems and natural resources and their monitoring are crucial factors and indicators to determine the policies and countermeasures against the climate change. It is therefore important to continuous measurement and collection of quantitative data of the eco-systems and natural resources in the State during the implementation period of TBGCP. It is also desirable to continuously conduct a survey and measurement around important biological habitats. Therefore, it is necessary to continue to investigate important biological habitats in the state and their importance, and then to align the distribution with TBGP active areas. For this purpose, the distribution of activity areas of TBGP will be continuously investigated based on existing information, such as activity records managed by the Forest Department. In a case where there is no distribution map, the map should be prepared. In accordance with the distribution map, TBGP sites and the target area of TBGCP will be selected in light of the above conditions. When making the selection, the scope of the supply chain as shown in Figure 10.3 shall be assumed. The scope and number of estimated supply chains and the number of surveys will be determined according to the regional characteristics and trends revealed in the distribution map. In TBGP sampling areas, the types and species of forest products and timber produced from private land forests and public land forests within the JFM influence area and the biological habitat of the conservation target will be identified, and the survey related to the supply chain shown in the technical policy on forest resource utilisation shall be conducted for the main products.
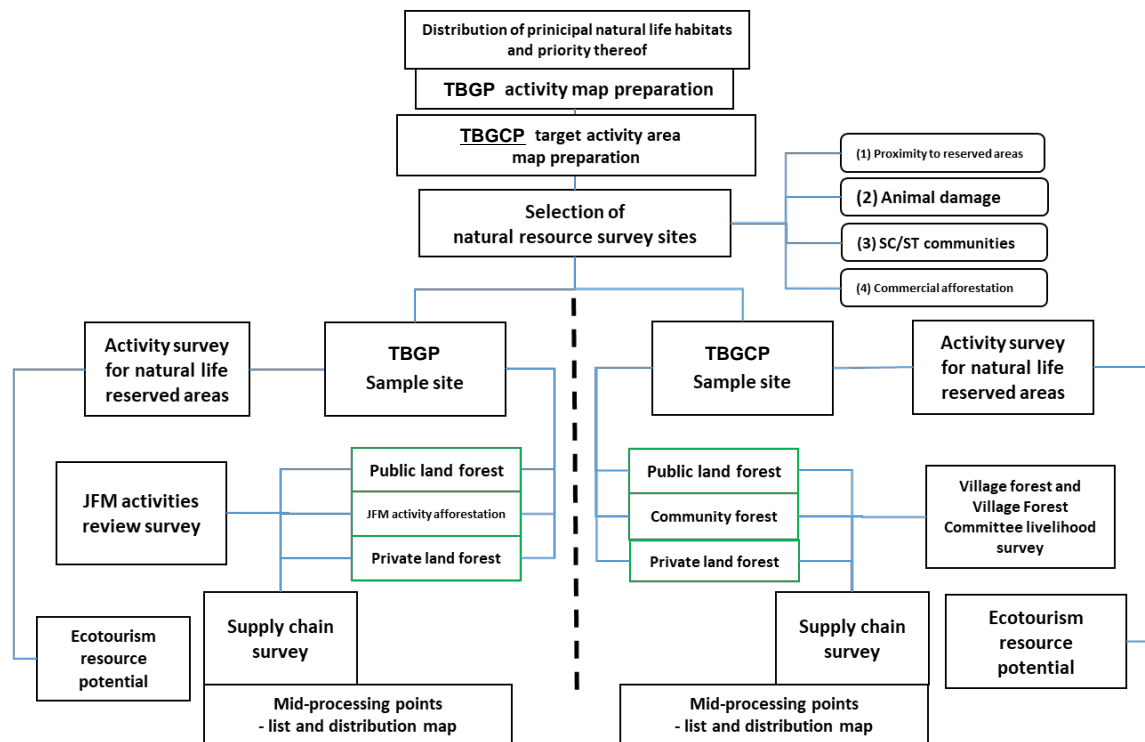
Figure 10.4: Indicative Resource Use Survey Flow (Draft)

In addition, in the JFM activity area, the contents of the activities carried out in TBGP, the results where tree planting was carried out, the ratio of commercial use, and the household livelihood survey will be more clarified during the TBGCP implementation period.

(3) Implementation of Surveys and Proposals with a View toward Collaboration with Private Companies including Japanese Companies and Research Institutes

3-1: Examining forest products and certification systems based on trends of ESG investing companies

In TBGP, around 143,000 ha of trees were planted in non-forest areas through the distribution and planting of seedlings and guidance to farmers. TBGCP also plans to plant trees in non-forest areas. Regarding forest products for sale produced from these non-forest plantations, it is necessary to strengthen the supply chain by organising producers such as farmers and matching them with private companies, including Japanese companies. On the other hand, some private companies situated at the downstream of the supply chain have an interest in biodiversity conservation; these companies have already worked in reforestation for forest conservation encompassing diverse ecosystem services as Corporate Social Responsibility (CSR). In India, the Companies Act of 2013 prescribes that all companies that make a certain profit should spend 2% of their net profit on CSR activities. CSR activities include environmental conservation and activities pertaining to environmental considerations, so that many private companies have supposedly invested in activities such as biodiversity forest conservation. Furthermore, with the prevalence of Environment, Social, and Governance (ESG) investment, which advocates the importance of socially- and environmentally-conscious corporate activities, corporate awareness of biodiversity conservation in forests and coastal areas is increasing. However, under the present circumstances, it is difficult for private Japanese companies to obtain by themselves information on ecosystem conservation activities and to plan and implement the activities. Therefore, at present, JICA is conducting interviews about the needs of Japanese companies that are sensitive to ESG investment trends and examining how to collaborate in TBGCP. In addition, building a sustainable and strong forest product supply chain through discussions on policies that include the Indian side is expected in the future. Based on this initiative, an attempt at realisation will be made in TBGCP through coordination with the Indian government and private companies, and through related surveys.

The introduction of forest certification and managed timber (management of processing and distribution processes) certification is also being considered to prevent the contamination of illegal timber, in order to prevent the mixing of timber and forest products with those obtained by illegal logging, thereby reducing the value of the company's ESG investment. At that time, the TBGCP will examine the introduction of the existing certification system, the possibility of acquiring wide area certification from the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC), costs and issues in such cases, the needs of the certification system of the final buyer, and the cost bearer at the time of introducing the certification system, among other things. The possibility of creating an independent certification system that is suitable for India will be considered.

3-2: Consideration of cooperation with research institutes in Japan and India to improve project results

Forest and coastal ecosystem services range from improving wildlife habitat to mitigating natural disasters such as cyclones, preventing erosion, improving water source recharge functions, and improving carbon sequestration capacity. This requires knowledge in a wide range of fields. Therefore, collaboration with universities and research institutes that have knowledge is effective in producing project outcomes. At present, JICA is proceeding with discussions and is considering collaboration with research activities conducted in TBGCP. In collaboration with such efforts, it is possible that TBGCP will work with international organisations such as the International Union for Conservation of Nature (IUCN) Commission on Ecosystem Management (CEM) for ecosystem management, the United Nations Office for Disaster Risk Reduction (UNDRR) Stakeholder Engagement Mechanism (SEM) for disaster prevention, and the University of Madras, which is familiar with the environment in Tamil Nadu, to realise TBGCP and improve results subject to Section 5 & 6 of the Biological Diversity Act 2002.

(4)   Strengthening the Project Implementation and Monitoring System

4-1: Monitoring system assuming participation of the VFC and utilisation of spatial information

As mentioned above, the resources produced by TBGP are based on those continuous form and number of JFM activities and their wide distribution, and that this situation can make it difficult for TNFD officers alone to monitor the target resources and their quantities, including the total amount, and changes to them. Therefore, it is indispensable to monitor the resources using the monitoring system including the VFC of each JFM and the resources and activity records prepared by the VFC. It can be assumed that VFC has played a major role in the implementation of TBGP. Regarding the monitoring system, the individual capacities of TNFD officers and their team composition shall be further strengthened in the implementation period of TBGCP; not only that, but the fact-finding surveys of the current system, including the VFC, shall also be continuously conducted during the term. Strengthening policies accordingly shall be proposed based on those continuous survey results. In addition, in TBGCP, it is important to manage the target animal and plant habitats to be conserved and the location and amount of resources, as well as changes thereto. In this regard, the strengthening of the implementation system that utilises GIS for TBGCP implementation and monitoring shall be continuously examined to keep improving the monitoring system.

Further, regarding the range of the monitoring system, it shall be considered to stress that monitoring system include the outside forest areas. It is because planting activities in TBGP have been strengthened in the outside forest areas and it can be expected to continue it in TBGCP as urban and peri-urban forestry activity. However, data and database of GIS section is assumedly concentrating mainly on the forest lands in the state. It is therefore important to consider how to extend monitoring areas to agriculture land, marginal land, urban and peri-urban area land, too, as the monitoring system of TNFD.

4-2: Developing the capacity for the environmental and social consideration of TNFD

With support of Project Management Consultant, the PMU shall review and finalize the Environmental Impact Assessment Framework (EIAF) and prepare for the Guidance Note to ensure social and environmental safeguard, selection criteria reflecting the social-environmental safe guard perspective, screening criteria, and other documents, in order to show the DMUs, RMUs and other stakeholders the project procedures and instruct them on how to implement the project. According to the EIAF, the PMU shall prepare and implement the Environmental Management Plan and Monitoring Plan, with support of the PMC.

4-3: Appropriate setting and monitoring of gender mainstreaming indicators

According to the Gender Action Plan, actions necessary to achieve the gender mainstreaming, indicators, and the data necessary to evaluate the level of achievement shall be decided, and the monitoring systems at the PMU, DMU, and RMU levels would be formulated.

10.3. Target Area and Selection Criteria

This section discusses the target of the TBGCP and the indicative selection criteria, as well as the selection method for each component.

10.3.1. Target Areas of the TBGCP

In TBGCP, the total 81 Divisional Management Units (DMUs) across the state are involved (Figure 10.5). The list of the target DMUs is shown in Annexure 10.1.
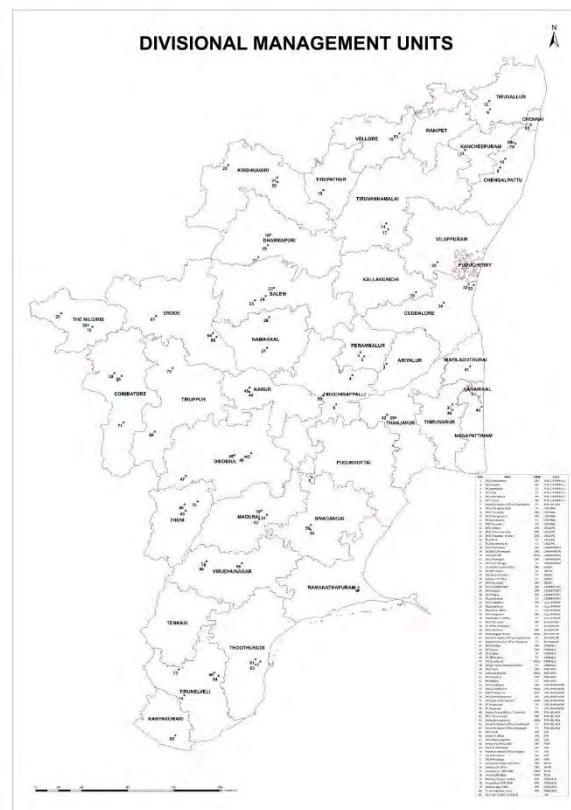
Figure 10.5: Location of the Target 81 Divisional Management Units (DMUs)

In the TBGCP, main components can be divided into four categories: 1. Ecosystem Based Climate Change Measures, 2. Human Wildlife Conflict Measures, 3. Promoting Supply Chain Development, and 4. Livelihood Improvement Activities. Target areas of those four components will be varied depending on activities in each component.

In the biodiversity activities, there are focusing eco-system, animals and also certain conflicts between animals and human inhabitants and the target areas have been identified accordingly. In case of eco-tourism and eco-development activities, there have been designated eco-tourism villages and eco-development regions. Target areas of these two components are accordingly specified in 10.5 Scope of Work. Potential beneficiaries of these two components are assumed to be stakeholders surrounding biodiversity habitat areas and eco-tourism/eco-development villages excluding TNFD members and stakeholders as the direct beneficiaries of TBGCP.

In case of the activities of urban and peri-urban forestry and supply chain development in the increasing natural resource base component, however, there is no specific focusing areas and their activities have been planned to operate broadly and equally in 32 districts in all Tamil Nadu state according to the DPR. It is however considered that it be required to select and prioritise focusing areas/districts in order to effectively and efficiently manage TBGCP with a certain manner of operational strategies. Selection and prioritising criteria of the activities of increasing natural resource base has been discussed between TNFD and JICA.

10.3.2. Selection Criteria for the Project Sites

This section discusses the outline of the selection method and criteria for the above-mentioned four components.

(1)   Component 1: Ecosystem Based Climate Change Measures, & Component 2: Human Wildlife Conflict Measures

In the Component 1 of the TBGCP, a number of biodiversity conservation activities, urban and peri-urban forestry are planned. In the Component 2 of the TBGCP, activities against Human Wildlife Conflict are planned. Project activity areas are designated mainly in protected areas, and the following concept shall be utilized in order to develop the selection of criteria:

a.   Biodiversity Conservation Activities

Selecting the species or populations that should be prioritized as targets for in-situ conservation primarily depends on local requirements and circumstances because there is no precise or agreed methodology. Selection has been practically made with an influence of the priorities and mandate of the institution or agency involved commissioning the conservation actions. This is the reason why the species chosen and the actions proposed by agricultural or forestry staff in a country will most likely differ from those made by conservationists, conservation biologists, ecologists or taxonomists.

In the absence of an agreed set of criteria, each country adopts different sets of criteria based on the knowledge, experience, and interests of those involved in the exercise. Commonly used criteria are:

1) State of biodiversity, uniqueness or rarity as biodiversity significance.

2) Presence of threatened, endangered or declining species and/or habitats.

3) Existing conservation management measures.

4) Presence of domesticated biodiversity component.

Considering the above, the aforesaid criteria for Tamil Nadu are shown in the following table.

Table 10.1: Indicative Criteria for Biodiversity Conservation Activities

No	Criteria	Description
1	State of biodiversity	Contains species richness defined as the number of species per unit area representing the status of biodiversity.
2	Uniqueness or rarity	Contains species (populations, communities), habitats or ecosystems, geomorphological or oceanographic features which have uniqueness being rarely found anywhere else. Contain a mosaic of natural, semi-natural, and man-made habitats, having a significant diversity of life forms for in-situ conservation of biological diversity.
3	Importance for threatened, endangered or declining species and/or habitats	Contain threatened species of outstanding universal value from the point of view of science or conservation.
4	Hydrological importance	Contains an important site for maintaining hydrology to sustain the health of the ecosystem
5	Existing conservation management measures	Contains a support network and experts that can assist with knowledge generation and on-site field-testing. Contains a management system which can be used as a framework to build strengthened inventories, monitoring, evaluation, site designation and on-site management measures
6	Occurrence of restricted-range species	Includes areas that offer refuge or corridors for threatened and endemic fauna and flora

b.   Urban and Peri-urban Forestry Activities

In the urban and peri-urban forestry activities, seedlings will be raised and planted in the urban and

peri-urban areas in all districts in Tamil Nadu State. It is also planned to fruitfully utilize the Extension Centers set in the Division Management Unit of 32 districts throughout the state.

Beneficiaries for planting in their land will be screened through public announcement and advertisement, etc. In planning, the number of seedlings to be raised, distributed, and planted, these main categories can be considered.

1) Criteria based on the operational capacity of each Extension Centre: The number of planted trees in the TCPL activity in TBGP and the number of operation staff in the present Extension Centre can be utilized as indicators to estimate the present capacity of an Extension Centre in each district.

2) Criteria by considering the need and afforestation capacity in the area (capacity of planting sites/land): This capacity can be estimated from some statistical information.

3) Criteria based on the relationships between biodiversity conservation/forest conservation areas and urban and peri-urban areas: The number and areas of protection areas can be used.

Above criteria and their indicators are shown in the following table:

Table 10.2: Indicative Criteria and Indicators for Urban and Peri-urban Forestry Activities

No.	Criteria and Indicators
Criterion 1: Operational capacity of each Extension Centre	
Indicators:	1. The number of planted trees in TCPL (Tree cultivation Plantation Land) activity in TBGP in districts 2. Survival rates of the planted trees in TBGP in districts 3. The number of operation staff in the present Extension Centre in districts 4. Number of seedlings to be produced by nurseries in each Extension Centre
Criterion 2: Capacity of area/land for planting trees in TBGCP	
Indicators:	1. Population and population density of districts 2. Extent areas of residential and industrial areas in districts 3. Requirements and requests from beneficiary residences, groups and organization for planting trees
Criterion 3: Relationships between biodiversity/forest conservation area and urban and peri-urban areas	
Indicators:	1. The number and extent areas of protection areas/wildlife conservation areas in districts 2. Extent areas of residential and industrial areas in districts 3. Distance between protection areas/wildlife conservation areas and urban and peri-urban areas

Regarding the selection of beneficiaries of seedling supply, the basic policy for the selection is to be sequentially determined on the premise of all applicants. Marginalized groups such as women, women's groups, SC, ST, and the poor will be considered to be prioritized.

(2)   Component 3: Promoting Supply Chain Development

In the Component 3 of TBGCP, supply chain development activities are planned to be conducted. In each activity, the locations of activity base are needed in the supply chain development activity. For the prioritization and the selection, the following criteria shall be utilized:

a.   Supply Chain Development

Another activity of Component 2 is the supply chain development. Similar to the urban and peri-urban forestry, this activity is planned to be expanded throughout the state. In developing this activity, the state has been strategically divided into nine areas. Each of these nine strategic areas consists of

multiple districts. In a strategic area, biodiversity conservation areas, forest conservation areas, eco-development/eco-tourism areas, forest utilization areas, and urban and peri-urban areas are set as the areas treated as one or more continuous landscapes.

Since there are several extension centres in each strategic area, an extension centre is required to be determined and selected to have and develop functions as activity base in each strategic area and supply chain development activities need to be carried out at the extension centres of those bases.

For the supply chain development activities, it is at first necessary to determine the target products of non-timber forest products (NTFPs) and timber-based forest products (TFPs) to handle as market information. Then, when deciding an extension centre or district to be the base, one of criteria shall be the quantity of the distribution of target product(s).

As an indicator for the quantity of the distribution of the products, the following items can be listed:

1) the number of types of NTFP and TFP distributed in districts,

2) the total quantities of resources of each product, and

3) the amount of distribution.

In addition, if a future market expansion is expected, it is necessary to consider the population and economic indicators, such as the population, land for industrial, and main industries in the districts.

For the third criteria, it is important to consider the influence of the supply chain of forest products to bio-diversity and forest conservation areas. As described above, nine strategic areas are regarded as the continuous landscapes from the biodiversity/forest conservation areas, eco-development/eco-tourism areas, forest utilization areas and urban and peri-urban areas. Also increasing natural resources other than forest areas are partly, but with significantly large portion, considered and performed for reducing pressures of the forest resource exploitation from outside of the conservation areas.

In the below table, those three criteria and indicators are listed:

Table 10.3: Indicative Criteria and Indicators Related to Forest Product Supply Chain

No.	Criteria
Criterion 1: Quantity of distribution of focusing products in district (current capacity)	
Indicators:	1. The number of target product types 2. Quantity of resources/standing trees 3. Quantity of JFM as the resource locations of forest timber 4. The number of operation staff in the present Extension Centre in districts
Criterion 2: Future capacity of area/land to predict future market extend	
Indicators:	1. Population and population density of districts 2. Extent areas of residential and industrial areas in districts
Criterion 3: Relationships between biodiversity/forest conservation area and forest product supply chain development	
Indicators:	1. The number and extent areas of protection areas/wildlife conservation areas in districts 2. Extent areas of residential and industrial areas in districts 3. Distances between protection areas/wildlife conservation areas and urban and peri-urban areas

(3) Component 4: Livelihood Improvement Activities

For the Component 4, the project sites have already been proposed by the TNFD, thereby the detailed

activities have been planned as summarised in the Interim Report. Meanwhile, target villages or engaged villages for Community-based Ecotourism (CBET) will be determined during the implementation process of the project. The processes and selection criteria of the project sites and communities/villages are described by the sub-component of the ecotourism and ecodevelopment activities as follows:

a.   Ecotourism

(1)   CBET Sites

A total of five target CBET sites have already been selected and proposed by the TNFD, and the responsible forest division and location (district) of each CBET site or circuit are as indicated below:

Table 10.4：Responsible Forest Division and Location of Each CBET Site or Circuit

Area	No.	Name of CBET site/Circuit	Location (Forest division/District)
Western Ghats	1	Genepool Garden	Gudalur / The Nilgiris
Eastern Ghats	1	Kurumbapatti – Yercaud	Salem / Salem
	2	Aiyur- Denkinekottai – Hoganekal Waterfalls	Hosur / Krishnagiri
	3	Kollimalai – Medicinal Plant Conservation Area – Akash Ganga Waterfalls – Yelagiri Hills	Namakkal / Salem
	4	Yelagiri – Amirthi – Jamunamarathur – Bheeman Waterfalls – Kular Cave	- Tirupattur / Vellore - Vellore / Vellore - Tiruvannamalai / Tiruvannamalai

The reason why the Genepool Garden was selected as the project site is mainly to improve various factors such as infrastructure (accommodation, parking lot, water supply system, etc.), and equipment and materials so that the site can enjoy the influx of visitors. On the other hand, the four CBET sites in the Eastern Ghats were selected to attract more tourists to the Eastern Ghats, with the aim of reducing tourist flow to the Western Ghats, as a high volume of tourists have negatively impacted wildlife there.

(2)   Communities or Villages

For the CBET in the Genepool Garden, there is an existing Ecodevelopment Committee (EDC) that has been founded as a core management body. Therefore, the EDC will take major roles and responsibilities in the development of the CBET site in collaboration with TNFD.

Meanwhile, the target communities/villages for the four CBET sites in the Eastern Ghats will be determined through the process for establishing the management structure of EDC, Self-help Group (SHG), or VFC in each CBET site. The tentative selection criteria for the communities/villages are:

1)   Those that are within or near the CBET sites

2)   Those that have socio-economic linkage with the CBET sites

3)   Those that are facing conflicts with wild animals

4)   Those that are inhabited by SC/ST groups.

b.   Ecodevelopment Activities

The ecodevelopment activities will be carried out on village basis. A total of 155 villages/hamlets have been identified as the target for the ecodevelopment activities by TNFD. The criteria applied

for the selection are listed as follows:

1) Those that are located in the Eastern Ghats

2) Those that are the target area of the Soil and Moisture Conservation (SMC)

3) Those that are facing conflicts with wild animals.

10.4. Indicative Project Phase and Implementation Schedule

(1) Indicative Project Phase

The TBGCP has an eight-year project period, and this project period will be divided into the three phases, namely an assessment and preparation phase (one year), implementation phase (five years), and consolidation (final touches and winding up) phase (two years).

Table 10.5: Tentative Project Phases and Activities

Phase	Year	Main Project Activities
Assessment and Preparation Phase	2022/23 (one year)	Setting up of the PMU and other required units, the selection of PMC, preparation of all manuals including Operational & Accounting procedures (an Operation Manual providing detailed guidelines for project implementation), procurement of necessary equipment, a compendium of on-going government programmes/schemes, the selection of resource organisations/teams from NGOs, detailed remote sensing satellite data based mapping and analysis, the finalisation of selection criteria, orientation of the PMU and other required units, the finalisation of target areas, initiation of required strengthening and development of infrastructure, site preparation, the selection of sites, and baseline surveys.
Implementation Phase	2023/24-2027/28 (five years)	Preparation of implementation plans in target areas and activities and implementation of project activities.
Consolidation Phase	2028/29-2029/30 (two years)	Ensuring of the sustainability of assets created under TBGCP, internalisation of project learning, experiences, procedures, and best practices evolved in the course of project implementation, and transfer of charges of all assets created under TBGCP and documents.

(2) Indicative Implementation Schedule

The indicative implementation schedule is shown in Table 10.6.

Table 10.6: Indicative Implementation Schedule

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
									0
Pledge									0
Signing of Loan Agreement									0
Consulting Services									0
Selection of Consultant									0
Implementation of Consulting Service									0
	0	0	0	0	0	0		0	0
									0
1. Ecosystem Based Climate Change Measures	6	12	12	12	12	18		0	72
1.1. Marine Ecosystem Based Habitat and Species Recovery	0	0	0	0	0	0		0	0
1.1.1 Coral	0	0	0	0	0	0		0	0
(1) Survey and Assessment of Selected Site	6	12	6	0	0	0		0	24
(2) Facilitation of Reef Building Planning at Communities	0	0	12	12	12	6		0	42
(3) Coral Rehabilitation with Communities	0	0	6	12	12	6		0	36
(4) Coral Monitoring	0	0	0	6	12	6		0	24
(5) Establishment of Interpretation Centre/Ecotourism Collarium	0	0	6	12	12	6		0	36
1.1.2 Seagrass/seaweed	0	0	0	0	0	0		0	0
(1) Assessment of Seagrass Habitats	6	12	6	0	0	0		0	24
(2) Seagrass Restoration Work in Degraded Areas	0	0	12	12	12	6		0	42
(3) Monitoring and Maintenance	0	0	0	6	12	6		0	24
(4) Awareness Programme for Local Fishermen's Communities	0	0	6	12	12	6		0	36
(5) Encauraging native seawood caltivation in the area	0	0	6	12	12	6		0	36
1.1.3 Dugongs	0	0	0	0	0	0		0	0
(1) Fixing Permanent Monitoring Sites and Conducting Population survey	0	6	12	12	12	6		0	48
(2) Protection by Engaging Anti-poaching Watchers	0	6	12	12	12	6		0	48
(3) Awareness Programme for Local Fishermen's Communities	6	12	12	12	12	6		0	60
(4) Inter-departmental Coordination	6	12	12	12	12	6		0	60
1.1.4 Sea Turtles	0	0	0	0	0	0		0	0
(1) Establishment of Sea Turtle Hatchery	0	6	12	12	12	6		0	48
(2) Patrolling by Engaging Anti-poaching Watchers	0	6	12	12	12	6		0	48
(3) Map Preparation for Identification of Potential and Existing Nesting Sites	0	6	12	12	12	6		0	48
(4) Data Collection using Mobile Application for Grant of Rewards/Compensation to Fisherfolk	0	6	12	12	12	18		0	60
(5) Awareness Building	0	6	12	12	12	6		0	48
(6) Monitoring and Documentation	0	0	0	0	0	12		0	12
(7) Inter-departmental Coordination	0	6	12	12	12	6		0	48

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Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
1.2 Climate Change Measures through Improvement of Land Ecosystem (urban and peri-urban forestry ,mangrove forests, shelterbelts, removal of invasive alien species, etc)	0	0	0	0	0	0		0	0
1.2.1 Survey and Demarcation of All-Inclusive Species in Protected Areas (PA)	0	0	0	0		0		0	0
(1) Assessment of the Removal Methods Applied in TBGP Phase 1	6	12	12	12	6	0		0	48
(2) Spatial Analysis using Satellite Imagery	6	12	12	12	6	0		0	48
1.2.2 Removal of Invaded Alien Species	0	0	0	0	0	0		0	0
Removal of Invaded Alien Species	6	12	12	12	12	6		0	60
1.2.3 Nursery Establishment of Indigenous/Native Fodder Species	0	0	0	0	0	0		0	0
Nursery Establishment of Indigenous/Native Fodder Species	0	6	12	6	0	0		0	24
1.2.4 Trial on Utilisation of Invasive Species	0	0	0	0	0	0		0	0
Trial on Utilisation of Invasive Species	0	6	12	12	12	6		0	48
1.2.5 Carbon Management in Invaded Areas	0	0	0	0	0	0		0	0
(1) Site Selection	6	12	6	0	0	0		0	24
(2) Survey	0	6	12	12	12	18		0	60
1.2.6 Site Assessment for Mangrove	0	0	0	0	0	0		0	0
(1) Ground Level Check	6	12	6	0	0	0		0	24
(2) Site Demarcation	6	12	6	0	0	0		0	24
1.2.7 Site Preparation for Mangrove	0	0	0	0	0	0		0	0
(1) Destilling of Older Canals	6	12	6	0	0	0		0	24
(2) Dredging of Mangrove Areas	6	12	6	0	0	0		0	24
1.2.8 Propagules Preparation for Mangrove	0	0	0	0	0	0		0	0
(1) Initial Year Activities	6	12	6	0	0	0		0	24
(2) First Year Activities	0	6	6	0	0	0		0	12
(3) Second Year Activities	0	0	6	6	0	0		0	12
1.2.9 Tending for Mangrove	0	0	0	0	0	0		0	0
Tending	0	6	12	12	12	6		0	48
1.2.10 Blue Carbon Monitoring for Mangrove	0	0	0	0	0	0		0	0
Blue Carbon Monitoring	6	12	12	12	12	6		0	60
1.2.11 Procurement of Equipment for Transportation and Planting	0	0	0	0	0	0		0	0
(1) Procurement of Equipment for Transportation and Planning	6	12	6	0	0	0		0	24
1.2.12 Transportation and Planting Equipment	0	0	0	0	0	0		0	0
a) Raising Seedlings	6	12	12	12	6	0		0	48
b) Planting Seedlings including Transporting	0	6	12	12	6	0		0	36
c) Transporting	0	6	12	12	6	0		0	36

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
1.2.13 Promoting Publicity	0	0	0	0	0	0		0	0
(1) Promoting Publicity	6	12	6	0	0	0		0	24
1.2.14 Forest Extension Centre Revamping	0	0	0	0	0	0		0	0
(1) Forest Extension Centres (FEC) Revamping	6	12	6	0	0	0		0	24
1.2.15 Promoting Reward System	0	0	0	0	0	0		0	0
(5) Promoting Reward System	0	0	0	0	6	6		0	12
1.3 Research and Implementation of Climate Change Measures (mitigation, adaptation) Utilizing Land and Marine Ecosystems	0	0	0	0	0	0		0	0
1.3.1 Forensic Works	0	0	0	0	0	0		0	0
Forensic Works	6	12	12	12	12	18		0	72
1.3.2 Animal Care Science Studies	0	0	0	0	0	0		0	0
(1) Strengthening the Infrastructure of AIWC	6	6	0	0	0	0		0	12
(2) Aiding the Animal Care Science Studies at Captive and Field Levels	6	6	0	0	0	0		0	12
1.3.3 Wildlife Policy Research and Development	0	0	0	0	0	0		0	0
(1) Wildlife Policy Research and Development	6	12	12	12	12	18		0	72
(2) Research Works for Species Recovery with Special Focus on Marine Species	6	12	12	12	12	18		0	72
(3) Studies on Ecology and Habitat of Migratory Terrestrial and Marine Species	6	12	12	12	12	18		0	72
(4) Capacity Building and Knowledge Sharing	6	12	12	12	12	18		0	72
(5) Status Assessment and Landscape Analysis	6	12	12	12	12	18		0	72
(6) Status Assessment of Habitat Conservation and Protection of Lesser Known Wild Animal	6	12	12	12	12	18		0	72
1.3.4 India-Japan Academic Consortium	0	0	0	0	0	0		0	0
(1) Activity Cost of Indian Reserachers and Academics	6	12	12	12	12	18		0	72
2. Human Wildlife Conflict Measurs	6	12	12	12	12	18		0	72
2.1 Measures for Human Wildlife Conflict	0	0	0	0	0	0		0	0
2.1.1 Mitigation Planning	0	0	0	0	0	0		0	0
(1) Enhancing Community Tolerance	6	12	12	12	6	0		0	48
(2) Developing Committee Interaction Permanent Platforms	6	12	12	12	6	0		0	48
(3) Augmentation of Fodder and Forbs in Wildlife Areas	6	12	12	12	6	0		0	48
(4) Augmentation of Pinch Period Water Availability	6	12	12	12	6	0		0	48
(5) Habitat Connectivity Management	6	12	12	12	6	0		0	48
2.1.2 Improvement of Corridors	0	0	0	0	0	0		0	0
(1) Improving Infrastructure	6	12	12	12	6	0		0	48
(2) Developing and Strengthening Barriers	6	12	12	12	6	0		0	48

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
2.1.3 Capacity Building for Local Staff	0	0	0	0	0		0	0	0
(1) Awareness Building	6	12	12	12	3		0	0	45
(2) Developing Community Information Network	6	12	12	12	3		0	0	45
(3) Stakeholder Abatement Support	6	12	12	12	3		0	0	45
(4) Capacity Building of Officers and Staff	6	12	12	12	3		0	0	45
2.1.4 Development of Mobile Application	0	0	0	0	0		0	0	0
Development of Mobile Application	6	12	12	12	6		0	0	48
2.2 Infection Disease Measures	0	0	0	0	0		0	0	0
Ecological Countermeasures for Pandemic Prevention	6	12	12	12	12	6		0	60
3. Promoting Supply Chain Development of Forestry Products	6	12	12	12	12		18	0	72
3.1 Forestry Research	0	0	0	0	0		0	0	0
3.1.1 Afforestation and Urban and Peri-urban Forestry	0	0	0	0	0		0	0	0
Afforestation Technology for Urban and Peri-urban Forestry	6	12	12	12	6		0	0	48
3.1.2 Tree Improvement	0	0	0	0	0		0	0	0
Tree Improvement	6	12	12	12	6		0	0	48
3.1.3 Bio Productivity Enhancement as Supply Chain Development	0	0	0	0	0		0	0	0
Bio-productivity Enhancement	6	12	12	6			0	0	36
3.1.4 Conservation of CR/EN/DD	0	0	0	0	0		0	0	0
Conservation of CR/EN/RD	6	12	12	12	6		0	0	48
3.2 Promoting supply chain development	0	0	0	0	0		0	0	0
Promoting supply chain development	6	6	0	0	0		0	0	12
4. Livelihood Improvement Activities (vocational training in Eastern Ghats and environment improvement for ecotourism)	6	12	12	12	12		18	0	72
4.1 Ecotourism	0	0	0	0	0		0	0	0
4.1.1. Genepool Garden in Gudalur (Western Ghats)	0	0	0	0	0		0	0	0
(1) Preparatory Work	0	0	0	0	0		0	0	0
1) Establishment of Management Structure	1	0	0	0	0		0	0	1
2) Development of Ecotourism Management Plan (micro-plan)	2	0	0	0	0		0	0	2
(2) Development of Infrastructure	0	1	0	0	0		0	0	0
1) Construction of Infrastructure	3	8	5	5	0		0	0	21
2) Improvement of Infrastructure	2	6	1	0	0		0	0	9
3) Purchase of Equipment and Materials	0	2	0	0	0		0	0	2
4) Other Items	1	2	0	0	0		0	0	3

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
(3) Participatory Assessment of Impacts of Interventions	0	0	0	0	0		0	0	0
1) Participatory Assessment	0	1	1	1	1		2	0	6
4.1.2. Four circuits in Eastern Ghats	0	0	0	0	0		0	0	0
(1) Preparatory Work	0	0	0	0	0		0	0	0
1) Establishment of Management Structure	1	0	0	0	0		0	0	1
2) Development of Ecotourism Management Plan (Micro-plan)	2	0	0	0	0		0	0	2
(2) Capacity Building and Skill Development for Stakeholders	0	0	0	0	0		0	0	0
1) Training for Common Topics (8 modules)	2	6	0	0	0		0	0	8
2) Training for Target-wise Topics (11 modules)	2	6	0	0	0		0	0	8
(3) Development of Infrastructure	0	0	0	0	0		0	0	0
1) Kurumbatti - Yercaud Circuit (Eastern Ghats)	0	0	0	0	0		0	0	0
I. Construction of Infrastructure (Building)	0	3	0	0	0		0	0	3
II. Construction of Other Infrastructure	2	4	2	0	0		0	0	8
III. Improvement of Other Infrastructure	0	0	1	3	3		1	0	8
IV. Purchase of Equipment and Materials	3	2	7	12	12		6	0	42
VI. Development of Ecotourism Products	6	12	12	12	12		6	0	60
2) Aiyur - Denkinekottai - Hoganekal Waterfall Circuit (Eastern Ghats)	0	0	0	0	0		0	0	0
I. Construction of Infrastructure (Building)	0	7	4	5	0		0	0	16
II. Improvement of Infrastructure (Building)	0	1	0	1	1		0	0	3
III. Construction of Other Infrastructure	0	0	3	5	6		0	0	14
IV. Purchase of Equipment and Materials	3	3	0	2	1		0	0	9
V. Training and Exposure Visits	2	2	3	3	5		1	0	16
VI. Information, Education and Communication (IEC) Activities	0	3	2	2	2		2	0	11
VII. Others	0	2	2	1	4		1	0	10
3) Kollimalai - Medicinal Plant Conservation Area - Akash Ganga Waterfall Circuit (Eastern Ghats)	0	0	0	0	0		0	0	0
I. Construction of Infrastructure (Building)	2	2	0	0	0		0	0	4
II. Construction of Other Infrastructure	2	4	0	2	3		0	0	11
III. Improvement of Other Infrastructure	0	0	0	2	1		0	0	3
IV. Purchase of Equipment and Materials	0	1	1	2	3		1	0	8
V. Development of Ecotourism Products	6	12	12	12	6		0	0	48
VI. Others	1	2	2	2	2		1	0	10

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
4) Yellagiri - Amrithi - Jamunamarathur - Beeman Water fall - Kular Cave Circuit (Eastern Ghats)	0	0	0	0	0	0	0		0
a. Anguthai Jonai Ecotourism Site	0	0	0	0	0	0	0		0
I. Construction of Infrastructure (Building)	0	6	0	0	0	0	0		6
II. Construction of Other Infrastructure	3	0	0	0	0	0	0		3
III. Improvement of Other Infrastructure	1	1	1	0	0	0	0		3
IV. Purchase of Equipment and Materials	1	0	0	0	0	0	0		1
b. Jalagambarai Ecotourism Site	0	0	0	0	0	0	0		0
I. Construction of Infrastructure (Building)	0	6	0	0	0	0	0		6
II. Construction of Other Infrastructure	3	1	5	0	0	0	0		9
III. Improvement of Other Infrastructure	1	0	0	0	0	0	0		1
IV. Purchase of Equipment and Materials	1	0	0	0	0	0	0		1
c. Beeman Waterfalls Ecotourism Site	0	0	0	0	0	0	0		0
I. Construction of Infrastructure (Building)	0	2	0	0	0	0	0		2
II. Construction of Other Infrastructure	4	4	5	2	2	1	0		18
III. Improvement of Infrastructure (Building)	1	0	1	0	0	0	0		2
IV. Improvement of Other Infrastructure	1	1	0	0	0	0	0		2
(4) Participatory Assessment of Impacts of Interventions	0	0	0	0	0	0	0		0
1) Participatory Assessment	0	1	1	1	1	1	1		5
4.2. Ecodevelopment Activities	0	0	0	0	0	0	0		0
4.2.1. Hold State-Level Workshop	0	0	0	0	0	0	0		0
(1) State-level Workshop	1	0	0	0	0	0	0		1
4.2.2. Orient Communities on the Scope and Purpose	0	0	0	0	0	0	0		0
(1) Kick-off Meetings, etc.	3	0	0	0	0	0	0		3
4.2.3. Train Field Staff Teams to Design and Facilitate Participatory Processes using Appropriate Tools	0	0	0	0	0	0	0		0
(1) Training	2	0	0	0	0	0	0		2
4.2.4. Facilitate Participatory Planning of Ecodevelopment Plans	0	0	0	0	0	0	0		0
(1) Field Level Micro-planning Exercises	3	0	0	0	0	0	0		3
4.2.5. Constitute EDCs and their Executive Committees	0	0	0	0	0	0	0		0
(1) Workshop and Meeting	1	2	0	0	0	0	0		3
4.2.6. Facilitate Study Tours to Expose EDCs to Other Successful Groups	0	0	0	0	0	0	0		0
(1) Study Tours	0	3	0	0	0	0	0		3
4.2.7. Prepare Ecodevelopment Plans, Addressing Socio-economic and Ecological Requirements and Opportunities including Skill Training	0	0	0	0	0	0	0		0
(1) Consultive Workshops	0	3	0	0	0	0	0		3

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
4.2.8. Implement Ecodevelopment Plans	0	0	0	0	0	0		0	0
(1) Ecodevelopment Activities	0	0	0	0	0	0		0	0
1) Implementation of Ecodevelopment Activities (Training, etc.)	0	6	12	12	6	0		0	36
(2) Soil and Moisture Conservation (SMC)	0	0	0	0	0	0		0	0
1) Reclamation and Improvement of Tribal Lands	0	6	6	6	6	0		0	24
2) Stone Paving of Paths, Steps, and Community Utility Area	0	6	6	6	0	0		0	18
(3) Preservation of Traditional Knowledge among Tribal and Local People	0	0	0	0	0	0		0	0
1) Conduct of Natuvaidyar (traditional medicine practioner) conference at Kollihills, Namakkal Forest Division	0	1	0	0	0	0		0	1
2) Conduct of Natuvaidyar (traditional medicine practioner) conference at Yercaud, Salem Forest Division	0	1	0	0	0	0		0	1
3) Conduct of Natuvaidyar (traditional medicine practioner) conference at 3 places (Kalrayans, Jamunamutthur, Kallakurichi)	0	1	0	0	0	0		0	1
(4) Heritage Conservation (Eastern Ghats)	0	0	0	0	0	0		0	0
1) Restoration of Historical Kullar Caves in Patramanagalam RF in Jamunamahur Range	6	12	12	12	12	18		0	72
2) Restoration of Gudiyam Caves in Pulikundrum RF in Tiruvallur Division	2	9	12	12	12	6		0	53
3) Conservation of Religious Heritage site of Mel Siddhar Kovil at Kanjamalai RF in Shevroys South Range (Eastern Ghats)	6	8	8	8	8	2		0	40
4) Conservation of Religious Heritage site of Kariyaramar Kovil at Kurumbapatti RF in Shevroys South Range (Eastern Ghats)	4	6	6	6	6	2		0	30
(5) Soil and Water Conservation (SWC) Measures	0	0	0	0	0	0		0	0
1) Construction of Loose Boulder Check Wall Vegetative Barrier, etc.	5	5	5	5	5	0		0	25
2) Construction of Mega-harvesting Structure	0	5	0	5	0	0		0	10
4.2.9. Participatory Assessment of Impacts of Interventions	0	0	0	0	0	0		0	0
(1) Participatory Assessment	0	1	1	1	1	2		0	6
5. Management Capacity of Government Agencies	6	12	12	12	12	36		4	94
5.1 Policy Planning and Implementation Ability (cooperating with researches)	0	0	0	0	0	0		0	0
Policy Planning and Implementation Ability (cooperating with researches)	6	12	12	12	12	6		0	60
5.2 Activation of Research Activities	0	0	0	0	0	0		0	0
Activation of Research Activities	6	12	12	12	12	18		0	72
5.3 Map Preparation	0	0	0	0	0	0		0	0
5.3.1 Estimation of Areas of Trees Outside of Forest Areas (Pilot Study)	0	0	0	0	0	0		0	0
(1) Extracting Areas of Trees Outside of Forest Areas	1	3	0	0	0	0		0	4
5.3.2 Soil Type Mapping for RFs (Pilot Study)	0	0	0	0	0	0		0	0
(1) Conducting Soil Type Classification	1	3	0	0	0	0		0	4
5.4 Infrastructure and Mobility	0	0	0	0	0	0		0	0
5.4.1 GIS Enhancement	0	0	0	0	0	0		0	0
(1) Improvement of GIS Capacity	4	4	0	0	0	4		0	12

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
5.4.2 MIS Enhancement	0	0	0	0	0		0	0	0
(1) Improvement of MIS Capability in Hardware	4	4	0	0	0		4	0	12
5.4.3 Equipment	0	0	0	0	0		0	0	0
Equipment	2	4	2	1	1		3	0	13
5.4.4 Vehicles	0	0	0	0	0		0	0	0
Vehicles	2	2	2	0	0		0	0	6
5.4.5 Construction of Quarters	0	0	0	0	0		0	0	0
Construction of Office Buildings	4	12	8	0	0		0	0	24
5.4.6 Management Plan Development Cell	0	0	0	0	0		0	0	0
(1) Establishment of Management Plan Development Cell	5	12	12	12	12		18	0	71
5.4.7 Preparation for Working Plans	0	0	0	0	0		0	0	0
(1) Implementing the Activities	5	12	12	12	12		18	0	71
5.5 Capacity Development	0	0	0	0	0		0	0	0
5.5.1 Implementation of Training	0	0	0	0	0		0	0	0
Implemetation of Training	0	0	0	0	0		0	0	
5.6 Pilot Studies	0	0	0	0	0		0	0	0
5.6.1 Biological Diversity Study	0	0	0	0	0		0	0	0
Biological Diversity Study	0	12	12	12	12		36	4	88
5.7 Monitoring and Evaluation	0	0	0	0	0		0	0	0
5.7.1 Baseline Survey	0	0	0	0	0		0	0	0
(1) Baseline Survey	4	0	0	0	0		0	0	4
5.7.2 Mid-term Evaluation	0	0	0	0	0		0	0	0
(1) Mid-Term Evaluation	0	0	2	2	0		0	0	4
5.7.3 Terminal Evaluation	0	0	0	0	0		0	0	0
(1) Terminal Evaluation	0	0	0	0	0		12	4	16
5.7.4 Annual Plannig and Review Meeting/Workshop	0	0	0	0	0		0	0	0
(1) Annual Planning	1	1	1	1	1		2	0	7
(2) Review Meetings	1	2	2	2	2		3	0	12
(3) Workshops	0	0	0	1	0		1	0	2
5.7.5 Annual Statutory Audit	0	0	0	0	0		0	0	0
(1) Annual Statutory Audit	0	1	1	1	1		2	0	6

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Month
5.7.6 Concurrent Monitoring	0	0	0	0	0	0		0	0
(1) High Power Committee	1	1	1	1	1	2		0	7
(2) Governning Body	1	2	2	2	2	4		0	13
(3) Executive Body	2	4	4	4	4	6		0	24
(4) General Body Meeting	1	1	1	1	1	1		0	6
5.7.7 Review Meeting/process Monitoring	0	0	0	0	0	0		0	0
(1) Development of Standard Formats, General Instructions, and Guidelines	3	0	0	0	0	0		0	3
(2) PMU Level Meeting	6	12	12	12	12	18		0	72
(3) Circle level meeting	6	12	12	12	12	18		0	72
(4) DMU Level Meeting	6	12	12	12	12	18		0	72
(5) RMU Level Meeting	6	12	12	12	12	18		0	72
5.7.8 Activity Monitoring	0	0	0	0	0	0		0	0
(1) Internal Monitoring (Codal Provisions)	0	2	2	2	2	3		0	11
(2) External Monitoring	0	2	2	2	2	3		0	11
(3) Scientific Spatial Monitoring	0	4	4	4	4	6		0	22
5.7.9 Thematic Studies and Documentations	0	0	0	0	0	0		0	0
(1) Studies for Specific Topics	0	0	0	3	6	9		0	18
(2) Documentation of Best Practices and Lessons Learnt	0	0	0	3	0	3		0	6
5.7.10 Regular Publication	0	0	0	0	0	0		0	0
(1) Annual Report	0	1	1	1	1	2		0	6
(2) News Letter	1	4	4	4	4	6		0	23
5.8 Staff Cost	0	0	0	0	0	0		0	0
5.8.1 Office Staff	0	0	0	0	0	0		0	0
(1) Office Staff	6	12	12	12	12	36		4	94
5.8.2 Constructual Staff	0	0	0	0	0	0		0	0
(1) Contractual Staff	6	12	12	12	12	36		4	94
5.9 PMU Operation Cost	0	0	0	0	0	0		0	0
5.9.1 PMU Operational Cost	0	0	0	0	0	0		0	0
PMU Operational Cost	6	12	12	12	12	36		4	94

*The structure of the project activities in Table 10.6 and the structure shown in Table 10.7 do not match because the former indicative table was prepared before the latter table in the next section was finalized.

10.5. Scope of Work by Component

TBGCP has four core project components and one supplemental component to achieve the project objective.

- Component 1: Ecosystem Based Climate Change Measures
- Component 2: Human Wildlife Conflict Measures
- Component 3: Promoting Supply Chain Development
- Component 4: Livelihood Improvement Activities
- Component 5: Management Capacity Development

An overview of the components of TBGCP is given below (Table 10.7).

Table 10.7: Tentative Outline of TBGCP

Project Activities
1   Ecosystem Based Climate Change Measures
1.1 Climate change measures through improvement of marine ecosystems
1.1.1 Coral
Survey and assessment of selected site
Facilitation of reef building planning at communities
Survey and assessment of selected site
Coral monitoring
Establishment of interpretation centre/ecotourism collarium
1.1.2 Seagrass/seaweed
Assessment of seagrass habitats
Seagrass transplantation work in degraded areas
Monitoring and maintenance
Awareness programme for local fishermen's communities
Encouraging native seaweed cultivation in the area
1.1.3 Dugongs
Fixing permanent monitoring sites and conducting population survey
Protection by engaging anti-poaching watchers
Awareness programme for local fishermen's communities
Inter-departmental coordination
1.1.4 Sea turtles
Establishment of sea turtle hatchery
Patrolling by engaging anti-poaching watchers
Map preparation for identification of potential and existing nesting sites
Data collection using mobile application for grant of rewards/compensation to fisherfolk
Awareness building
Monitoring and documentation
Inter-departmental coordination
1.2 Climate change measures through improvement of land ecosystem
1.2.1 Invasive alien species
Survey and demarcation of all-inclusive species in Protected Areas (PA)
Removal of invaded alien species
Nursery establishment of indigenous/native fodder species
Trial on utilisation of invasive species
Carbon management in invaded areas
1.2.2 Mangrove plantations
Site assessment for mangrove
Propagules preparation for mangrove
Seedling preparation for mangrove
Tending for mangrove
Blue carbon monitoring for mangrove
1.2.3 Promoting urban and peri-urban forestry
Procurement of equipment for transportation and planting

Transportation and planting equipment
Promoting publicity
Forest Extension Center revamping
Promoting a reward system
SHEP

1.3 Research and implementation of climate change measures (mitigation, adaptation) utilising land and marine ecosystems

1.3.1 Forensic work
1.3.2 Animal care science studies
1.3.3 Wildlife policy research and development
1.3.4 India-Japan research consortium

2   Human Wildlife Conflict Measures

2.1 Measures for human wildlife conflict

2.1.1 Mitigation planning
2.1.2 Improvement of corridors
2.1.3 Capacity building for local staff
2.1.4 Development of mobile application
2.1.5 Infection disease measures

2.2 Infectious diseases measures

3   Promoting Supply Chain Development

3.1 Forestry research

3.1.1 Afforestation technology for urban and peri-urban forestry
3.1.2 Tree improvement
3.1.3 Bio-productivity enhancement
3.1.4 Conservation of CR/EN/DD

3.2 Promoting supply chain development

3.2.1 NTFP supply chain development
3.2.2 Timber supply chain development

4   Livelihood Improvement Activities

4.1 Ecotourism

4.1.1 Genepool garden in Gudalur
4.1.2 Four circuits in the Eastern Ghats

4.2 Ecodevelopment activities

4.2.1 Hold state-level workshop
4.2.2 Orient communities on the scope and purpose
4.2.3 Train field staff teams to design and facilitate participatory processes using appropriate tools
4.2.4 Facilitate participatory planning of ecodevelopment plans
4.2.5 Constitute EDCs and their executive committees
4.2.6 Facilitate study tours to expose EDCs to other successful groups
4.2.7 Prepare ecodevelopment plans, addressing socio-economic and ecological requirements and opportunities including skill training
4.2.8 Implement ecodevelopment plans
4.2.9 Participatory assessment of impacts of interventions

5   Management capacity development

5.1 Policy planning and implementation ability
5.2 Activation of research activities
5.3 Map preparation

5.3.1 Estimation of areas of trees outside of forest areas (pilot study)
5.3.2 Soil type mapping for reserved forests (pilot study)

5.4 Infrastructure and mobility

5.4.1 GIS enhancement
5.4.2 MIS enhancement
5.4.3 Equipment
5.4.4 Vehicles
5.4.5 Construction of office buildings
5.4.6 Management plan development cell
5.4.7 Preparation for working plans

5.5 Capacity development

5.5.1 Identification of training

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5.6 Pilot studies
        5.6.1 Biological diversity study
5.7 Monitoring and evaluation
        5.7.1 Baseline survey
        5.7.2 Mid-term evaluation
        5.7.3 Terminal evaluation
        5.7.4 Annual planning and review meeting/workshop
        5.7.5 Annual statutory audit
        5.7.6 Concurrent monitoring
        5.7.7 Review meeting/process monitoring
        5.7.8 Activity monitoring
        5.7.9 Thematic studies and documentations
        5.7.10 Regular publication
        5.7.11 Procurement committee meeting
5.8 Project management unit (PMU)
        5.8.1 Staff cost
5.9 PMU Operation Cost
        5.9.1 Improvement of MIS capacity in TNFD
        5.9.2 Operation and maintenance
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10.5.1. Component 1: Ecosystem Based Climate Change Measures

To mitigate and adapt climate change by ecosystem, the following activities will be conducted during TBGCP period under Component 1: Ecosystem Based Climate Change Measures (Table 10.8).

Table 10.8: Activities for Ecosystem Based Climate Change Measures

Sec. No.	Activity	Preparatory (ex. Site Selection)	Design (ex. Survey/Design)	Implementation (ex. Operation/Management)
1.1	**Climate Change Measures through Improvement of Marine Ecosystems**			
1.1.1	**Coral**			
1.1.1.1	Survey and Assessment of Selected Site	TNFD/National Biodiversity Board	TNFD	TNFD
1.1.1.2	Facilitation of Reef Building Planning at Communities	TNFD	TNFD Community with supportfrom NGO	TNFD Community
1.1.1.3	Survey and Assessment of Selected Site	TNFD	TNFD Community with support from NGO	TNFD Community
1.1.1.4	Coral Monitoring	TNFD	TNFD Community	Coral Monitoring
1.1.1.5	Establishment of Interpretation Centre/Ecotourism Collarium	TNFD	TNFD	TNFD
1.1.2	**Seagrass/Seaweed**			
1.1.2.1	Assessment of Seagrass Habitats	TNFD/ Fisheries Department	TNFD/ Fisheries Department	TNFD/ Fisheries Department
1.1.2.2	Seagrass Restoration Work in Degraded Areas	TNFD/ Fisheries Department	TNFD/ Fisheries Department	Community/ Fisheries Department
1.1.2.3	Monitoring and Maintenance			

1.1.2.4	Awareness Programme for Local Fishermen's Communities	TNFD/Fisheries Department/ District Administration/ local police	TNFD/Fisheries Department/ District Administration/ local police	TNFD/Community
1.1.2.5	Encouraging Native Seaweed Cultivation in the Area			
1.1.3	**Dugongs**			
1.1.3.1	Fixing Permanent Monitoring Sites and Conducting Population Survey	TNFD/ WII	TNFD/WII	Community
1.1.3.2	Protection by Engaging Anti-poaching Watchers	TNFD/ Fisheries Department / District Administration / Community	TNFD/ Fisheries Department / District Administration /Community	Community
1.1.3.3	Awareness Programme for Local Fishermen's Communities	TNFD/ Fisheries Department / District Administration / Community	TNFD/Fisheries Department/ District Administration/ Community	Community
1.1.3.4	Inter-departmental Coordination	TNFD/Fisheries Department/ Community	TNFD/Fisheries Department	TNFD/Fisheries Department
1.1.4	**Sea turtles**			
1.1.4.1	Establishment of Sea Turtle Hatchery	TNFD	TNFD/Fisheries Department/ District Administration/ Community	Community
1.1.4.2	Patrolling by Engaging Anti-poaching Watchers	TNFD	TNFD	TNFD
1.1.4.3	Map Preparation for Identification of Potential and Existing Nesting Sites	TNFD/Fisheries Department	TNFD/Fisheries Department	Community
1.1.4.4	Data Collection using Mobile Application for Grant of Rewards/Compensation to Fisherfolk			
1.1.4.5	Awareness Building	TNFD/Fisheries Department	TNFD/Fisheries Department	TNFD/Fisheries Department
1.1.4.6	Monitoring and Documentation			
1.1.4.7	Inter Departmental Coordination	TNFD	TNFD	TNFD
1.2	**Climate Change Measures through Improvement of Land Ecosystem**			
1.2.1	**Invasive Alien Species**			
1.2.1.1	Survey and Demarcation of All-Inclusive Species in Protected Areas	TNFD/ Community	TNFD/WII or academic institutions	TNFD/WII or academic institutions
1.2.1.2	Removal of Invaded Alien Species	TNFD/ Community	TNFD/WII or academic institutions	TNFD/WII or academic institutions

1.2.1.3	Nursery Establishment of Indigenous/Native Fodder Species	TNFD	TNFD	TNFD
1.2.1.4	Trial on Utilization of Invasive Species	TNFD	TNFD	TNFD
1.2.1.5	Carbon Management in Invaded Areas	TNFD	TNFD/WII or academic institutions	TNFD/WII or academic institutions
1.2.2	**Mangrove Plantations**			
1.2.2.1	Site Assessment for Mangrove	TNFD/District Administration/ Local NGO	TNFD/District Administration/ Local NGO	TNFD/District Administration/Local NGO
1.2.2.2	Propagules Preparation for Mangrove		TNFD/District Administration/ Local NGO	TNFD/District Administration/Local NGO
1.2.2.3	Seedling Preparation for Mangrove		TNFD/District Administration/ Local NGO	TNFD/District Administration/Local NGO
1.2.2.4	Tending for Mangrove		TNFD/District Administration/ Local NGO	TNFD/District Administration/Local NGO
1.2.2.5	Blue Carbon Monitoring		TNFD/District Administration/Local NGO	TNFD/District Administration/Local NGO
1.2.3	**Promoting Urban and Peri-urban Forestry**			
1.2.3.1	Procurement of Equipment for Transportation and Planting	TNFD/32 Division Management Units and their Extension Centres and nurseries	TNFD/Extension Centres	TNFD/Extension Centres
1.2.3.2	Transportation and Planting Equipment			
1.2.3.3	Promoting the Publicity			
1.2.3.4	Forest Extension Centres (FEC) Revamping			
1.2.3.5	Promoting Reward System			
1.2.3.6	Smallholder Horticulture Empowerment & Promotion (SHEP)	TNFD (in detail, to be decided during project)	TNFD (in detail, to be decided during project)	TNFD (in detail, to be decided during project)
1.3	**Research and implementation of climate change measures (mitigation, adaptation) utilizing land and marine ecosystems**			
1.3.1	Forensic Work			
1.3.2	Animal Care Science Studies			
1.3.2.1	Strengthening the Infrastructure of AIWC			
1.3.2.2	Aiding the Animal Care Science Studies at Captive and Field Levels			
1.3.2.3	Wildlife Policy Research and Development			
1.3.3	Wildlife Policy Research and			

	Development			
1.3.3.1	Research Works for Species Recovery with Special Focus on Marine Species			
1.3.3.2	Studies on Ecology and Habitat of Migratory Terrestrial and Marine Species			
1.3.3.3	Capacity Building and Knowledge Sharing			
1.3.3.4	Status Assessment and Landscape Analysis			
1.3.3.5	Status Assessment of Habitat Conservation and Protection of Lesser Known Wild Animal			
1.3.4	India-Japan Academic Consortium			

Source: Developed by the Study Team

1.1 Climate change measures through improvement of marine ecosystems

The state of Tamil Nadu has the second largest coastline (1,076 km) on the Indian mainland, stretching from Tiruvallur District in the north to Kanniyakumari District in the south along the Bay of Bengal and Indian Ocean. There are totally 13 coastal districts in Tamil Nadu, with Ramanathapuram having the longest coastal length (237 km) and Chennai having the shortest (19 km).

Marine ecosystems in Tamil Nadu are now highly disturbed and very much threatened due to climate change such as siltation and erosion, flooding, saltwater intrusion, and storm surges. Besides this, increasing human population, urbanisation, and accelerated developmental activities are threats on marine ecosystems. The Tamil Nadu coast is rich with various ecosystems, therefore the preservation and protection of coastal ecosystem are quite acute issues.

1.1.1 Coral

Coral reefs provide a variety of human needs to the coastal communities, which are important for subsistence, fisheries, tourism, and shoreline protection. The Gulf of Mannar (GoM) in Tamil Nadu is one of the four major coral reef areas in India where was declared a "Marine Biosphere Reserve" in 1989 under UNESCO's Man and the Biosphere Programme. The present average live coral cover is 35 %, with 117 coral species, including 13 new records. Over 150,000 people live in the coastal zone of the GoM, many of whom (over 50,000) depend directly on reef fishery resources (Patterson et.al., 2007[89]). 25.52 km^2 of reef area and 2.16 km^2 of reef vegetation in GoM have been lost over a period of ten years (Thanikachalam and Ramachandran, 2003[90]). The seafloor is the place where coral reef builds. The reduction of the seafloor has estimated as 0.51 m on average over a period of 24 years. Coastal and island erosion due to an increased suspended sediment concentration is considered to be one of the reasons for seafloor reduction. The corals of Tamil Nadu also greatly

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[89] Patterson Edward, J.K., G. Mathews, Jamila Patterson, Dan Wilhelmsson, Jerker Tamelander and Olof Linden, (2007). Coral reefs of the Gulf of Mannar, Southeastern India – Distribution, Diversity and Status. SDMRI Special Research Publication No.12, 113 p.

[90] Thanikachalam, M., Ramachandran, S. 2003. 'Shoreline and Coral Reef Ecosystem Changes in Gulf of Mannar, Southeast Coast of India'. *Journal of the Indian Society of Remote Sensing*. Volume 31, pp. 157-173. https://doi.org/10.1007/BF03030823

damaged by frequent bleaching events and, to some extent, by destructive fishing, invasive algal assemblage, sedimentation, diseases, and destructive waves and currents. Over 32 km^2 of coral reef has already degraded around the 21 islands of the GoM.

1.1.1.1 Survey and Assessment of Selected Site

For selecting transplanting sites, the size, abundance, distribution and habitat complexity of reefs are surveyed and assessed. Four divers carry out underwater survey at 21 islands for 40 days during two years at the 1st year and 2nd year.

1.1.1.2 Facilitation of Reef Building Planning at Communities

At the sites selected by 1.1.1.1, reef building planning is facilitated at communities. Reef building planning is prepared with consideration of the main causes of coral deterioration in GoM are bleaching, destructive fishing, invasive algal assemblage, and sedimentation (Table 10.9). Since growths of transplanted corals is dependent on the coral species and sites, monitoring will be done to determine species adaptability in sites focusing more on the first year as many tropical coral restoration projects have shown that surviving the first year is critical. Initial causes of reef degradation is rather important for restoration so that regular monitoring, maintenance, and appropriate environmental conditions at the recipient site are required. Community participation is indispensable especially in monitoring, maintenance. Planning therefore will be made from the initial with communities.

Table 10.9: Monitoring for Corals according to the Cause

Cause	Monitoring Items
Bleaching	Sea water temperature
Destructive fishing	Number of incidents
Invasive algal assemblage	Identification of species, frequency and extent of invasion
Sedimentation	Changes of seafloor level, siltation

1.1.1.3 Survey and Assessment of Selected Site

Coral rehabilitation will be carried out from 3rd year to 5th year for 3 years with community participation. Rehabilitation is done to secure the corals onto solid materials or simply replant them securely to natural reef areas. Corals can be secured to a solid structure using a wide variety of straps, glues, wedges and other techniques. Reef conditions must be conducive for growth by maintaining the same light levels (depth), and transplant the corals to an area where threats such as sedimentation, pollution, anchor damage, etc. are low or absent. Communities closer to the sea or the project's area rather than farming community are participated in rehabilitation. Prior to rehabilitation at the field, workshop and training of reef building, collecting coral fragment are given to communities.

1.1.1.4 Coral Monitoring

Two reef professionals will work on coral monitoring for 24 days in two years at 4th and 5th year. Monitoring should focus on respective points according to the cause. Transplantation will not succeed unless chronic stressors are removed or minimization of threats. Maintenance thereby requires removal of algae, sponges and coral predators, reattachment of loose fragments, and fixing artificial structures.

The Ministry of Environment & Forests, Government of India in February 2003 started a project to envisage the Remote Sensing data-based mapping of coral reefs of the four major coral reef sites in India, including the GoM off of Tamil Nadu. Consequently, Landsat (ETM+) data was found to be

the most useful amongst different satellite images for delineating coral reefs in the GoM.

Institutions such as the Department of Ocean Development, the Space Applications Centre, the Zoological Survey of India, and the Central Marine Fisheries Research Institute have worked on research on coral reefs and problems related to coral management and monitoring. The Department of Ocean Development has been working to prepare a GIS-based information system for critical habitats for coastal ecosystems. The Space Applications Centre in Ahmedabad has used Remote Sensing data to assess the area under coral reefs and prepare a coral reef atlas of India.

In TBGCP, monitoring will be conducted with the following cooperation system. With the Department of Ocean Development, critical habitats for coastal ecosystems are identified. With the Space Applications Centre, coral reefs areas are regularly checked. Changes of seawater temperature related with bleaching problem are monitored either with the Department of Ocean Development or with the Space Applications Centre. Places of destructive fishing and of invasive algal assemblage occurrence are mapped through GIS-based information system at Geomatics Centre.

1.1.1.5 Establishment of Interpretation Centre/Ecotourism Collarium

Projects in other countries demonstrated that even if transplantation efforts were not able to restore sufficient areas of reef, the increased awareness reached by involving local stakeholders or tourists was beneficial for reefs by itself.

The interpretation centre is established to generate public understanding and appreciation of corals with exhibition of coral species including endangered ones, habitats of coral reefs and their conservation. The interpretation centre will have color photos and graphics. It will also contain well-preserved specimens. In addition, Ecotourism Collarium is installed to show the three dimensional life of corals to explain coral reef with every fine detail within or outside the interpretation center.

1.1.2 Seagrass/Seaweed

Thirteen seagrass species are found in Tamil Nadu. Seagrass ecosystems have been destroyed at a rapid rate despite the fact that they support high biodiversity and sustain the livelihood of coastal inhabitants. They serve as the primary food for green sea turtles, dugongs, and they support a rich variety of fish, which in turn attracts a diversity of predators including a rich diversity of birds and some large mammals. Dugong is an endangered marine mammal that is facing severe threat due to loss of seagrass. Sustaining and rehabilitating seagrass beds have been thereby acute issue for marine ecosystem conservation in Tamil Nadu.

1.1.2.1 Assessment of Seagrass Habitats

Seagrass and seaweed are assessed in Gulf of Mannar & Palk Bay from the viewpoints of biomass, species composition, and recovery process (Table 10.10). 4 divers will work for the assessment for 60 day during 2 years in the 1st and 2nd year.

Table 10.10: Assessment of Seagrass/Seaweed

Sea Grass Habitats	Items
Objective	Estimation of area of seagrass bed required as a feeding ground per dugong
Place	Palk Bay - Gulf of Mannar
What to measure	1. Seagrass biomass considering seasonal variation
	2. Species composition
	3. Recovery process after feeding

How to measure	1. Seagrass biomass is best obtained seasonally for any baseline study. A suitable number of quadrats of an adequate size is used with a selection of two or more sites in the area. When the area is too large to allow adequate coverage through direct biomass harvesting, Remote Sensing techniques will be used. 2. From the above samples of biomass, identify composition with the help of seagrass experts. 3. Set up monitoring plots of seagrass beds and check recovery rate.
Frequency	1&2&3 Seasonally, 30 days/year, 2 years

1.1.2.2 Seagrass Restoration Work in Degraded Areas

Restoration will be made by either transplants or seeds. Transplanting has been common in Tamil Nadu, which consists of two steps 1) nursery of seeds and 2) transplant of raised seedlings.

Three types of seagrass restoration methods, PVC (polyvinyl chloride) frames, bamboo frames, and coir nets were compared in Palk Bay in 2020 (V. Balaji, V. Sekar, G. Murugesan 2020[91]) to find the most ecofriendly and cost-effective method suitable for community-based seagrass restoration (Table 10.11). The cost for labour and materials for bamboo and coir method is less than that for PVC frames. The material cost of bamboo frames was 46 % less than that for PVC frames, and the same cost for coir frames was 102 % less than that for PVC frames. The labour cost for bamboo frames was 47 % less than that for PVC frames, and the same cost for coir frames was 33 % less than that for PVC frames. The coconut coir net method is the best method, as it is of relatively low cost, easily available, and suitable for large scale, community-based seagrass restoration.

PVC Frames has been used for years in Tamil Nadu so that knowledge for successful restoration is accumulated. Adopting PVC Frames thus will be the default method in the TBGCP among three methods. Other two methods will be used when they are considered more appropriate.

Table 10.11: Comparison of Seagrass Restoration Methods

	PVC Frames	Bamboo Frames	Coir Nets
Construction			
Materials	Not available locally	Easily available	Easily available
Manpower	Need for technical manpower	No technical manpower	No technical manpower
Workability	Medium	Medium	Large number of seagrass sprigs
Cost	High	Low	Low
Macro faunal settlements	Low	Low	High

As there is no established technology for many of seaweed/seagrass, technical inputs are necessary for successful restoration. TNFD has already worked with WII, through this collaborative work, continuous efforts in research and implementation should be done specially for establishment of high preference species like *Cymodocea serrulata*, *Thalassia hemprichii*, and *Syringodium isoetifolium*.

In contrast to the above traditional ocean-based culture methods, land-based tank culture systems provide the opportunity to realize a stable seaweed mass production by control of culture conditions including temperature, seawater exchange, and nutrient supply. However, land-based system requires investment in plant and equipment and operating cost. This will be worth considering when traditional

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[91] V. Balaji, V. Sekar, and G. Murugesan. 2020. 'Comparison of Seagrass Restoration Methods Adopted in Palk Bay, India'. *Journal of the Marine Biological Association of India*. Volume 62, No. 1. doi:10.6024/jmbai.2020.62.1.2137-13

culture methods encounter hard constraints or commercial culture gets highly important in Tamil Nadu.

1.1.2.3 Monitoring and Maintenance

Survival rates of transplanted seagrass and changes of density are monitored in GoM & Palk Bay during 2 years after transplanting. Four divers will work for 60 day during 2 years. Density of seagrass is also monitored with a comparison of naturally occurring seagrass meadows. Transplanted conditions such as water depth, seagrass bed condition should be recorded as well. Maintenance are carried out during the project period. Removal of invasive seaweeds Kappaphycus alvarezii is especially needed.

1.1.2.4 Awareness Programme for Local Fishermen's Communities

According to the workshop proceedings made by the M.S. Swaminathan Research Foundation and the Food and Agriculture Organization of the United Nations (FAO) in 1997[92], there are about 47 fishing villages along the coast, of which 38 are in Ramanathapuram District and nine in V.O. Chidambaranar District bordering the GoM park area. There are about 50,000 fisherfolk in these villages, of whom more than 12,000 are active fishermen.

(1)   Awareness Creation and Publicity

Implementing folklore program and distributing posters/pamphlets are conducted for increasing seagrass conservation awareness. Awareness program starts from 3rd year to conduct 100 camps a year during 3 years.

(2)   Community Patrolling

Community patrolling is conducted with 12 persons for 12 months to maintain transplanted seagrass beds and to control human disturbance such as destructive fishing practices, shore based pollution, and developmental activities leading to sedimentation.

1.1.2.5 Encouraging native seaweed cultivation in the area

Based on the result of seaweed assessment, native seaweed cultivation is encouraged in the designated area.

1.1.3 Dugongs

TBGP formulated the Species Conservation Action Plan for Dugongs in Palk Bay exclusively for the conservation of dugongs. Further activities should be based on this plan for better outputs (Table 10.12). Dugong protection needs consideration from two aspects, those of human and habitat and/or an integrated approach of the two aspects.

Table 10.12: Locations and Activities of Dugong Protection

Dimension	Issues
Place	Palk Bay - Gulf of Mannar
	Ramanathapuram, Pudukkottai, Thiruvarur, Thanjavur, Nagapattinam
Activity	a) Fixing permanent monitoring sites and conducting population survey (refer to 1.1.3.1)
	b) Assessment of seagrass habitats in Palk Bay (refer to 1.1.2.1)

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[92] http://www.fao.org/3/x5627e/x5627e06.htm#TopOfPage

c) Creation of awareness amongst the fisherfolk through folklore programmes (refer to 1.1.2.3)

d) To enhance protection of the animals by way of engaging anti-poaching watchers (refer to 1.1.3.2)

e) Inter-departmental co-ordination from the Coast Guard, Fisheries Department, marine practice, District Administration, local police, etc (refer to 1.1.3.4)

f) Regular patrolling by the field protection staff

g) To carry out seagrass transplantation work in degraded areas (refer to 1.1.2.2)

h) To educate on the importance and awareness programme about sea cow and seagrass conservation for local fishermen's communities (refer to 1.1.3.3)

i) Development of Android-based mobile application for the granting of rewards/compensation to fisherfolk (refer to 1.1.4.2)

1.1.3.1 Fixing Permanent Monitoring Sites and Conducting Population Survey

The population survey is by far the most important, since it provides a basis for preparing a conservation scheme. 12 persons are engaged for 12 months and assess population at fixed permanent monitoring sites.

In the 2013 report of the Zoological Survey of India (ZSI), 250 dugongs were observed in the 2010 survey conducted in the GoM, the Andaman and Nicobar Islands, and the Gulf of Kutch in Gujarat. The Gujarat Ecological Education and Research Foundation conducted an intensive survey on dugongs in the GoM and Palk Bay between 2007 and 2009, estimated that there were 78 and 80 individuals in the GoM and Palk Bay, respectively 2015[93]. Referring to these previous surveys, TBGCP will conduct a population survey as indicated in Table 10.13.

Table 10.13: Population Survey of Dugong Protection

Population Survey	Items
Objective	Estimation of dugong number in the area
Place	Palk Bay - Gulf of Mannar
Methods	1. Referring to the United Nations Environment Programme (UNEP) Dugong Questionnaire Survey Project Manual 2012, interview of fishermen about observation points and numbers to scope in the areas where dugongs mostly inhabit. 2. By the method used in TBGP, the population is counted at the identified places through the above interview. 3. Feeding amount per day, % of feed in seagrass are measured.
Analysis	From the equation, necessary seagrass bed per one dugong (ha) = (Amount of seagrass eaten in one year (kg) / seagrass biomass per ha (kg/ha)) $\div$ % of feed in seagrass

1.1.3.2 Protection by Engaging Anti-Poaching Watchers

A decade back, fishermen used to sell dugong meat at INR 1,000 per kilogram in Tamil Nadu, Gujarat, and Andaman. Many people used to consume the meat under the wrong impression that it would cool their body temperature. The engagement of anti-poaching watchers contributes to the protection of dugongs. 24 persons for protection and 24 persons for patrol are engaged for 12 months during 4 years.

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[93] Yashpal Anand, Ketan Tatu, and C. N. Pandey. 2015. "Status of Dugong (*Dugong dugon*) in Gulf of Mannar and Palk Bay, Tamil Nadu, India". *Indian Journal of Geo-Marine Science*. Volume 44, No. 9, pp. 1442-1448.

1.1.3.3 Awareness Programme for Local Fishermen's Communities

Awareness building is made by implementing folklore program. Posters and pamphlets are also distributed to communities to increase awareness. Community participation is implemented for dugong conservation. Two persons will be dispatched to participate in dugong conservation at total 20 sites for 6 months during 4 years.

1.1.3.4 Inter-departmental Coordination

Towards dugong protection, the inter-departmental coordination will be conducted with the major steps shown in Table 10.14.

Table 10.14: Steps of Inter-departmental Co-ordination

Step	Work Item	Activities
1	Preparatory meeting	Concerned TNFD officers and NGO will organise a preparatory meeting with the village head and other representatives of the village to explain the purpose and outlines of dugong protection.
2	Orientation meeting	The NGO will hold an orientation meeting for villagers, especially members of the sub-committee, to explain the objective, procedure, and methods of each activity for dugong protection. During the meeting, the villagers will also discuss a vision of the village, including what kind of environment and livelihood they want to have in 30 years.
3	Dugong observation mappreparation	Villagers, mainly the sub-committee members, will prepare a dugong observation map, including observation date and time, location, and number of individuals in order to understand the current living conditions and develop a shared understanding on these among villagers.
4	Comparison between the observation map and the 2007-2009 map	The community observation map will be compared to the mapprepared by Yashpal Anand [94] in 2015 in order to understand the current living conditions objectively in terms of distribution and numbers.
5	Protection zoning	Based on the objective understanding on the observation map, villagers will discuss appropriate zoning for protection whilst maintaining benefits for the entire community. If there is a possibility of villagers to receive any negative impact from the protection zoning, measures to avoid such impact will be discussed. Finally, a protection zoning map will be prepared.
6	Identification of sites forthe protection	Based on the protection zoning map, the villagers will identify target areas for dugong protection.

Source: Developed by the Study Team

1.1.4 Sea Turtles

Major conservation and management work for sea turtles has been conducted only during the past few years under the funding support of TBGP. TBGCP will strengthen those activities conducted in TBGP, which were shown to be effective.

Table 10.15: Sea Turtle Protection

	Items
Location	Palk Bay and Gulf of Mannar
Activities	Awareness camp for local fisherfolk Conducting stakeholder workshop Fishermen youth and adults' engagement as sea turtle watchers Establishment of permanent hatchery Fishermen engagement as hatchery watchers

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[94] http://nopr.niscair.res.in/handle/123456789/34935

TBGCP	Erection of information boards
	Capacity-building training for field staffs
	Printing publicity material like caps, t-shirts, and pamphlets
	Supply of fuel for patrolling vehicle-like boats and jeeps; hiring of boats
	Provision for engaging sea turtle watchers
	Provision for hatchery watchers
	Supply of gadgets such as torches, protective gear, and other anti-poaching equipment
	Monitoring and documentation
	Rewards for fishermen for rescue and release
	Multimedia publicity and interpretation
	Creation of temporary outpost
	Research and monitoring (contents and frequency to be determined)

Source: Modified from TNFD 2019 DPR

1.1.4.1 Establishment of Sea Turtle Hatchery

Hatchery site must be as similar as possible to the habitat of the nesting site of the turtles, and hatcheries should be located on the nesting beach. The hatchery should be located well above the high tide line, but not in heavily shaded areas, or sand with a very high humus/organic soil content. 44 hatcheries per year are made for 4 years from 2nd year to 5th year.

1.1.4.2 Patrolling by Engaging Anti-Poaching Watchers

Anti-poaching watchers will be allocated for 12 costal districts for 4 years. Watchers are looking for signs of illegal activity specially poaching and the illegal turtle trade on patrolling for the protection of sea turtles.

1.1.4.3 Map Preparation for Identification of Potential and Existing Nesting Sites

Maps covering the selected 10 km^2 target area using satellite images to identify potential and existing nestling sites are prepared. Since the nesting takes place from January to March in Tamil Nadu, mapping is necessary to be done during these periods.

1.1.4.4 Data Collection Using Mobile Application for Grant of Rewards/Compensation for Fisherfolk

In TBGP, the Wildlife Division, Ramanathapuram has developed an Android-based mobile application for dugongs through Kambaa Inc. of Coimbatore. This application will be also used for sea turtle conservation in TBGCP.

Currently an Android application with a desirable user interface in nine languages is utilised amongst fisherfolk in coastal India. "Fisher Friend", which is the latest technology interface in the Google Play store, can be utilised since over 29,000 fisherfolk now access Fisher Friend from 576 landing centres in 59 coastal districts in nine states of India.

The above existing mobile application is distributed to the forest officers. Forest officers enter the site information on the spot and report it to the Forest Department.

1.1.4.5 Awareness Building

Awareness building is conducted through awareness camp for local fisherman folks in local villages. 11 camps are held every year from 2nd year to 5th year for 4 years. Besides awareness camp, installment of the signboards for notice/caution/announce, printing publicity materials, supply of T-

shirts and caps to the local fishermen/village heads, and multimedia/publicly through a small video clip and telecast in the local cable channels, are conducted.

1.1.4.6 Monitoring and Documentation

Activities for sea turtle conservation are monitored and documented at the last year of the Project. Locations of newly constructed hatchery will be interpreted for its effectiveness in terms of reducing anti-poaching, increasing of sea turtle. Documentation will be circulated into related institutions to attribute to improvement of conservation activities.

1.1.4.7 Inter-departmental Coordination

As the inter-departmental co-ordination, capacity building, stakeholders workshop, rewards to fisherman for rescue and release, construction of temporary outpost for watchers are conducted as shown in Table 10.16.

Table 10.16: Activities of Inter-departmental Co-ordination

Activity	Content
Capacity building to frontline forest staff	Trainings for staffs are 1) locating sea turtle movement for nesting on the beach, nests, 2) proper collection of eggs and recreating the same inside hatchery, 3) maintaining hatcheries until a release of sea turtles, 4) use of TEDs by fishermen, 5) other issues pertaining to sea turtle conservation.
Stakeholders workshop	Stakeholders will be local people especially fishermen and others collecting marine resources that may impact sea turtles, research and educational institution, government departments (Fisheries department, Forest department, Environment department, Marine Products Export Development Authority (MPEDA), etc.), NGOs working in this field. Towards stakeholders, workshop will be held.
Rewards to fisherman for rescue and release	Rs. 500 to 2000 has been announced from the Wildlife warden as cash award for rescue and release of dugongs and turtles. The expected awarded number are 2 fishermen per month for Dugong and 5 fishermen per month for turtle rescue during nesting season from Dec to May annually.
Construction of temporary outpost for watchers	4 outposts are proposed during the nesting period of turtles.

1.2 Climate change measures through improvement of land ecosystem

Degradation of land ecosystems in Tamil Nadu is observed due to climate change and increasing human population, urbanization, and accelerated developmental activities. Land ecosystem improvement is essential for Tamil Nadu to mitigate and adapt climate change.

1.2.1 Invasive Alien Species

TNFD has just started research on the biological control of invasive weed in collaboration with the Rain Forest Research Institute (RFRI). Since the state of Tamil Nadu has huge areas affected by forest fires and covered with invasive weeds that prevent the natural regeneration of tree species, it is urgent to enhance and promote this research. Since this topic is one of focal points in TBGCP, this research will be conducted continuously in collaboration with the RFRI. In particular, the Silviculture Division of the TNFD will be responsible for making a plan and coordination with the RFRI in the implementation of this research.

Lantana has actually been used to make furniture in the villages of Kattunayakan, Kurumbas,

Malayali, and Palliyar in Tamil Nadu. This illustrates another way for invasive alien species problem. Not only removal also developing a way to utilize invasive species will contribute to solve this issue.

Table 10.17: Eradication of Invasive Alien Species

	Items
Location	Protected Areas and non-protected forests areas where wildlife population is significant.
Divisions	Nagapattinam, Srivilliputhur WLS, Sathyamangalam, Megamalai WLS, Kodaikanal, Dindigul, Coimbatore, Dharmapuri, Erode, Hosur, Gudalur and Tirunelveli
Area of eradication	3,000 ha
Period	Over six years (2012-13 to 2016-17)
Activities	Removal of invasive alien species through uprooting followed by restoration using appropriate native or indigenous tree species
Monitoring	Impact of removal after four years - An increase in wildlife use area - New recruits of grass and native fodder species - Natural regeneration of native food plant for grizzled giant squirrel

1.2.1.1 Survey and Demarcation of All-Inclusive Species in Protected Areas

Invasive Alien Species problems is widespread over the state, however removals are urgently necessary for the places where indigenous species exist. All invaded alien species in Protected Areas & Reserved Forest Areas are surveyed and demarcated.

Assessment of the removal methods applied in TBGP is necessary. Verifying what kind of method was effective under what kind of environmental conditions will provide valuable information to determine what steps to do in next. In addition, it is useful to organize information on native species that recruited after extermination for designing ecosystem restoration.

(1) Assessment of the Removal Methods Applied in TBGP

In TBGP, removal activities were conducted at different places where environmental and social conditions are different. Effects of removal were different depending on the places. In order to identify reasons why removal effect varied, spatial distribution of invaded area where removal was conducted in TBGP is detected by satellite images. Together with land quality measurement such as water and soil conditions, in-depth understanding of invasion mechanism is attained and effective measures are formulated.

(2) Spatial Analysis Using Satellite Imagery

Spatial information technology is applied to grasp the distribution situation and to predict the expanding area, which could verify the effects of past activities towards alien species removal. Places of invasive species occurrence are mapped using satellite images through GIS-based information system at Geomatics Centre.

1.2.1.2 Removal of Invaded Alien Species

Nearly 3,000 km^2 of area in the state of Tamil Nadu were invaded by alien species. Such an extraordinary invasion of alien plant species is regarded as the second worst threat to biodiversity in the state. Alien invasive species impose impacts like the prevention of forest tree recruitment and the alteration of the functioning and structure of the forest ecosystem. Regeneration and growth of young

trees and/or herbaceous species are obstructed by the luxuriant growth of invasive species as well. Since grass species are also affected by the shrinking of its coverage area by invasive alien plant species, the feeding behavior of herbivore species such as the gaur (*Bos gaurus*), sambar deer (*Cervis unicolor*), chital (*Axis axis*), and elephant (*Elephas maximus*) have changed. These animals face a major threat to the main food of their diets. Consequently, the wild animals move out of the forest areas in search of food and water, subsequently provoking human-wildlife conflict.

Table 10.18 shows the steps and methods to remove invaded alien species to be taken.

Table 10.18: Steps and Methods of Removal of Invaded Alien Species

Step	Work Item	Method
Preliminary Year		
1	Site selection	A site for removal with subsequent native species planting will be selected through discussion between TNFD and community members using the following criteria: (i) being a forest protection area; and (ii) a site will be used after native species planting for domestic or commercial purposes.
2	Indigenous/native fodder species selection	Nurseries are prepared for indigenous/native fodder species. The species suitable for fodder will be selected from indigenous/native ones for the planting site by community members referring to advices from forest officials. Candidate species will be selected from 29 native fodder grass species (Examples include summer grass, broom grass and signal grass.) and 14 fodder tree species (Examples include giant thorny bamboo (*Bambusa bambos*), sacred fig (*Ficus religiosa*), Malabar plum (*Syzygium cumini*), portia tree (*Thespesia populnea*), white teak (*Gmelina arborea*), anjan (*Hardwickia binata*), and mahuwa (*Madhuca latifolia*).) that a group of experts from the Tamil Nadu Agricultural University (TNAU) identified in 2021.
3	Survey	Counting the number of trees and record diameter (*Prosopis juliflora*).
4	Removal by manual	Cutting at ground level and complete removal by uprooting. Pits of 30 cm x 30 cm x 30 cm size will be dug in blank areas for planting seedlings. In case of Anamalai Tiger Reserve, 200 seedlings will be planted per ha.
5	Fencing	A fence will be made along the boundary with peripheral earthen bunds and local materials such as bamboo and timber.
First Year of Removal		
1	Weeding	Recruited and/or emerged secondary weeds are manually uprooted during and immediately after the rains
2	Monitoring	Volume assessment and disposal of removed trees and roots (*Prosopis juliflora* & wattle)
3	Indigenous/native fodder species planting	Indigenous/native fodder species are planted in the removal area
Second Year of Removal		
1	Vacancy filling	Mortality areas of fodder species planting will be identified and new seedlings will be planted in the areas.
2	Weeding	Weeding will be conducted three times in the same manner as in the first year.
3	Monitoring	Volume assessment and disposal of removed trees and roots (*Prosopis juliflora* & wattle)
4	Indigenous/native fodder species planting	Indigenous/native fodder species are planted in the removal area
Third Year of Removal		
1	Vacancy filling	Mortality areas of fodder species planting will be identified and new seedlings will be planted in the areas.
2	Weeding	Weeding will be conducted two times in the same manner as in the

		firstyear.
3	Monitoring	Volume assessment and disposal of removed trees and roots (*Prosopis juliflora* & wattle)
4	Indigenous/native fodder species planting	Indigenous/native fodder species are planted in the removal area
Fourth Year of Removal		
1	Weeding	Mortality areas of fodder species planting will be identified and new seedlings will be planted in the areas.
2	Weeding	Weeding will be conducted two times in the same manner as in the first year.
3	Monitoring	Volume assessment and disposal of removed trees and roots (*Prosopis juliflora* & wattle)
4	Indigenous/native fodder species planting	Indigenous/native fodder species are planted in the removal area
Fifth Year of Removal		
1	Weeding	Mortality areas of fodder species planting will be identified and new seedlings will be planted in the areas.
2	Weeding	Weeding will be conducted two times in the same manner as in the first year.
3	Monitoring	Volume assessment and disposal of removed trees and roots (*Prosopis juliflora* & wattle)
4	Indigenous/native fodder species planting	Indigenous/native fodder species are planted in the removal area

Source: Developed by the Study Team

1.2.1.3 Nursery Establishment of Indigenous/Native Fodder Species

TNFD restored the Kalakkad Mundanthurai Tiger Reserve with native grasses successfully where non-breakable coarse grasses prevailed. Native grasses replaced the non-breakable coarse grasses in natural water pond areas. Promoting this in other areas and creating grasslands/meadows contributes to the improvement of the health of wildlife.

Local indigenous forest species are raised in Lantana and Prosopis removal area and planted in 1,000 ha for Lantana removal area and in 200 ha for Prosopis removal area. Planting in the former area is carried out at 2nd and 3rd year and latter at 3rd and 4th year.

Community members in target villages play a main role in creating and maintaining nurseries with technical advice and support from Tamil Nadu Agricultural University (TNAU) and its Forest College and Research Institute (FC&RI).

1.2.1.4 Trial on Utilisation of Invasive Species

Biomass of alien invasive species is measured for considering possible utilization like furniture. FC&RI has researched and developed about utilization of invasive species. Referring to their achievement, biomass measurement are conducted on two major invasive species Lantana and Prosopis at 5 ha respectively, from the 2nd year to 5th year.

1.2.1.5 Carbon Management in Invaded Areas

There are a number of reports on carbon changes due to Invasive Alien Species (IAS). Changes in the sequestration of carbon (C) have occurred across the community forest in Nepal following the widespread *Mikania micrantha* invasion (Gaudel et al., 2016[95]). This implies that quantifying the

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[95] Gokul Gaudel, Zhang Wen Hui, Dang Quang Hung, Le Thi Hien,Liang Xiao (2016) Assessment of Invasive Alien Plant Species: Impact on Carbon Sequestration. Imperial J. of Interdisciplinary Research 2 (10)

effect of invasive species are important for determining losses of C. Thus, a regular assessment and monitoring of the invasive weed is necessary to understand the problem and its impact on C pool of invaded forests. Climate change policies can incorporate IAS, by including IAS prevention and control, and by ensuring that measures to address climate change do not increase the threat of IAS (IUCN 2021[96]). Replacing IAS by native tree species will be good measure for carbon sequestration and erosion control to some extent. Thereby it is worth evaluating its effect in TBGCP. Table 10.14 shows tentative works of carbon management in invaded areas.

Table 10.19: Works of Carbon Management in Invaded Areas

Step	Work Item	Method
1	Site selection	Monitoring sites for carbon management are set up in the native species planting sites (refer to Table 10.13) after removal of invasive species. Control sites (invaded areas) are also set up besides these sites for comparison. TNFD and community members will find adequate sites collaboratively.
2	Survey	Following to "Resource Manual" made by ICFRE (2020[97]), carbon stocks measurement will be designed for sampling design, laying out of sample plots and estimation methods. Walkley and Black method is recommended in the manual for soil carbon analysis, but because of environmental concerns, this procedure is no longer in use. The method currently recommended is the dry combustion (muffle furnace) method (USDA, 1996[98]) which is quicker and more cost effective.

Source: Developed by the Study Team

(1)　Site Selection

20 monitoring sites, each 10 from Lantana and from Prosopis are selected for carbon monitoring. For the selection, results of "1.2.1.2 Spatial Analysis using Satellite imagery" are referred to obtain representative ones. Within the site having the size of 1 ha, subplots with the size of 10 x 10 m are made for monitoring.

(2)　Survey

Biomass is measured at subplots. Fresh weight of removed invasive alien species is measured and dry weight are measured after drying. Soil carbon is measured by the procedure of "Resource manual" prepared by Indian Council of Forestry Research and Education in 2020. Measurement is done at two different depths at 0 – 5 cm, 5 – 10 cm from undisturbed soil samples collected by cylinder. Carbon analysis method of "Resource manual" is Walkley and Black, but dry combustion method will be alternative method since this is cheaper and safe.

1.2.2 Mangrove Plantations

Mangrove planting needs to set clear objectives prior to implementation based on which a decision regarding conservation, rehabilitation, reforestation, restoration, or afforestation can be made. Since mangrove species distribution depends on a specific set of site-conditions, the selection of a suitable planting site should be the first priority, followed by the selection of appropriate species, the best-

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[96] https://www.iucn.org/resources/issues-briefs/invasive-alien-species-and-climate-change

[97] ICFRE (2020). Resource Manual: Measurement of Forest Carbon Stocks for Capacity Building of State Forest Departments. Indian Council of Forestry Research and Education, Dehradun (INDIA).

[98] UNITED STATES. Department of Agriculture. Natural Resources Conservation Service. Soil survey laboratory methods manual. Version 3.0. Washington: National Soil Survey Center, 1996. 440p. (Soil Survey Investigations Report, 42)

suited planting technique, and planting time for the given site (Schmitt and Duke, 2015[99]).

Cyclone Gaja hit Muthupet in 2018 and had a severe impact on the mangroves. New Indian Express released in 7 February 2021[100] cited that the latest remote sensing data from TNFD estimated 60 % of the total 11,886 hectares of Muthupet mangrove area has degraded leaving only 2,000 hectares (16.8 %) as a dense mangrove forest. Considering these circumstances, two districts in Muthupet, Nagapattinam and Thiruvarur, are possible candidate sites for rehabilitating mangroves in TBGCP.

Source; Restoration of Degraded Mangroves provided by Dr. Ramasubramanian, Director – Coastal Systems Research, MSSRF

Figure 10.6: The Impact on Muthupet Mangroves by Cyclone (Left: Before Gaja (Sep 2018) and Right: After Gaja (Dec 2018))

1.2.2.1 Site Assessment for Mangrove

Areas elevated by either siltation or tidal action have limited water flow. In order to solve water stagnation, fish bone canals have been dug to induce tidal flushing (Figure 10.7). However, in-depth site assessment should be conducted to examine effectiveness of those canal constructions. Latest news from New Indian Express in February 2021 reported 60 % of the total mangroves in Muthupet are degraded. It is plausible that constructed canals does not function well in terms of tidal flushing. Canal construction is costly so that its adequacy of construction needs to be precisely checked. Site assessment should be focused on validity of canal construction with a special attention on hydrology.

Source: MSSRF website, https://mssrf.org/content/mssrf

Figure 10.7: Site Assessment for Mangrove Plantation in TBGP

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[99] Schmitt K., Duke N. C., 2015 Mangrove management, assessment and monitoring. In: Tropical forestry handbook. Köhl M., Pancel L. (eds), Springer, Berlin, Heidelberg, pp. 1-29.
[100] https://www.newindianexpress.com/states/tamil-nadu/2021/feb/07/60-per-cent-reduction-in-tamil-nadus-largest-mangrove-cover-2260659.html

(3)   Ground Level Check

Topography (elevation and slope) and tidal amplitude (the difference between high and low tide) mainly determine the flooding and surface drainage characteristics of a site, whilst soil properties influence water infiltration, salt accumulation, and root penetration. All of these factors define mangrove regeneration, survival, and growth.

Ground level is measured using Auto-level or other instruments. Height difference between planting site and canals is recorded. If possible, difference from mean sea water level is recorded. Accretion and erosion of planting site are measured by inserting plastic pipes into the ground.

(4)   Site Demarcation

According to ground level, site is demarcated for planting and non-planting in the 1st and 2nd year. Planting site is divided into different species zones if necessary. Mapping is made to allocate planting locations.

(5)   Site Preparation

Where mangroves are constrained by inappropriate hydraulic water flow, de-silting (excavation) of the existing canals to recover water flow for the mangroves' growth is commonly practiced. Excavation should be limited where this operation is effective. In the same manner as 1.2.2.1 Site assessment, in-depth survey prior to site preparation is needed to determine what type of preparation to be conducted.

(6)   Desilting of Older Canals

Silt deposition in canals are excavated repeatedly in order to improve water flow in mangrove plantation sites. Sedimentation in canals occurs continuously by tidal action and/or cyclones. By examining siltation intensity and frequency, desilting is conducted at appropriate places and time in the 1st and 2nd years.

(7)   Dredging of Mangrove Areas

When plantation areas are elevated at higher level, dredging is conducted. Dredging may bring out environmental impact so that it should be paid attention to minimize possible impacts. Hydraulic restoration should be primary object in dredging. Places to dredge therefore are determined through ground level check in the 1st year.

1.2.2.2 Propagules Preparation for Mangrove

Eight mangrove species are reported in Muthupet; *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Avicennia marina*, *Ceriops decandra*, *Excoecaria agallocha*, *Lumnizera racemosa*, *Rhizophora apiculata*, and *Rhizophora mucronata*[101]. M S Swaminathan Research Foundation (MSSRF) planted mangroves in Tamil Nadu in 2017[102] jointly with the Veerankoil Village Development Committee (VDC) and TNFD. *Avicennia spp*. seeds with an interval of 50 cm along the canals at a depth of 20 cm below ground and *Rhizophora apiculata* and *R. mucronata* propagules with 2 m interval were planted. Taking these into consideration, propagules/seeds rather than seedlings are better to use in mangrove plantation with *Avicennia* and *Rhizophora* in TBGCP.

It is also important to plant different mangrove species besides the commonly planted *Avicennia* and *Rhizophora*, and to close the gaps created chiefly due to the impact of Cyclone Gaja and other reasons. Depending on site conditions, associated mangrove species are also useful to introduce in Muthupet.

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[101] Mangrove plants of Tamil Nadu https://www.researchgate.net/publication/274569821
[102] https://mssrf.org/content/mssrf-completes-mangrove-restoration-work-three-states-0

Because many of lands are elevated by cyclones, associated mangrove species that grow in high land will be more adaptive. TNFD has raised various species to create a dense mangrove patch, and there is a research plot in Killai Reserve Forest (near Pichavaram), Muthupet, Pichavaram, and other places. Outputs of this research will also be applicable to mangrove planting in TBGCP.

(1)   Initial Year Activities

Propagules are collected and planted on the slope for planting in the subsequent years. Totally 700 hectares, which are 350 hectares in the first year and 350 hectares in the second year, are made with selectively collected healthy propagules. Defected and yellowish color propagules are avoided.

(2)   First Year Activities

Seedlings prepared in the initial year are planted at 350 hectares.

(3)   Second Year Activities

Seedlings prepared in the second year are planted at 350 hectares.

1.2.2.3 Seedlings Preparation for Mangrove

This activity will be conducted in the same manner as the section 1.2.2.2.

1.2.2.4 Tending for Mangrove

Mangrove plantations will be maintained for five years in accordance with the following chart (Figure 10.8). The survival rate of planted mangroves will be measured, and damage factors/causes, if any, will be investigated. Based on these investigations, prevention measures for damage and supplementary planting will be implemented. Though MSSRF checked survival rates of planted mangroves after a half year, it is necessary to monitor until reproduction stage (flowering).

The 1st year tending is made at the second year after the first planting in 350 hectares. Subsequent tending will follow until the fourth year.
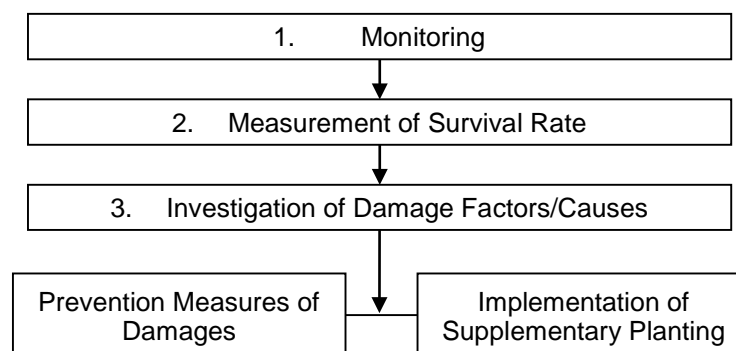
Source: created by the Study Team

Figure 10.8: Flow Chart for Tending

1.2.2.5 Blue Carbon Monitoring

Mangroves provide diversified ecosystem services such as protection from storms and erosion, tourism benefits, and climate adaptation and mitigation. These have been increasingly recognised as important considerations for environmental policymaking. A variety of research has shown that coastal ecosystems such as seagrasses, salt marshes, and mangroves provide climate mitigation

services because they are particularly effective at sequestering and storing carbon dioxide, referred to as "coastal blue carbon". Given the prominent carbon sequestration and storage in coastal ecosystems, blue carbon restoration projects have been implemented in many countries, often using carbon-financing mechanisms.

Procedures of blue carbon monitoring are almost same as ones mentioned in 1.2.1.5 Carbon Management in Invaded Areas. With guidance of "Resource Manual" made by ICFRE (2020), stock carbons in mangroves are measured both in above- and below-ground of mangrove forest. For the above-ground measurement, both remote sensing and fieldwork are carried out while soil analysis is done for below-ground measurement (Table 10.20).

Table 10.20: Collecting Data for Blue Carbon Monitoring

	Above-ground		Below-ground
	Remote Sensing	**Field Work**	**Laboratory**
Data	Hectares of mangrove habitat	Tree Diameter at Breast Height (DBH)	Carbon content of a soil sample
Associated Metadata	Satellite information (organization, type, ID), sensor used, dataset used, parameters, proxies, etc.	Date of measurement, species of the tree, location of the tree (latitude and longitude), tool used to measure diameter, description of where on the tree the measurement was taken, etc.	Date, type of tool used (make and model of the Nitrogen/Carbon analyser, Carbon/Nitrogen corder, or furnace for Loss of Ignition), sample ID and description, controls used, protocol used, etc.

Source: Developed by the Study Team

1.2.3 Promoting Urban and Peri-urban Forestry

The operation of activities of urban and peri-urban forestry have been planned in TBGCP to extend the forest cover areas in the state of Tamil Nadu as TCOF. In TBGP, TCOF has been conducted in rural areas successfully even during TBGP period. More than 80 million trees have been planted successively, with the main focus on rural areas in almost all districts of the state, with ten million trees per year from 2012 so far. It has been reported that activities in TBGP resulted in massive tree resources outside of forests in rural areas to partially reduce the pressure on the forests and biodiversity habitat areas and amelioration as a significant co-benefit, securing farmers against recurrent drought and the resultant agricultural crop losses.

In TBGCP, TCOF will be extended to urban and peri-urban areas from the rural areas of TBGP. This is partly because 48 % of the population of Tamil Nadu lives in urban areas and Tamil Nadu is one of the most urbanized states in India. It therefore has great meaning to extend tree cover areas in the areas where half of the population inhabits.

The operation and management of activities of urban and peri-urban forestry will be planned based on the Division Management Units and Forest Extension Centres in the former 32 districts (as of 2012) of the whole state.

From this operation, it is expected to achieve:

a) To alleviate the living environment of half of the population of the state of Tamil Nadu by increasing trees in urban areas, including industrial areas;
b) To enable half of the population to realize the importance of trees and the forest as a result of living closely by trees and forests;
c) To enable half of the population to realize the importance of biodiversity and habitat areas/forests; and

d)   To contribute the achievement of 33 % of the national tree coverage goal.

(1)   Operation Process

The process of the operation is assumed as shown in the tables below.

Table 10.21: Operation Process in Case Planting Provided by TBGCP

No.	Operation (Planting Provided by TBGCP)	Organization in Charge
1	Determining tree species to be planted	Extension Centre/Institute/owners
2	Producing seedlings	Nursery (Centre/local)
3	Publicly inviting beneficiaries to plant trees	Extension Centre
4	Examining eligibility for beneficiaries and approval	Extension Centre/DPMU
5	Dispatching of seedlings and planting team	DMU/outsourcing
6	Training of tendering/management of planted trees	Extension Centre
7	Start of tendering/ managing planted trees	Tree owners
8	Monitoring of trees	Owners/Extension Centre

Source: Summarized by the Study Team

Table 10.22: Operation Process in Case Planting by Beneficiaries

No.	Operation (Planting by Landowners)	Organization in Charge
1	Determining tree species to be planted	Extension Centre/Institute/ owners
2	Producing seedlings	Nursery (Centre/local)
3	Publicly inviting beneficiaries to plant trees	Extension Centre
4	Examining eligibility for beneficiaries and approval	Extension Centre/DMU
5	Delivery of seedlings or beneficiaries coming to nursery to transport seedlings	DMU/outsourcing
6	Training on planting/tendering/management of planted trees	Extension Centre
7	Planting by owners and start of tendering/managing planted trees	Tree owners
8	Monitoring of planted trees	Owners/Extension Centre

Source: Summarized by the Study Team

(2)   Operation Strategy

1)   Taller seedlings shall be used at 5% to secure the survival rate and growth of planted trees;
2)   An inclusive demand driven approach, making tree planting material and planting services available to anybody on demand;
3)   A reward system shall be implemented to secure survival rate and rewards will be based on the number of survivals; and
4)   The revitalization and strengthening of the <u>forest extension and Extension Centre</u> set up and services.

Operation details related to the TBGCP cost estimation are described as follows:

1.2.3.1 Procurement of Equipment for Transportation and Planting

In the urban and peri-urban forestry activities, totally more than 30 million trees are expected to be planted. Among those, about 8 million trees will require transportation of seedlings, and TNFD are expected to provide it. Trucks are then required to transport those seedlings in each Extension Centre. Handling tools and digging tools are required to hold workshops and tree planting ceremonies/festivals to demonstrate and instruct how to plant and take care the seedlings. For those ceremonies and workshops, extension centres also required vehicle (electric van) to transport extension workers and other participants. At the same time, motor cycles will be provided for each

extension centre workers to visit beneficiaries to consult planting trees and tendering trees. GPS are also required for each extension centre worker to mark planted locations and record them in a forest database.

1.2.3.2 Transportation and Planting Equipment

(1)   Raising Seedlings

Two types of bag sizes of seedlings will be prepared for the urban and peri-urban forestry activities: one is 45 x 16 cm taller seedling, and the other is 30 cm x 16 cm normal size. 45 x 16 cm taller seedling is 8 feet in height, and they are expected to be planted in non-farm lands. 30 cm x 16 cm normal size seedlings are to be planted in farmlands. All tall seedlings and majorities of seedlings are expected to be raised in central nurseries. It is partly because raising tall seedlings and seedlings of tree species suitable for urban peri-urban forestry require more intense and skilled cares, treatments, conditions, and circumstances of the central nursery can provide them more than green field nurseries.

(2)   Transporting and Planting Seedlings

As described above, totally more than 30 million trees are to be planted. Among those planting activities, transporting seedlings and planting operation for approximately one third of the total trees to be planted will be provided by outsourcing teams prepared by TNFD. Beneficiaries need to prepare planting areas and to maintain tree after trees planted. For the rest, 8 million trees, transportation of seedlings will be provided by TNFD and beneficiaries are expected to plant trees by themselves.

1.2.3.3 Promoting Publicity

A great deal of publicity needs to be created to inform the general public and all potential stakeholders about the intention of the Government to supply seedlings on their lands or in their premises. Brochures, stickers, and video clips are required for acknowledgement and publication of the Project activities, and manuals and booklets are also required as materials for trainings and workshops to disseminate methods and skills of tree planning and tendering activities. To acknowledge the activities broadly in the public, TV promotions to broadcast the video clips of the activities are planned to be conducted twice a year for the first two years of the activity term. Planting festivals (larbor day) are also planned to publicise the activities once a year for the first 2 years in 32 districts.

1.2.3.4 Forest Extension Centres (FEC) Revamping

The item is excluded from the scope of work.

1.2.3.5 Promoting a Reward System

A system of awards/rewards will be applied in place of incentives for surviving seedlings. An individual/farmer who has taken at least 100 seedlings will be eligible for the rewards. It has been proposed that the rewards will be based on the number of seedlings surviving and that the minimum reward will be INR 1,000, calculated at INR 10 per seedling. The maximum reward will be INR 25,000 for seedlings of 2,500 or more. Awards will be given during the third year. There will be five awardees per district. At an average of INR 15,000 per individual, the cost will work out to INR 7.2 million. In TBGP, a system of incentives was created, though it no longer exists because under the system all farmers are given incentives regardless of survival rate — whether a farmer's rate was ten percent or 90 percent. Instead, the reward system has been planned to be applied in TBGCP.

1.2.3.6 Smallholder Horticulture Empowerment & Promotion (SHEP)

JICA proposed to seek the possibility to implement Smallholder Horticulture Empowerment &

Promotion (SHEP) approach into the project especially for TCPL activities. JICA and TNFD agreed to continue to examine possibility of this idea and further discussion between TNFD and JICA for the concrete implementation.1.3 Research and implementation of climate change measures (mitigation, adaptation) utilizing land and marine ecosystems.

1.3 Research and implementation of climate change measures (mitigation, adaptation) utilizing land and marine ecosystems

1.3.1 Forensic Work

Forensic work deals with the development of protocols for the collection and preservation of biological samples of various species that are illegally traded in and from India. With DNA-based investigations for terrestrial and marine species, wildlife crime will be investigated for terrestrial and marine species, and population will be monitored. Three scopes for wildlife crime management are implemented (Table 10.23).

Table 10.23: Target Areas of Forensic Studies

Scopes	Contents
1. Molecular tools	- Development of molecular tools for wildlife crime scene management
2. Forensic procedures	- Standardisation of validated forensic procedures
3. Reference repository	- Development of a reference repository of biological samples

Source: TNFD 2019

1.3.2 Animal Care Science Studies

TNFD has set up the AIWC in the Tambaram Reserve Forest Area under the current management control of the Arignar Anna Zoological Park. Advanced state of the art labs for animal care sciences, wildlife forensic sciences, conservation education, and wildlife research were conducted at the AIWC. The AIWC has commenced basic wildlife forensic research and diagnostic operations in morphometry, DNA, and scat DNA laboratories under the CWFS. The morphometry laboratory of the CWFS is involved in developing a reference repository of wild animal samples ranging from skulls, long bones, horns, antlers, ivories, hair samples, feathers, and hide and skin samples for morphological comparative studies, to establish standards that aid in species identification.

The AIWC has also been conducting a hands-on training programme in wildlife crime investigation for field staff, a monthly guest lecture by eminent scientists in key areas of wildlife conservation and management, annual capacity enhancement training for zoo animal keepers in captive animal management, and outreach training for college students in wildlife conservation. The AIWC has already begun the study programme, with demand for the courses rising daily across India and internationally.

1.3.2.1 Strengthening the Infrastructure of AIWC

The infrastructures of AIWC are strengthened through establishment of Analog and Digital Library, of Digital Auditorium and Advanced Training rooms for hands on exercises, upgrading of AIWC campus, and setting up of Workshop for 3D Model preparation (Conservation Education).

1.3.2.2 Aiding the Animal Care Science Studies at Captive and Field Levels

Animal Care Science studies at captive and field levels are aided through construction of Wildlife disease diagnostic facilities and Wildlife disease therapeutics facilities. Wildlife disease diagnostic facilities are composed of histopathological facilities and imaging diagnostic facilities. Wildlife disease therapeutics facilities are ambulatory facilities and restraint facilities (Field equipment).

1.3.2.3 Wildlife Policy Research and Development

Wildlife policy has been underestimated in Tamil Nadu. Wildlife management cannot work without policy support. Wildlife policy takes various forms, such an explicit national policy, part of national nature conservation strategy or of a national development plan. Wildlife Policy Research and Development are conducted at AIWC in collaboration with the other department and agencies, e.g., MOEFCC, WWF, WII, etc.

1.3.3 Wildlife Policy Research and Development

WII has been conducting wildlife policy research in order to coordinate research at regional, national, and global levels to influence attitudes, policies, and practices towards the relationships between wildlife, environment, and human society. Attitudinal changes will develop a better sense of trust and regulations to follow between governments, people, donors, NGOs and the private sector, and for the mutual implementation of activities for society-wide resource development and utilization. The investigation and monitoring of various policies and practices will fill in the gaps between enforcement and accountability to achieve better environmental governance.

Two scientists and two research assistants conduct wildlife policy research. They review the management plans of the PA's, suggest scaling up measures, and prepare wildlife related policy documents and guidelines.

1.3.3.1 Research Works for Species Recovery with Special Focus on Marine Species

Increased anthropogenic pressures and incompatible land uses outside of PA threatens the ecological integrity of broader land- and seascapes. Realizing the need for immediate conservation efforts to reverse the declining trend of several terrestrial and marine species, MOEFCC entrusted the WII to develop guidelines for species conservation action plans. Subsequently in 2015, MOEFCC tasked WII with preparing Endangered Species Recovery Plans (ESRP) for identified nationally and globally important species such as the Great Indian bustard, Manipuri deer (sangai), Gangetic dolphin, and dugong. MOEFCC has funded this programme for an initial period of five years under the National Compensatory Afforestation Fund Management and Planning Advisory Council.

Two scientist and two research assistants conduct researches on species recovery with special focus on marine species. With the aims of strengthening existing population of selected species in its natural environment, Researches are conducted for establishment of the second population in the wild, improvement of habitat conditions and protection measures, enhancement of community participation in conservation, conservation education and capacity building.

1.3.3.2 Studies on Ecology and Habitat of Migratory Terrestrial and Marine Species

Two scientists and two research assistants conduct researches on ecology and habitat of migratory terrestrial and marine species. They carry out the field study on target species, make deliberations at state and national levels with associate organizations/agencies/NGOs and give trainings/workshops/seminars/symposiums involving the stakeholders (involving stakeholders based on target species).

1.3.3.3 Capacity Building and Knowledge Sharing

Capacity building and knowledge sharing are conducted with five different ways. They include 1) Capacity development for knowledge based on conservation practices, 2) Hands-on training for forest officials at multiple level, scientist, veterinary assistant surgeons and researchers, 3) Knowledge development and sharing, 4) Publications of research works, and 5) Development of centralized

database with data diagnostics and analytics center. The ways of 1) and 2) are conducted at the 1st year, and the ways of 3) and 4) are conducted at the 6th year are conducted. The way of 5) is conducted during 5 years from the 1st year to 5th year.

1.3.3.4 Status Assessment and Landscape Analysis

Status of floral, faunal and interacting dynamics of elements are assessed in 15 Wildlife Sanctuaries and other parks shown below.

- Mudumalai Wildlife Sanctuary,
- Indira Gandhi Wildlife Sanctuary,
- Mundanthurai Wildlife Sanctuary,
- Kalakad Wildlife Sanctuary,
- Grizzled Giant Squirrel Wildlife Sanctuary,
- Point Calimere Wildlife Sanctuary,
- Vallanadu Black Buck Sanctuary,
- Kanyakumari Wildlife Sanctuary,
- Sathyamangalam Wildlife Sanctuary,
- Megamalai Wildlife Sanctuary,
- Point Calimere Wildlife Sanctuary Block A and Block B,
- Kodaikanal Wildlife Sanctuary,
- Gangaikondan Spotted Deer Sanctuary,
- Cauvery North Wildlife Sanctuary,
- Nellai Wildlife Sanctuary,
- Five national parks at Mudumalai National Park,
- Indira Gandhi National Park,
- Mukurthi National Park,
- Guindy National Park,
- Gulf of Mannar Marine Park.

Habitat in landscape of protected areas is analyzed as landscape analysis.

1.3.3.5 Status Assessment of Habitat Conservation and Protection of Lesser Known Wild Animal

Habitat conservation and protection status of lesser-known wild animal (Pangolin, Star tortoise and Slender loris) in Western Ghats and Eastern Ghats of Tamil Nadu is assessed in terms of population. A certain districts like Dindigul, Pudukottai and Villupuram should be included. Assessment is conducted every year during 5 years from the 1st year to 5th year.

1.3.4 India-Japan Academic Consortium

To perform research activities about climate change measures (mitigation and adaptation) to maximize the effectiveness of activities 1.2 and 1.3. If the effect of the researched method is confirmed, that method to be reflected in the 1.2 and 1.3 activities and the policy on climate change countermeasures in the state and other projects, and expanded to other states.

10.5.2. Component 2: Human Wildlife Conflict Measures

Table 10.24: Activities for Human Wildlife Conflict Measures

Sec. No.	Activity	Site Selection	Survey/Design	Implementation
2.1	**Mitigation of Human Wildlife conflict**			
2.1.1	Mitigation Planning	TNFD/WII	TNFD/WII	TNFD/WII
2.1.1.1	Enhancing Community Tolerance			
2.1.1.2	Developing Committee Interaction Permanent Platforms			
2.1.1.3	Augmentation of Fodder and Forbs in Wildlife Areas			
2.1.1.4	Augmentation of Pinch Period Water Availability			
2.1.1.5	Habitat Connectivity Management			
2.1.2	Improvement of Corridors	TNFD/WII	TNFD/WII	TNFD/WII
2.1.2.1	Improving Infrastructure			
2.1.2.2	Developing Committee Interaction Permanent Platforms			
2.1.3	Capacity Building for Local Staff	TNFD	TNFD/academic institutions	TNFD/academic institutions
2.1.3.1	Awareness Building			
2.1.3.2	Developing Community Information Network			
2.1.3.3	Stakeholder Abatement Support			
2.1.3.4	Capacity Building of Officers and Staff			
2.1.4	Development of Mobile Application	TNFD	TNFD/academic institutions	TNFD/academic institutions
2.1.5	Infection disease measures (Ecological Countermeasures for Pandemic Prevention)			
2.2	**Infectious Diseases Measures**			

Source: Developed by the Study Team

2.1 Mitigation of Human Wildlife Conflict

While wildlife populations in Tamil Nadu are stable through various conservation efforts, human wildlife conflict is still acute problem and is recognized as a serious threat to the future of wildlife conservation in the state. According to TNFD, enrichment of forest habitat and land use change in the forest fringe habitats have resulted in occurrences of Human Wildlife Conflicts. Mitigation thereby needs integrated approaches including human dimension.

2.1.1 Mitigation Planning

Mitigation planning consists of different activities, which are stakeholder abatement support, developing committee interaction permanent platform, awareness building, developing and strengthening barriers. In order to develop committee interaction permanent platform, anti-depredation committees are formed with villagers and awareness programs about anti-depredation measures are conducted to drive away problematic animals. For developing and strengthening barriers, the Elephant Proof Trench (EPT) will be constructed.

2.1.1.1 Enhancing Community Tolerance

Compensation payment is widespread mitigation strategy used to reduce economic impacts in Tamil Nadu. Loss caused by wildlife conflict is classified as human death, injury, crop damage, livestock damage, property damage. Compensation thereby is paid for this different type of loss to strengthen community tolerance during 4 years from 1st year to 4th year.

2.1.1.2 Developing Committee Interaction Permanent Platforms

The need for 'Human Dimensions of Wildlife Management' to consider human involvement in wildlife conservation and management has been strongly recognized in the United States since the 1970s, and a lot of research has been done on local residents' awareness of wildlife and policy preferences on social aspects. In order to eliminate conflicts between wild animals and humans, which have become a problem, Human Dimensions of Wildlife Management is related to how individual residents think and act, what kind of mechanism the local community creates, and what human society should be. Even with the same wildlife problem, the values and interests in dealing with wildlife differ from person to person, such as farmers, residents involved in the tourism industry, and government officials involved in wildlife damage countermeasures. A social science approach is therefore needed to design effective wildlife conservation and management beyond these diverse values.

Anti-depredation committees are formed with villagers and awareness programs about anti-depredations measures are conducted to drive away problematic animals. Totally 1,580 camps are made for this purpose during 4 years.

2.1.1.3 Augmentation of Fodder and Forbs in Wildlife Areas

Palatable grasses, *Vallanadu Blackbuck* can restore habitats to attribute to biodiversity conservation. *Vallanadu Blackbuck* is raised up by sowing seeds in open area after ploughing. Establishment of *Vallanadu Blackbuck* are conducted for 4 years from 1st year to 4th year in 3,580 ha.

2.1.1.4 Augmentation of Pinch Period Water Availability

Bore well is drilled to augment pinch period water availability. Water is pumped out with solar power. Totally 62 wells are constructed during 4 years from 1st year to 4th year.

2.1.1.5 Habitat Connectivity Management

Watchtowers are constructed and anti-poaching camps are organized. Totally 11 watchtowers equipped with thermal camera are constructed at vantage points during 4 years from 1st year to 4th year.

2.1.2 Improvement of Corridors

In 2005, the Wildlife Trust of India (WTI), along with collaborators, published Right of Passage: National Elephant Corridors Project. The first edition of this report identified 88 corridors across the country. The second edition, published in 2017, identified 101 corridors. As per the second edition, 28 corridors are in Southern India, 25 in Central India, 23 in Northeastern India, 14 in the Northwest Bengal region, and 11 in Northwestern India. In 2006, to curb human-animal conflicts and reduce animal fatalities, the risk of inbreeding, and extinction, 88 corridors as important corridors for elephants in India were proposed. Later in 2010, the Elephant Task Force of the Ministry of Environment published Gajah, which recommended that state governments announce the corridor lands as reserved forests or private forests, and declared all of the corridor areas to be ecologically

sensitive areas.

2.1.2.1 Improving Infrastructure

122 buildings are listed to be pending for construction in the building requirements list of TNFD. 1 Conservator Officer Quarter, 14 Forest Ranger Officer Quarters, 45 Forester Quarters, 8 Forest Guard Quarters, 39 combined Forest Guard and Forest Watcher Quarters, 8 Forest Guard cum driver Quarters, 7 Forest Watcher Quarters are required to be built in the TBGCP period facilitate better implementation of the project. A half of the buildings are constructed in the first 2 years and the rest is done for the rest of project periods.

2.1.2.2 Developing and Strengthening Barriers

Developing and strengthening barriers are made to prevent movement of wild animals into human habitation. EPT is made to dig out soil and secure livelihood of tribal communities through barriers around tribal settlement. EPT will be made from 1st year to 4th year with total stretch length of over 20 km.

2.1.3 Capacity Building for Local Staff

Training for local staffs is given 5 times per year for 4 years from 1st year to 4th year. Training will be given to learn effective handling and mitigation of HWC through training program, exposure visits to officers, staff of RRT (Rapid response teams Units).

2.1.3.1 Awareness Building

Training for local staffs is given 5 times per year for 4 years from 1st year to 4th year. Training will be given to learn effective handling and mitigation of HWC through training program, exposure visits to officers, staff of RRT (Rapid response teams Units).

2.1.3.2 Developing Community Information Network

Education and outreach are established by Awareness camp. Totally 16 Awareness Camps are conducted at forest ranges.

2.1.3.3 Stakeholder Abatement Support

Public hearing is established through Awareness camp. Totally 176 Awareness Camps are conducted at forest ranges.

2.1.3.4 Capacity Building of Officers and Staff

Training is established for officers and staffs with 5 times per year during 4 years.

2.1.4 Development of Mobile Application

Mobile application is developed to capture wildlife observation or indirect evidences electronically for their geocoordinates, date, time and images. It will also record the tracking path of the field staffs.

2.1.5 Infection Disease Measures (Ecological Countermeasures for Pandemic Prevention)

Ecological service recently is considered as public health service. Although quantitative linkages

between environmental and human health are limited, the advent of the COVID-19 pandemic provides an impetus for this consideration. Landscape-based interventions to arrest the drivers of land use-induced zoonotic spillover were implemented as ecological countermeasures. In this context, ecological countermeasures can be employed to prevent land use-induced zoonotic spillover by fostering landscape immunity and reducing the risk of human exposure to wildlife-transmitted pathogens. Invasive species removal and the reintroduction of native plants are ecological countermeasures when undertaken to address zoonotic disease risks.

Invasive alien plants may provide optimal habitats for zoonotic pathogens, hosts, and vectors; they tend to have long flowering durations, vigorous growth, and increased biomass as they spread, particularly in disturbed sites[103]. The large-scale removal of invasive alien plants that facilitates zoonotic spillover can function as an ecological countermeasure when the goal is disease risk mitigation.

2.2 Infectious Diseases Measures

TNFD will research and identify animal-derived infectious diseases occurring in Tamil Nadu, such as bat-derived Nipah virus and tick-induced Kyasanur forest disease (research can be collaborated with AIWC which is advanced institute of wildlife conservation and Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) (wildlife institute of India)) Any technical mitigation measures are considered during the research and can be performed in accordance with the research results.

Once research activities and identification of infectious diseases are taken, prevention policies are formulated to mitigate the contact damage.

In addition, capacity development for local residents are performed against infectious diseases.

10.5.3. Component 3: Promoting Supply Chain Development

This component will mainly focus on the promotion of supply chain development of natural/forest resources which have been developed mainly in tree growing activities in the past, including JFM, promotion activities in the TAP 1 and 2, and Tree Planting Outside Forest (TPOF) in rural areas in TBGP.

Regarding this component, the Forest Extension Centres and the Forest Research Institute play a key role in the implementation of relevant activities.

Table 10.25: Activities for Promoting Supply Chain Development

Sec. No.	Activity	Site Selection	Survey/Design	Implementation
3.1	**Forestry Research**			
3.1.1	Afforestation Technology for Urban and Peri-urban Forestry	Extension Centres and Forestry Research Institutes	TNFD/Extension Centres/Forestry Research Institutes	TNFD/Extension Centres/Forestry Research Institutes
3.1.2	Tree Improvement	Extension Centres and Forestry Research Institutes	TNFD/Extension Centres/Forestry Research Institutes	TNFD/Extension Centres/Forestry Research Institutes
3.1.3	Bio-productivity Enhancement	Extension Centres and Forestry Research Institutes	TNFD/Extension Centres/Forestry Research Institutes	TNFD/Extension Centres/Forestry Research Institutes
3.1.4	Conservation of			

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[103] Stone CM, Witt ABR, Walsh GC, Foster WA, Murphy ST. 2018. "Would the Control of Invasive Alien Plants Reduce Malaria Transmission? A Review". *Parasites and Vectors*. Volume 11, Article Number 76.

	CR/ED/DD			
3.2	**Promoting Supply Chain Development**			
3.2.1	NTFP Supply Chain Development	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres
3.2.2	Timber Supply Chain Development	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres
3.2.2.1	Survey on the Regulated Timber Markets in the Whole State and/or Regional Situations	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres
3.2.2.2	Procurement of Required Equipment	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres
3.2.2.3	Development of the E-Platform	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres
3.2.2.4	Design a Portal Site for Setting up an E-marketing Site	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres
3.2.2.5	Portal Site Introductory Workshop	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres
3.2.2.6	Follow up Workshop for Renewal Portal Site	Extension Centres	TNFD/Extension Centres	TNFD/Extension Centres

Source: Developed by the Study Team

3.1 Forestry Research

In order to execute activities of increasing the natural resource base, the development of several technologies and researches is required. In addition, crucial researches and developments are planned to be executed not only for the TBGCP activities, but also for the development of the forestry sector in the Tamil Nadu state. Those research and development activities include: tree improvement by means of genetic combining of high demanding species to secure the planting materials in the state, developing methodologies of tree seasoning treatment, and research and development of for some research be conducted for fundamital forestry development.

3.1.1 Afforestation Technology for Urban and Peri-urban Forestry

The research items or research and development for Afforestation technology for urban and peri-urban forestry and their operation contents are shown in Table 10.26.

Table 10.26: Research Items for Afforestation Technology for Urban and Peri-urban Forestry

No.	Research/Work Items	Contents
1	(**Technical transfer training**) Training held in Chennai to foster trainers who train extension workers in each Extension Centres	One-day training. Average attendances are 15 candidate trainers. Resource person to prepare the training by preparation for 3 day previously
	(**Technical transfer training**) Training to train extension workers in each Extension Centres	One-day training. 4 days required to go to district and return to transport and prepare the training
2	**Developing a viable Urban Forestry Model**	Research with trial planting to develop Urban Forestry Model
3	**Developing taller planting technique** and Developing transplanting techniques	Research with trial planting to develop taller seedling planting techniques and transplanting techniques
4	**Development of Phytoremediation Models** for different effluent systems of industrial districts	Research with trial planting to develop Phytoremediation Models for different effluent systems of industrial districts

5	**Development of Eco-park, Biodiversity parks**	Development of Eco-park, Biodiversity park in various ecosystem (5 areas), setting up the parks and maintain them for 5 years

3.1.1.1 Technical Transfer Training

In the urban and peri-urban forestry operation, it will be necessary to handle different methods and soils such as roads, sewage drains, waste lands, dumps, mine spoils, industrial effluents, domestic and industrial wastes, dumps etc. from conventional tree planting activities. In order to work based on these, training to FEC staff who will be the main actors of the activities in the first few months of TBGCP.

3.1.1.2 Developing a Viable Urban Forestry Model

In the operations of urban and peri-urban forestry, it is expected to deal with various situations and landscapes in urban and peri-urban areas, such as riverine plantations, residential areas, avenues, ponds, railway stations, waste Lands, community lands, farmer lands, dumping yards and etc. To deal with those circumstances, it will be necessary to introduce or use tree species that have not been used so far and their planting methods. The following can be considered as activities for developing new operational models:

1. Screening of highly drought tolerant, site specific species
2. Screening of species for pollution abetment
3. Screening of carbon sequestration short and long rotation species
4. Screening of agroforestry models for different agro climatic zones

3.1.1.3 Developing Taller Plants Planting and Transplanting Techniques

It has been conserved that taller seedlings be planted in the operation mainly in order to achieve higher survival rates. It will be necessary to introduce or apply specific techniques to grow seedlings and to use their planting methods. The following can be considered as activities for developing new.

(Taller plants planting)
1. Producing pole stage seedling within 2-3 years in high nutrient condition
2. Developing required planting medium and nutrient regime
3. Developing cost efficient container for the above purpose and economical transportation

(Transplanting techniques)
1. Developing transplanting techniques for common urban tree species
2. Developing suitable techniques, identification of suitable species and sites for transplanting

3.1.1.4 Development of Phytoremediation Model

In the Urban and peri-urban area will have several industrial pollution sources and remedial measures need to done through Afforestation. Activities which are already initiated in research wing in this regard will be further extended to suite local requirements. The activities involve:

1. Screening species for potential phytoremediation plants
2. Developing a tree based sewage water treatment model
3. Developing textiles industries effluent treatment model
4. Developing dying industries effluent treatment models

3.1.1.5 Development of Eco-parks and Biodiversity Parks

Theme based biodiversity park will be developed as an attractive educative destination in each districts. The suggestive themes are Nakshatra vanam, Agro-forestry model, Pollution abetment, NTFP Planting, Medicinal Garden etc. Based on conditions of urban areas above component will be modified. The activities include survey, design, construction and management plan.

3.1.2 Tree Improvement

Research and development for tree improvement aims to seek out elite trees (Plus Trees) of important tree species with good morphological traits, growth and other properties in the Tamil Nadu State. These trees inherit the genes as clones of the elite trees. These activities aim to provide a stable supply of good seedlings in both quantity and quality in afforestation activities in Tamil Nadu state. These activities should contribute to the creation of forest resources with high economic value in the future.

The research items and their contents of the Tree Improvement are shown in Table 10.27.

Table 10.27: Research Items for Tree Improvement

No.	Research/Work Items	Responsible Organization
1	Establishment of Hi-Tech Central Nursery in all at the district	Polly house with mist system as cutting seedling propagation chambers
2	Genetic combine for high demanding species	Genetic combine for high demanding species in all Central nurseries
3	Assembling candidate plus tree (CPT)'s planting materials	Assembling CPT's in extension Centres in following forms like hedge, seedling seed orchards, clonal seed orchards, seed stands to ensure supply of quality planting materials
4	Capacity building and training to Extension Personnel	Capacity building and training to the Extension personnel

3.1.2.1 Establishment of Hi-Tech Central Nursery

Central Nursery Establishment in Each District

For the tree improvement, Central nurseries of FECs will play important roles. Central nurseries are provided in all Extension Centres in 32 districts, though they do not have enough resources to produce and keep an adequate number of quality nursery stock throughout the year to satisfy the demand of the general public. In the last decade, nurseries in the public sector suffer from quality deficiency and an absence of competent staff. The state government is accordingly expected to be an important actor playing an interventionist role to supply quality planting materials at reasonable prices. It was then proposed to establish a modern central nursery in each of the former 32 districts (as of 2012) of the state of Tamil Nadu. It will be expected that the nurseries have stocks of no less than 25,000 seedlings at any point in time.

To overcome these situations, infrastructure facilities and central nurseries in 32 districts are expected to be upgraded. There is, however, no precise details and cost breakdown for the upgrades. The TNFD and the Study Team are required to have further discussions to finalize the cost breakdown. In the Urban and peri-urban forestry operation, it will be necessary to handle different methods and soils such as roads, sewage drains, waste lands, dumps, mine spoils, industrial effluents, domestic and industrial wastes, dumps etc. from conventional tree planting activities. In order to work based on these, training to FEC staff who will be the main actors of the activities in the first few months of TBGCP.

For the tree improvement based on the genetic combining by assembling planting materials from candidate trees, high tech nurseries are required to be established in suitable places in districts.

Clonal propagation chambers with poly house and misting systems / hedge Stoll are also expected to be established to cater to the needs of the district for species like Melia, Neem, Casuarina, ailanthus etc. Clones of important species like tamarind, teak, sandal will be assembled to utilize as good planting materials in the future.

3.1.2.2 Genetic Combine for High Demanding Species and Assembling CPT's Planting Material

Candidate trees have been identified in various agro climatic zones and being recorded so far and some of the promising trees are raised as seed stands and further into seed orchards based on results. In the current situations, good prominent planting materials of the divisions have been supplied by research wings as and when required by them. This system has been sufficient for the regular schemes of TNFD but massive schemes like TBGCP / MTP need identified sources of planting materials at district level itself. It has been therefore proposed that tree improvements be taken at district level by the research wing. The identified candidate plus trees (CPT) of all the species required for the forest division will be assembled at the suitable nursery or central nursery or extension centre in the district. Seed stands, clonal propagation units will be established as per requirements of the district. These units will be developed, used for supply of planting materials during the TBGCP period. It is expected that continuing use of planting materials be handed over to the forest division in future. During the project period the field staff of the division shall be intensively trained vegetative propagation and nursery techniques.

To envisage the operation and to estimate the cost, an example of process to setup seed stands and scion hedges are briefly described as bellow:

Table 10.28: Example of Process to Setup Seed Stands and Scion Hedges

CPT Survey	Based on the designation status, distribution map, and quantity of existing CPTs for each tree species, further collection plans for future CPTs, Sood Orchard based on those existing CPTs and newly added CPTs, and new plans for cultivating yard will be formulated.
Workshop	Learn about CPT, procedures and methods to clonal propagation, scion hedges/gardens and seed stands /orchards in workshop
Plan	Search for CPTs of 3 tree species, 10 CPTs each, 12 scions from each CPT totally 3,600 scions (or a certain number) 1,500 for seed stands and 1,500 for scion hedges (or a certain numbers)
Procedure	1 Find CPTs in the district 2 Collect scions (cuttings) from the CPTs 3 Transport CPTs from the existing clonal propagation units (CPU) 4 Plant cuttings in a nursery (not necessary for ones sent from CPU) 5 Cure for 20 days in a nursery (or a certain period: not necessary for ones from CPU) 6 transplant scions to pots (not necessary for ones from CPU) 7 Move the pot seedlings to the Polly House 8 Cure pot seedlings for 3 months or a certain period. 9 Levelling and preparing the scion hedges and seed stands 10 1,500 trees (or a certain number) to be planted in the scion hedges 11 1,500 trees (or a certain number) to be planted in the seed stands

3.1.2.3 Capacity Building and Training to Extension Personnel

Main purposes for training to Extension personnel on tree improvement is to help the field staff to realise the importance of quality planting materials, to make the quality planting materials available to them at their own place and to empower them with techniques to maintain them and used them.

Extensive training will be imparted on them during the project period to make them self-sufficient in producing required number of quality seedlings.

In order to continue with refresher training to staff and farmers, Permanent training centres in each district extension centres are planned to be established.

3.1.3 Bio-productivity Enhancement

The research items of the Bio Productivity Enhancement and their operational contents are shown in Table 10.29.

Table 10.29: Research Items for Bio-productivity Enhancement

No.	Research/Work Items	Contents
1	Developing an e-platform for Market Intelligence of Timber Products	Contents are described in 10.5.2.2
2	Developing 'Forest Utilisation Units' (FUU)	Installation of Kiln/wood treatment facilities in FUUs in Salem, Courtallem, Dingigul, Tanjavur, Nagarcoil for seasoning and wood treatment for preservation and value addition
3	Developing seasoning and treatment schedules for lesser-known timber sources	Seasoning and Treatment schedules will be for lesser known timber sources
4	Developing a 'Money-Yield Table' for important tree species	Yield table combined with financial assessment for important tree species, such as Teak, Melia ailanthus, Neem, Vaai gmelina, etc.

3.1.3.1 Developing an E-platform for Market Intelligence of Timber Products

Activity contents are described in 3.2.

3.1.3.2 Developing 'Forest Utilisation Units' (FUU)

In Salem, Courtallam, Dindigul, Thanjavur and Nagercoil, timber markets have been well-established and there is a large scale requirement of effective and efficient tree treatment for important timber tree species. Seasoning kiln and timber treatment plants are therefore planned to be established in the Forest Utilisation Units in those areas. Facility for utilizing the same on payment basis are planned to be developed.

Before setting up the Kiln and treatment plants in five locations, surveying shall be conducted to design kiln structures to be suitable in each location. Kilns will be then designed and ordered according to the type and purposes of the tree species mainly used in the area.

In all five locations, kiln type of dehumidifying drying with steam are planned to set up. Pressure adjustment kiln will be added in two places afterward. During the initial survey, two locations will be determined.

3.1.3.3 Developing Seasoning and Treatment Schedules

Seasoning protocols and treatment schedules for some of the potential but less popular timers will testes for their properties, different seasoning and treatment schedules will be developed to improve the timber quality and marketing.

3.1.3.4 Developing a 'Money-Yield Table' for Important Tree Species

Growth predictions and yield tables have been made for important tree species, such as Teak, Melia, Ailanthus, Neem, Vagai, Gmelina etc. by the Research wing in Tamil Nadu State so far. To be more practical uses of those yield prediction tables, especially to determine the time to be harvested, it has been suggested to develop money-yield table/curve, which are yield curve/table integrated with financial assessment.

The concept of the money-yield curve is shown in Figure 10.9.

Developed by the Study Team
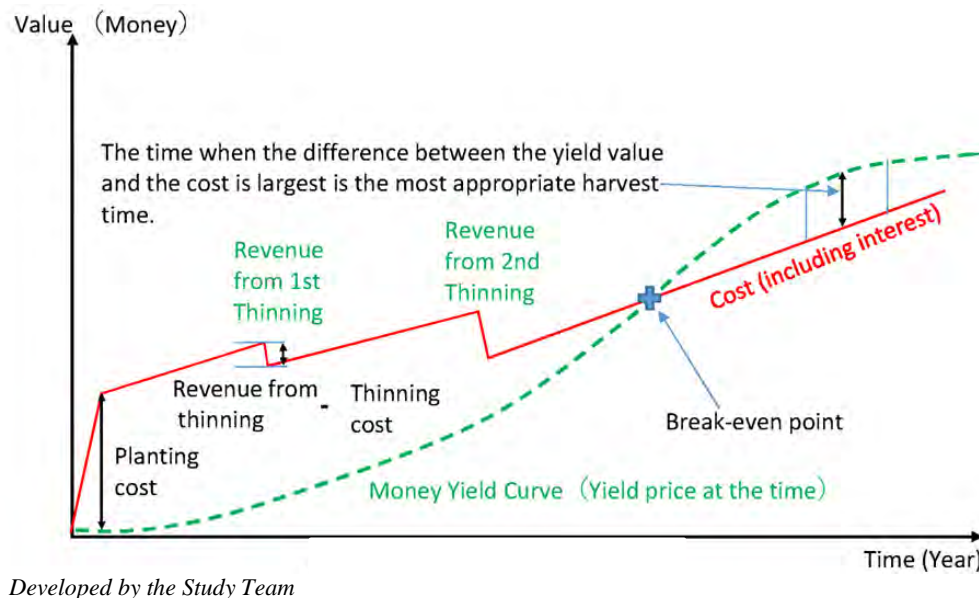
Figure 10.9: Concept of Money-Yield Curve

For the development of the money-yield curves/tables for six tree species as shown above, series of surveys and workshops will be held among researchers and forestry officers.

3.1.4 Conservation of CR/EN/DD

3.1.4.1 Process of Conservation of CR/EN/DD

Outline of the Process of the Conservation of species of Critically Endangered (CR)/Endangered (EN)/Data Deficient (DD) are shown as follows.

1. Determine the tentative CR/EN/DD from the information since many investigations have been conducted in the Tamil Nadu so far.
2. Investigate and identify those species and the Habitat distribution in the state.
3. Assess needs for conservation of these species and prioritize conservation activities. (from the tentative, classify those species based on classification of CAMP: Conservation Assessment and Management).
4. Develop operational work plans according to the priorities of those species and their distributions/zones.
5. Carry out conservation activities according to the operational plans.
6. Monitor and verify the execution effect.
7. Modify the execution plan =====> Management Cycle

The specific activities of investigation, evaluation, planning, execution, monitoring, and re-planning of these conservation activities are shown in CAMP. In order to follow that process of CAMP, CAMP Workshop shall be held before starting all the activities. The CAMP Workshop can help all

stakeholders understand these series of activities.

In the conservation of CR/EN/DD in the Tamil Nadu state, the following issues and management are regarded as priority items:

1. Removal of Invasive species
2. Vegetation management plan
3. Replacement of monoculture plantations
4. Restoration of Shola

Therefore, these points shall be considered in the new operation management work plan in TBGCP. At the same time, as the rehabilitation of critical tree species, 100,000 trees are planted.

3.1.4.2 Establishment of Demo Garden

Demo gardens shall be established along with the interpretation centres or important research centres that should assemblage in respect of Rare, Endemic, Threatened plants of taxonomical, medicinal, trade, cultural and conservation significance.

3.1.4.3 Training, Workshop, and Capacity Building

Training programs and workshops should be conducted on continuous and sustainable development of Medicinal Plants, NTFPs and Rare & Threatened species at State level. These programs can be achieved by involving some of the educational and research institutions coordinated by the forest department.

The research items of the CR/EN/DD and their operational contents are shown in Table 10.30.

Table 10.30: Research Items for CR/EN/DD Research

No.	Research/Work Items	Contents
1	Survey and assessment and planning of CR/EN/DD species through CAMP workshops	Survey and assessment of Populations and endemic and threatened species and their dynamics of the population based on CAMP and workshop results.
2	Planting in situ/ex situ of CR/EN/DD species	Demonstration planting on tree species in respect of Rare, Endemic, Threatened plants of taxonomical, medicinal, trade, cultural and conservation significance
3	Establishment of Demo garden	Demonstration planting on tree species of Rare, Endemic, Threatened plants of taxonomical, medicinal, trade, cultural and conservation significance
4	Training, workshop and capacity building	Training and workshop on medical Plants, NTFPs and Rare and Threatened Plants at state level (40 participants)

3.2 Promoting Supply Chain Development: Developing an E-platform for Marketing Intelligence of NTFPs and Timbers

3.2.1 NTFP Supply Chain Development

The TNFD is planning to undertake market interventions to correct anomalies and inefficiencies of the existing value supply chain of NTFPs through FSCs. Supply chains of NTFPs collected from forests have long been recognized to be grossly inefficient due to the imperfections of the traditional market and the exploitative behaviour of intermediaries. For the development of supply chains of NTFPs and timber products in order to alleviate the inefficiency, the following processes and

activities are expected to be implemented with the intervention of the Extension Centres by means of e-platform marketing.

Proposed supply chain development in TBGCP for NTFPs by using e-portal sites are as follows:

Table 10.31: Proposed Activities of NTFP Supply Chain Development

No.	NTFP Supply Chain Development
1	Non-destructive collection of NTFPs
2	Development of preliminary handling protocol
3	Transport to Extension Centres for processing, packaging, and storage
4	Brand promotion in cooperation with brand ambassadors/package value added NTFPs, Khadi Gramodyog/organic products branding
5	E-marketing through marketing tie-ups with the Khadi Gramodyog, e-tailers like Snapdeal, Flipcart, and Amazon
6	Development of modalities of payment proceeds between collectors and JFMCs by intervention (service) of the TNFD (Extension Centre) with a service charge
7	Development of sales models to drive sales such as applying incentives for sales and fostering sales personnel

Source: TNFD
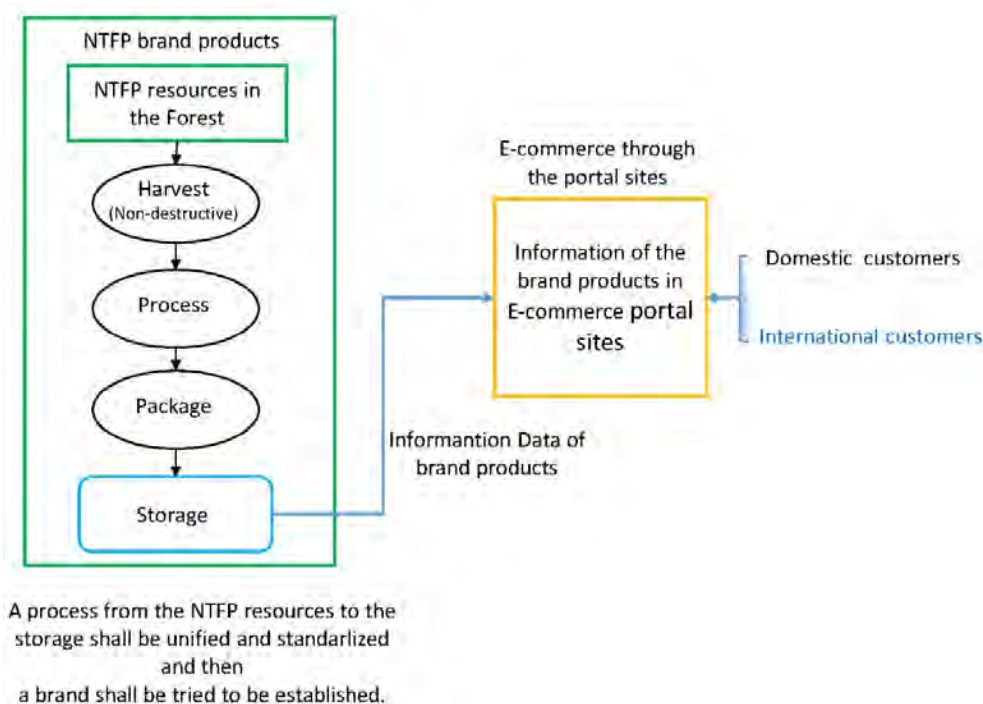
Figure 10.10: Conceptual Flow of Supply Chain of NTFP Brand Products through E-commerce Portal Site

By branding NTFPs, it is expected to increase the value of products by unifying and improving methods and qualities of harvesting, manufacturing, and packaging of NTFPs. At the same time, it will be possible to protect the forests of resource-rich areas. In addition, its branding is to make it possible to acquire a wide range of customers inside and outside the country within E-commerce.

3.2.2 Timber Supply Chain Development

Proposed e-platform development for regulated timber products are as follows:

Table 10.32: Proposed Activities of NTFP Supply Chain Development for Timber Products

No.	Timber Supply Chain Development
1	'As is where is' marketing basis. Tree growers can acknowledge the best timing for harvesting. Mature trees to be kept at sites as standing trees until the appropriate time.
2	'One stop or single window solution'. No requirement to transport felled trees to Extension Centres. The Centres only take care of permissions for felling and transport to reduce infrastructure development such as warehouses and stockyards.
3	Pilot testing for supply chain development to apply on an 'as is where is' and 'one stop solution' basis
4	Online application for felling and transporting permissions
5	Development of monitoring system to support 'one stop solutions' and online application to secure the compliance of the supply chain.

Source: TNFD
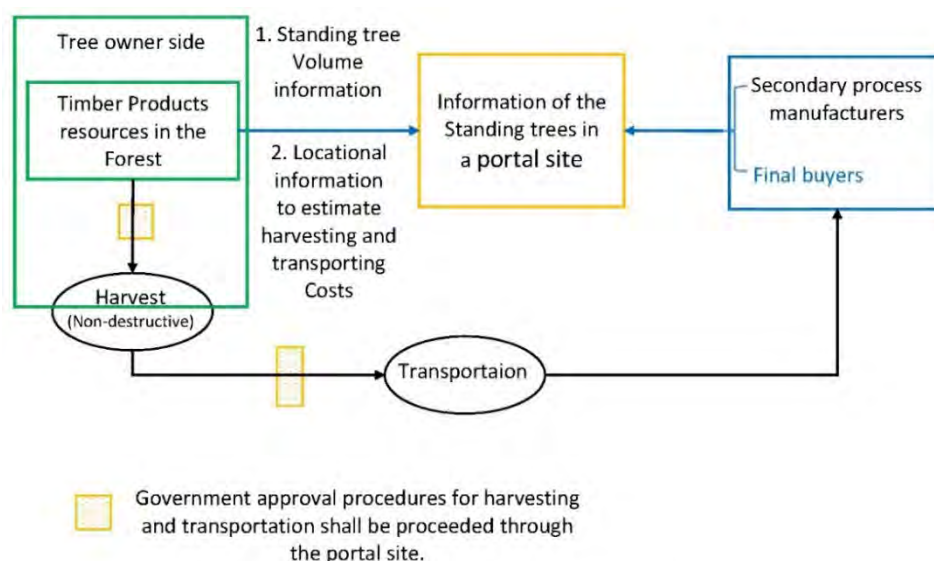
Basic concept diagram of one stop solutions

Figure 10.11: Conceptual Flow of Supply Chain of Timber Products through E-platform

As shown in the above figures, in order to brand NTFP and to develop supply chain by utilizing E-portal sites, or to trade Regulated Timber Products on E-based while storing resources in the forest, in TBGCP, the following activities have been considered:

3.2.2.1 Survey on the Regulated Timber Markets in the Whole State and/or Regional Situations

In each District, there should be unique NTFPs that need to be marketed. These NTFPs and important timber species have to be identified in each district. On top of that, in the case of NTFPs, it is necessary to consider and create a resource-friendly harvesting methods, a manufacturing methods and a packaging methods for branding the NTFPs in each district.

In the case of Timber forest products, it is also required to identify important tree species as a timber in each district. These identifications of NTFPs and tree species for timber are expected to conduct in the initial survey and study as a research and development activity. During the survey, workshops and interviews shall be held to grasp situations of supply chains of NTFPs and timber Products among stakeholders, such as NTFPs and Timber producers, manufacturers, transporters, buyers, ITC system engineers etc. In the workshops, requirements, requests, conveniences, limitations of the expected system, problems and restrictions in current situations etc. shall be discussed.

3.2.2.2 Procurement of Required Equipment

For creating the e-based portal site systems for NTFPs and timber products, the computers and internet connection are crucial and they shall be well-equipped. If the system works well, running cost will be expected to be paid from the fees as an agent of the transaction between sellers and buyers.

3.2.2.3 Development of the E-platform

Branded NTFPs are expected to be transacted in e-based commercial portal site widely with domestic and international customers as described and shown in Figure 3.

In case of the timber tree species and their products, it is expected to create e-platform system where standing trees of those important species on site are allowed to be transacted before harvesting operation through e-portal site. At the same time, the government logging permits and transportation permits will be granted through the portal site.

These types of portal sites for supply chains of NTFPs and timber products are expected to be considered and created in TBGCP activities.

This workshop will be held to pursue what is convenient and profitable for all stakeholders This workshop will be held in each district.

3.2.2.4 Design a Portal Site for Setting up an E-marketing Site

Based on results of the above surveys, interviews and workshops with stakeholders, utilisation of the existing portal site and new portal sites, if necessary, shall be designed by system engineers together with resource persons who are responsible in TNFD. It is required the systems be convenient and profitable for all parties and stakeholders, such as NTFPs and Timber producers, manufacturers, transporters, buyers, ITC system engineers, and TNFD as much as possible. As far as government permissions on tree harvesting and transportations are concerned, it may be important to open the portal sites in the Forestry Department portal site. However, it will be depending on the consideration of conveniences and profitability of all parties, which will be indicated with participations to attendants to the sites. These will be one of the crucial indicators to evaluate the activities.

3.2.2.5 Portal Site Introductory Workshop

At the commencement of the e-commerce based portal sites, introduction of the using methods and on NTFPs and Timber products, each stakeholder such as NTFPs and Timber producers, processors, transporters, buyers, ITC system engineers etc. Using the portal sites shall be promoted as much as possible. Requests and requirements from the stakeholders shall be acquired repeatedly, and minor improvement shall be repeated to meet stakeholders' requests always.

3.2.2.6 Follow up Workshop for Renewal Portal Site

At the end of a year after starting operation of the portal sites, a follow up workshop shall be held to have evaluations of stakeholders in several places. The evaluations include conveniences, advantages, disadvantages, difficulties to use, and frequencies to use. Based on the results of the workshop information, the first major improvement of the portal site will be conducted if necessary.

From this point, the monitoring, evaluation and improvement cycle processes shall be mainly included and conducted in the e-portal site.

It has been suggested to constitute a 'Tree and NTFP Marketing Society'. All 32 district society

members are to be federated. It is also suggested that the State Tree and NTFP Marketing Society be housed in and serviced by a dedicated division of TAFCORN.

There is another suggestion to form a body of the Marketing Society, utilizing the existing setup of the JFMC-Forest Development Agency (FDA)-State Forest Development Agency (SFDA). Agroforestry and the marketing of value added NTFPFDAs certainly come within the purview of their mandate/roles. The responsibilities of SFDA/FDA and the FDA mechanism may be suitable to undertake such market interventions.

10.5.4. Component 4: Livelihood Improvement Activities

This component will largely focus indirectly on biodiversity conservation of PA as well as directly on livelihood improvement of the local communities that involve in the management of PA. This component will support the following sub-components:

Table 10.33: Activities for Livelihood Improvement Activities

Sec. No.	Activity	Site Selection	Survey/Design	Implementation
4.1	**Ecotourism**			
4.1.1	**Genepool Garden in Gudalur (Nilgiris District)**			
4.1.1.1	Preparatory Work	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices)
4.1.1.2	Capacity Building and Skill Development for Stakeholders	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices), local NGO(s)
4.1.1.3	Development of Infrastructure	TNFD (TBGCP Office and relevant division offices)	TNFD (TBGCP Office and relevant division offices)	Contractors
4.1.1.4	Participatory Assessment of Impacts of Interventions	-	TNFD (TBGCP Office and relevant division offices)	TNFD (TBGCP Office and relevant division offices)
4.1.2	**Four Circuits in the Eastern Ghats**			
4.1.2.1	Preparatory Work	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices)
4.1.2.2	Capacity Building and Skill Development for Stakeholders	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices), local NGO(s)
4.1.2.3	Development of Infrastructure	TNFD (TBGCP Office and relevant division offices)	TNFD (TBGCP Office and relevant division offices)	Contractors
4.1.2.4	Participatory Assessment of Impacts of Interventions	-	TNFD (TBGCP Office and relevant division offices)	TNFD (TBGCP Office and relevant division offices)
4.2	**Ecodevelopment Activities**			
4.2.1	Hold State-level Workshop	TNFD (TBGCP Office)	TNFD (TBGCP Office)	TNFD (TBGCP Office)
4.2.2	Orient Communities on the Scope and Purpose	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices)
4.2.3	Train Field Staff Teams to Design and Facilitate Participatory Processes using Appropriate Tools	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices), local NGO(s)

4.2.4	Facilitate Participatory Planning of Ecodevelopment Plans	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices), local NGO(s)
4.2.5	Constitute EDCs and their Executive Committees	-	TNFD (relevant division offices)	TNFD (relevant division offices), local NGO(s)
4.2.6	Facilitate Study Tours to Expose EDCs to Other Successful Groups	-	TNFD (relevant division offices)	TNFD (relevant division offices), local NGO(s)
4.2.7	Prepare Ecodevelopment Plans, Addressing Socio-Economic and Ecological Requirements and Opportunities including Skill Training	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices), local NGO(s)
4.2.8	Implement Ecodevelopment Plans	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices), local NGO(s)
4.2.9	Participatory Assessment of Impacts of Interventions	-	TNFD (TBGCP Office and relevant division offices)	TNFD (relevant division offices), local NGO(s)

Source: Developed by the Study Team

4.1 Ecotourism

Two locations have largely been identified as target areas for ecotourism: i) Genepool Garden in Gudalur (Nilgiris District) and ii) four circuits in the Eastern Ghats. Ecotourism in TBGCP should be developed keeping in mind the Tamil Nadu Ecotourism Policy 2017.

4.1.1 Genepool Garden in Gudalur (Nilgiris District)

Genepool Garden is a tropical garden located in Nadugani Village near Gudalur Town and Ooty Hill Station in Gudalur Taluk in Nilgiris District. It is situated at an elevation of 900 metre mean sea level (MSL) and has an area of 242.14 ha. Figure 10.12 illustrates the sites of Genepool Garden in Gudalur.

Distant view of Genepool Garden	Orchidarium

Source: Taken by the Study Team

Figure 10.12: Photos Taken in Genepool Garden in Gudalur, Nilgiris District

The Genepool Garden was established in FY 1989-90 and is a repository for highly endangered flora species of both the Western and Eastern Ghats. The facility has been run by the research wing of the TNFD. Current activities include:

i)   In-situ conservation of existing plant life and forms;

ii) Ex-situ conservation of endemic and endangered plant forms;
iii) Reintroduction and recovery programme of endangered species;
iv) Propagation of fast disappearing plant species; and
v) Education and research and awareness.

The Genepool Garden is equipped with the following facilities;

i) Fern House;
ii) Orchidarium;
iii) Herbarium;
iv) Botanical Museum;
v) Tissue culture laboratory; and
vi) Interpretation Centre.

Despite the greater significance of the Genepool Garden, as described above, the influx of visitors remains low owing to various factors, which include the lack of accommodations, vehicle parking, and the absence of matter that attracts eco-tourists. Therefore, keeping in view the excellent landscape, aesthetic beauty, and salubrious climatic conditions, there is ample scope for improvement for the Genepool Garden on the lines of ecotourism, so as to entice a greater number of visitors throughout the year.

The following processes shall be taken to promote ecotourism in the target area.

4.1.1.1 Preparatory Work

(1) Establishment of Management Structure

As a core management body of the development of CBET in the Genepool Garden, an EDC comprising tribes has been formed and registered under the Societies Registration Act in 2017. An opportunity to include as many forest dependents/dwellers and other vulnerable people as possible into the EDC should be sought.

Moreover, a MOU was signed between the EDC and TNFD. The following items stipulated in the MOU will be reviewed and agreed upon by the two parties prior to the initiation of the actual activities: i) Objectives of the development of CBET and ii) Roles and responsibilities of the EDC and TNFD.

Furthermore, the implementation processes and contents of CBET will also be confirmed and agreed upon by the two parties.

(2) Development of Ecotourism Management Plan (Micro-plan)

An Ecotourism Management Plan (EMP) or 'Micro-plan' will be developed by the EDC, TNFD, and other stakeholders. This will basically follow the guidelines prepared during TBGP. The major contents of the plan will include i) vision, goals, and strategies, ii) objectives, iii) activities, and iv) zoning.

4.1.1.2 Capacity Building and Skill Development for Stakeholders

The main target of capacity building will consist of two groups: i) management staff and ii) tour guides. Training needs to vary, from a general course on ecotourism to more specific training on particular topics. Thus, it is essential for careful discussions to take place amongst the stakeholders. In general, it has been found that short technical courses have had little impact, whilst longer courses, including learning-by-doing and on-the-job training (OJT), have proved necessary. Although the actual training topics will be determined in the process of EMP development, as described in the

previous section, potential key topics to be considered are summarised by the training target as follows.

Table 10.34: Potential Key Topics by Target

Target	Topics	
	Common	Target-wise
Management staff	● Safety management ● Handling visitors, customer care, and hospitality skills ● Environmental management (including biodiversity) ● Environmental interpretation and education ● Tourism and ecotourism ● Basic language ● Impact monitoring techniques	● Product development issues ● Marketing and communication ● Working and negotiating with commercial operators ● Management skills, legal issues, and financial control ● Guide training, including content and delivery ● Accounting ● Fundraising and public relations ● Extension techniques
Tour guides	● Trail design and maintenance	● Botany and zoology ● General information on the state (e.g. history, culture, socio-economic conditions, environment, and biodiversity) ● Site specific knowledge on fauna and flora

4.1.1.3 Development of Infrastructure

This activity will focus on the following four components: construction of infrastructure, improvement of infrastructure, purchase of equipment and materials, and other items.

(1)   Construction of Infrastructure

This component covers new development of infrastructure such as various kinds of buildings and facilities as indicated in Table 10.35.

Table 10.35: Tentative Specifications for Construction of Infrastructure

No.	Item	Details / Specifications	Quantity
1	Reception cum interpretation centre	This building is required at the entry point of Genepool Garden, where the visitors will be stopped and sent in the proposed 'Eco Tourism Vehicle'. At present there is no infrastructure at the entry area, and hence construction of a reception and interpretation building with furniture and amenities is essential. This building will be constructed with a room for a ticketing counter as well.	1
2	Eco-huts	Eco-huts will be constructed in a manner to merge with the local environment, using local sustainable materials. These huts will have minimal impact on the natural surroundings during construction, utilising localised architecture, and may be managed by the committee. One of the huts will be for use as an eco-shop, which will be run by members of the Toda tribe to sell their handmade products, etc.	5
3	Tree houses	Like adventures activities, tree houses are also equally attractive and capable of inviting a greater influx of tourists. Hence, the construction of houses on top of trees are proposed for three places.	3
4	Trekking shed	There is more demand for 'Genepool' among natural lovers. Hence, providing a trekking shed in this area will be more useful for conducting nature camps for students and volunteers for creating awareness about the importance of this ecosystem. The trekking shed can be maintained by the committee.	3
5	Eco-friendly toilet complex	The tourists will be accommodated with a toilet complex near the entry point. This complex will comprise separate washrooms with modest sanitary arrangements for men, women and physically challenged persons.	1

		This facility will help for proper disposal in septic tanks, without disturbing the environment. The creation of water facilities running from the existing stream to the proposed toilets will be done by laying pipelines.	
6	Water supply facilities	Availability of sufficient water determines the success of any project. Since a greater number of visitors is expected, provisions have to be made for ensuring continuous water availability to cater to the requirements of eco-tourists. This is new water supply facility with a tank, connection, taps, water filter, etc.	1 set

(2) Improvement of Infrastructure

There are a number of infrastructure items required to be improved mainly due to degradation over time or upgraded to meet high demand.

Table 10.36: Tentative Specifications for Improvement of Infrastructure

No.	Item	Details / Specifications	Quantity
1	Parking area	This facility is for the accommodation of 200 vehicles at a stretch, on the right side of the entry point of Genepool Garden.	1 set
2	Improvement of existing infrastructure	The existing infrastructures are in bad condition and should be greatly improved in order to attract more visitors in the spheres of education, research, and conservation. Those infrastructures include herbarium, museum, medicinal garden, orchidarium, biotech laboratory, and community hall.	-

(3) Purchase of Equipment of Materials

A large variety of equipment and materials are also required to be procured to further promote CBET in the site.

Table 10.37: Tentative Specifications for Purchase of Equipment and Materials

No.	Item	Details / Specifications	Quantity
1	Office equipment and furniture	Office equipment including computers and furniture will be purchased to maintain the complete accounts of the committee. The committee accounts are audited every year, and hence computalisation will be more useful and easy for monitoring.	
2	Equipment and exhibits for the Interpretation Centre	Display materials will be placed in the Interpretation Centre. The materials will be designed to be educative and to create awareness for the visitors. The displays will bring out the natural heritage of that area and of the Nilgiris, too.	
3	Vehicles for carrying tourists and water transportation	As private vehicles are not allowed beyond the entry point, a vehicle is essential for carrying visitors to Genepool Garden safely. Similarly, a water tanker is also required for the transportation of water into Genepool Garden to meet the requirements of tourists.	- Mini bus: 1 - Jeep: 1
4	Setting up of zip line and other adventures activities	The setting up of a zip line and other adventure activities like paragliding and hot air balloon are a matter of tourist attraction. Besides the fact that adventure activities are a matter of enjoyment, visitors can enjoy the aesthetic beauty of the canopy of dense forests, wildlife, etc. As days go by, this would undoubtedly be inviting to more tourists, which would go a long way in the fulfilment of the objectives of the project.	

(4) Other Items

This component mainly include activities related to environmental conservation as well as awareness

creation.

Table 10.38: Tentative Specifications for Other Items

No.	Item	Details / Specifications	Quantity
1	Waste management mechanism	The accumulation of garbage is an issue which requires efficient management. Hence, waste management by placing dust bins at required points is proposed.	1 set
2	Publicity, awareness creation, interpretation, and documentation	Provision is given for publicity materials like information boards and pamphlets to create awareness among students and the public. Students, being the future generation, should be made aware of the importance of forests, wildlife, and the need for the conservation of natural resources in order to thwart instances of human-animal conflict.	-

4.1.1.4 Participatory Assessment of Impacts of Interventions

Periodic impact assessments will be conducted in a participatory manner among the stakeholders every year during the project period. The expected stakeholders include such as EDCs, TNFD (TBGCP Office and relevant division offices), and involved NGOs. In principle, the method will follow the guidelines developed during TBGP but the following indicators or determinants of impact will be used for effective and efficient assessment.

Table 10.39: Impacts and Indicators for Participatory Assessment on CBET

Kind of Impact	Indicator/Determinant
Ecological and environmental	● Change in vegetation (by infrastructure, activity) ● Change in animal habitat (by infrastructure, activity)
Social and cultural	● Number of tourists ● Number of bednights ● Type of tourists ● Activities in which tourists participate ● Change in population in surrounding communities ● Change in cultural norms of surrounding communities
Economic	● Income ● Expenditure ● Net profit
Technical and managerial	● Number of complaints/compliments by tourists ● Number of qualifications, awards, certificates, etc. obtained

4.1.2 Four Circuits in Eastern Ghats

There are four proposed CBET destinations in the Eastern Ghats, as shown below.

Table 10.40: Proposed CBET Sites in the Eastern Ghats

No.	Name of Circuit	Location
C1	Kurumbapatti – Yercaud	Salem Forest Division
C2	Aiyur- Denkinekottai – Hoganekal Waterfalls	Dharmapuri Forest Division
C3	Kollimalai – Medicinal Plant Conservation Area – Akash Ganga Waterfalls – Yelagiri Hills	Namakkal Forest Division
C4	Yelagiri – Amirthi – Jamunamarathur – Bheeman Waterfalls – Kular Cave	Tirupattur, Vellore, and Tiruvannamalai Forest Divisions

At the same time, the characteristics of these four CBET destinations are illustrated by Figure 10.13.

Main Entrance of Aiyur Ecotourism site (Circuit: Aiyur- Denkinekottai – Hoganekal Waterfalls)	Toilets for visitors at Crocodile Rehabilitation Park (Circuit: Aiyur- Denkinekottai – Hoganekal Waterfalls)
Way to Anguthi Jonai Waterfalls (Circuit: Yelagiri – Amirthi – Jamunamarathur – Bheeman Waterfalls – Kular Cave)	Interpretation centre in amirthi (Circuit: Yelagiri – Amirthi – Jamunamarathur – Bheeman Waterfalls – Kular Cave)

Source: Taken by the Study Team

Figure 10.13: Site Characteristics of the CBET Destinations

The four CBET sites include existing ones which need to be improved and promoted. The main focus will be to attract more tourists to the Eastern Ghats, with the aim of reducing tourist flow to the Western Ghats, as a high volume of tourists have negatively impacted wildlife there.

Unlike with Genepool Garden, no EDCs have been formed yet. Therefore, the implementation processes will be almost the same as those adopted for TBGP.

4.1.2.1 Preparatory Work

(1) Establishment of Management Structure

EDC(s) will be formed in each target circuit and registered under the Societies Registration Act in 2017. As the same case as the Genepool Garden, it should be noted that an opportunity to include as many forest dependents/dwellers and other vulnerable people as possible into the EDC should be sought.

(2) Development of Ecotourism Management Plan (Micro-plan)

This process will be promoted with the same process outlined for the Genepool Garden.

4.1.2.2 Capacity Building and Skill Development for Stakeholders

The trainings for common and target-wise topics will be promoted with the same process outlined for the Genepool Garden.

4.1.2.3 Development of Infrastructure

The activities planned under this component vary considerably and can be categorised into nine as specified in Table 10.41; i.e. i) Construction of infrastructure (Buildings), ii) Construction of other infrastructure, iii) Improvement of infrastructure (Buildings), iv) Improvement of other infrastructure, v) Purchase of equipment and materials, vi) Training and exposure visits, vii) Information, education and communication (IEC) activities, viii) Development of ecotourism products, ix) Others. In the table below, C1, C2, C3, and C4 correspond to the proposed the CBET four circuits.

Table 10.41: Tentative Activities for Ecotourism Site Development

No.	Item/Activity	Details	C1	C2	C3	C4-1	C4-2	C4-3
1	Construction of infrastructure (Buildings)	Trekking sheds, training cum meeting halls, eco huts, jungle lodges and resorts, tribal eco shop, canteen, dress changing rooms, etc.	X	X	X	X	X	X
2	Construction of other infrastructure	Entrance arch/gate, trekking path, children's park, toilets, bore wells, benches, awareness boards, medicinal plant/herbal gardens, Nakshatra vanam (Star forest), pargolas, Martyr point, parking places, rain water harvesting facilities, water supply facilities, soil and moisture conservation structure to prevent erosion, watch tower, canopy walk, wild animal models and signages, barricades/fencing, mini bridges, compound walls, etc.	X	X	X	X	X	X
3	Improvement of infrastructure (Buildings)	Forest rest house and dormitory, eco huts, interpretation centre		X				X
4	Improvement of other infrastructure	Children's park, trekking path, lawn formation, watch towers, dressing rooms, water holes structure, etc.	X	X	X	X	X	X
5	Purchase of equipment and materials	Solar light facilities, vehicle, natural sound system, dustbin boxes, electric two wheelers, solar power system, safety equipment set, binoculars, drones, tents, CCTV cameras, etc.	X	X	X	X	X	
6	Training and exposure visits	Conducting video and film shows, awareness camping, Educational and recreational facilities, signages, Nature education camps		X				
7	Information, education and communication (IEC) activities	Development of cultural, eco guides and bird watcher guide, etc.		X				
8	Development of	Creation of website, Promotion	X		X			

	ecotourism products	and marketing ecotourism products, Advertisement for marketing ecotourism products, Training to guides for exposure visit, Purchase of eco-cycle, bullock carts and mini bus, Engaging facilitators, etc.						
9	Others	Aesthetic architecture, creation and maintenance of website, marketing, signboards fixing, engaging field guides and drivers, maintenance of base camp, fuel and maintenance of vehicle, pathway arrangements formation, apiary training, etc.	X	X	X			

Note: The 4th circuit (Yellagiri - Amrithi - Jamunamarathur - Beeman Water fall - Kular Cave) are divided into three sections; i.e. i) Anguthai Jonai (C4-1), ii) Jalagambarai (C4-2), and iii) Beeman Waterfalls (C4-3).

4.1.2.4 Participatory Assessment of Impacts of Interventions

This process will be promoted with the same process outlined for the Genepool Garden.

4.2 Ecodevelopment Activities

The tribal population accounts for 0.795 million (1.1%) out of about 72 million of the total population of Tamil Nadu State. The majority of the tribes live in the hilly ranges of the Eastern and Western Ghats and the discontinuous hill tracts of the adjoining plain and hills. The majority of them live under hand-to-mouth conditions and depend for their livelihoods on forest resources, causing immense pressure on forests as they live mostly in forests or adjoining forest areas. They practice rain-fed agriculture and the productivity of their land is poor. Rain water run-off is high, which promotes heavy soil erosion. Hence, the TNFD has proposed taking up the revitalization of 193 ITDP villages treated under the TAP 2 from 2005-06 to 2008-09. Later, it was agreed to limit the target villages just in the Eastern Ghats and eventually the total number of the villages/hamlets decreased to 155.

The ecodevelopment activities consist of five sub-components. These are: i) Ecodevelopment activities; ii) Soil and moisture conservation (SMC); iii) Preservation of traditional knowledge among tribes and local people; iv) Heritage conservation; and v) Soil and water conservation (SWC) measures. The following processes, which are almost the same as TBGP, shall be conducted for the promotion of ecodevelopment in the target area.

4.2.1 Hold State-level Workshop

A state-level workshop will be organised, aiming at sharing the experiences of ecodevelopment in TBGP and discussing the plans for TBGCP. The major participants will be the implementing officers from various sections of TBGCP.

4.2.2 Orient Communities on the Scope and Purpose

Starting with kick-off meetings, where the stakeholders discuss the overall plans for ecodevelopment, a series of meetings will be held to share the scope and purpose of ecodevelopment. Since there might be a number of target villages/hamlets (155), these meetings will be organised by the forest division or district. An opportunity to include as many forest dependents/dwellers and other vulnerable people as possible into the EDC should be sought.

4.2.3 Train Field Staff Teams to Design and Facilitate Participatory Processes Using Appropriate Tools

This is a process for capacity building of field staff who facilitate the target communities in ecodevelopment activities. Tools, methods, and guidelines developed through the implementation of TBGP will fully be utilised for this process.

4.2.4 Facilitate Participatory Planning of Ecodevelopment Plans

The trained field staff will facilitate the planning process in collaboration with the EDCs and other stakeholders of ecodevelopment activities. Ideally speaking, part of the process shall be facilitated by the EDCs so that ownership of the ecodevelopment activities by the locals is further enhanced. The expected outcomes of this session will be draft Ecodevelopment Plans in each target village. The Ecodevelopment Plans cover five components; i.e, i) Ecodevelopment Activities, ii) Soil and Moisture Conservation (SMC), iii) Preservation of Traditional Knowledge among Tribal and Local People, iv) Heritage Conservation (Eastern Ghats), and v) Soil and Water Conservation (SWC) Measures. Particularly for the Ecodevelopment Activities, it is expected there are diverse local needs so rapid needs assessment will be conducted.

4.2.5 Constitute EDCs and Their Executive Committees

Similar to the case of CBET, EDC(s) will be constituted in each target village and registered under the Societies Registration Act in 2017. Executive committee(s) in each EDC will also be formed as required.

4.2.6 Facilitate Study Tours to Expose EDCs to Other Successful Groups

Study tours to visit other successful groups such as EDCs, VFCs, and SHGs will be organised for the target EDCs. It is also worthwhile to facilitate cross-visits with those organisations in terms of more effective ways of sharing experiences and know-how.

4.2.7 Prepare Ecodevelopment Plans, Addressing Socio-economic and Ecological Requirements and Opportunities Including Skill Training

In this process, the Ecodevelopment Plans drafted in the previous process will be completed in each target village. As specified in the next section, the tentative plans for each component have already been designed but the details of the activities such as the responsibilities of each stakeholder, implementation schedule, budget (cost estimates), etc. should be clarified at this stage.

4.2.8 Implement Ecodevelopment Plans

The ecodevelopment plans depicted in the previous section will constantly be carried out following the implementation schedule. During the course of the implementation, SHGs will be organised by target village/area and activity in accordance with local needs and conditions in order to facilitate effective management of the activities.

(1)   Ecodevelopment Activities

As aforementioned, a wide range of local needs is expected to this component so actual needs should properly be itemized. Just as examples, the items and their details accumulated from the previous experiences during the TBGP are sorted out in the table below:

Table 10.42: Tentative Plans for Ecodevelopment Activities

No.	Item	Details	Quantity/ Specification
1	Capacity building among tribal youth by imparting training	The following are examples for modules: ➢ Vehicle driving ➢ Agricultural clinic ➢ Areca nut plates ➢ Rearing honeybee combs, etc.	155 villages/ hamlets
2	Provision of free LPG connection to tribal families		155 villages/ hamlets
3	Skill development	The following are examples for modules: ➢ Driving and providing licences ➢ Basic computer knowledge for tribal youth ➢ Tailoring (mainly for women) ➢ Dairy management ➢ Poultry farming ➢ Honey collection and beekeeping ➢ Mushroom cultivation ➢ Piggery and other animal husbandry ➢ NTFP development	155 villages/ hamlets

(2) Soil and Moisture Conservation (SMC)

SMC will chiefly be practised with two methods; i.e. i) Reclamation and improvement of tribal lands and ii) Stone paving of paths, steps, and community utility area as detailed as follows:

Table 10.43: Tentative Plans for Soil and Moisture Conservation

No.	Item	Details	Quantity/ Specification
1	Reclamation and improvement of tribal lands	This will be carried out by constructing stone wall masonry to avoid soil erosion, to recharge the groundwater, and for the improvement of agriculture outputs.	155 villages/ hamlets
2	Stone paving of paths, steps, and community utility area	This activity will help conserve soil and moisture/water in a way to construct structures such as paths, steps, community utility area, etc. One of the characteristics of the structures is that those will be constructed with eco-friendly materials only without cement.	60 villages/ hamlets

(3) Preservation of Traditional Knowledge among Tribal and Local People

The method of this component will be conduct of Natuvaidyar (traditional medicine practioner) conference. At present, five places are candidates of the conferences.

Table 10.44: Tentative Plans for Preservation of Traditional Knowledge among Tribal and Local People

No.	Item	Details	Quantity/ Specification
1	Conduct of Natuvaidyar (traditional medicine practioner) conference	The major purposes of the conferences are identified as follows: i) To preserve the knowledge of various traditional medicines used in the treatments, ii) To utilize those medicinal treatments by all the people, iii) To share the knowledge and gather information, iv) To recognize and encourage the service of traditional medical practioners, v) To give thrust on natural based medicines, vi) To create awareness among the public about easily available natural medicine, vii) To share	At 5 places (i.e. Kollihills, Yercaud, Kalrayans, Jamunamutthur, Kallakurichi)

| | | experience and knowledge among traditional medical practioners, viii) To carry over their knowledge to next generation.
 Such a conference with traditional medicine practitioners has not been conducted though studies have been undertaken to document traditional knowledge. Normally they are shy of sharing their knowledge and therefore separate conferences in different places are suggested. | |

(4)   Heritage Conservation (Eastern Ghats)

A total of four sites are the current target of the component. More specifically, historical caves and religious sites will be the major targets of conservation.

Table 10.45: Tentative Plans for Heritage Conservation

No.	Item	Details	Quantity/ Specification
1	Conservation of heritage sites	This activity aims to conserve heritage sites such as historical caves and religious heritage sites and to provide facilities for visits to students and tourists. There are many components are included in the activity; e.g. construction and improvement of infrastructure (reception cum interpretation centre, sheds, trekking route, water harvesting facility, waste management facility), engaging staff (guide, watchers), monitoring and evaluation.	At 4 places (i.e. Kullar Caves in Patramanagalam RF, Gudiyam Caves in Pulikundrum RF, religious heritage site of Mel Siddhar Kovil at Kanjamalai RF, religious heritage site of Kariyaramar Kovil at Kurumbapatti RF)

(5)   Soil and Water Conservation (SWC) Measures

SWC measures will mainly be expanded with two methods; i.e. i) Construction of loose boulder check wall vegetative barrier, etc. and ii) Construction of mega-harvesting structure as detailed as below:

Table 10.46: Tentative Plans for Soil and Conservation Measures

No.	Item	Details	Quantity/ Specification
1	Construction of loose boulder check wall vegetative barrier, etc.	• This activity is a revival of soil and water conservation works that exist in RF areas. • This infrastructure is to prevent soil erosion and stain moisture for prolonged periods at water sources and natural springs in RF areas.	250 sites
2	Construction of mega-harvesting structure	• Rain water received from streams in the watershed area is harvested within the RF by way of constructing percolation ponds. Water harvested in this way recharges the underground water system. • This infrastructure will be developed in RFs and PA in the divisions of Hosur and Dharmapuri. There are two sizes of structure, medium and small.	40 sites

4.2.9 Participatory Assessment of Impacts of Interventions

Periodic impact assessment will be conducted in a participatory manner among the stakeholders every year during the project period. The expected stakeholders include EDCs, local participants, TNFD (TBGCP Office and relevant division offices), and involved NGOs. In principle, the method will follow the guidelines developed during TBGP, but the following indicators or determinants of impact will be used for effective and efficient assessment.

Table 10.47: Impacts and Indicators for Participatory Assessment on Ecodevelopment

Kind of Impact	Indicator/Determinant
Ecological and environmental	• Change in soil and water conditions (by infrastructure, activity)
Social and cultural	• Number of beneficiaries • Change in population in surrounding communities • Change in cultural norms of surrounding communities
Economic	• Income • Expenditure • Net profit
Technical and managerial	• Number of qualifications, awards, certificates, etc. obtained

10.5.5. Component 5: Management Capacity Development

Management capacity development will be a vital part of project implementation, particularly in TBGCP, as there are various activities implemented.

5.1 Policy Planning and Implementation Ability

Training (Domestic and Overseas) for TNFD officials will be conducted in order to effectively utilize the research activities and results of the activities of this project in the policies of Tamil Nadu and the action plans of forest officials.

5.2 Activation of Research Activities

In order to effectively implement the activities of this project, TNFD will take the lead in planning research on the implementation method of the activities of this project, demonstrating it in the pilot area, and applying the obtained results to other target areas and reflect to the action plan planning etc.

5.3 Map Preparation

Maps play an important role in the implementation of a wide range of project activities. As a result of the Study in progress, it appears that the following maps and datasets need to be prepared in TBGCP.

Table 10.48: Tentative Map Preparation Required for TBGCP

Activities	Target	Work contents	Responsible for
Migration of existing maps in accordance with UTM-WGS84 Projection	State (forest area)	To survey forest boundaries using DGPS with higher accuracy.	TNFD and the State Survey Department
RFs using DGPS with special reference to RFs which are not marked on SOI topographic maps	State (RFs)	To survey RFs which are not marked on SOI topographic maps.	TNFD and the State Survey Department
Wetlands, water bodies within the notified forests of the TNFD	State (within forest area)	To survey location of wetlands and other water bodies within forest areas as point form.	TNFD and the State Survey Department
Water harvest structures constructed under various schemes	State (Specified locations)	To survey location of water harvest structures as point form.	TNFD and the State Survey Department

Forest type maps	State	To conduct forest type classification based on high-resolution satellite imagery with ground trothing surveys.	TNFD
District forest atlas	State	To update forest maps	TNFD
Tribal settlements	State	To survey location of tribal settlements as point form.	TNFD and the State Survey Department
Wildlife management – resource assessment maps	One district	To prepare vegetation type classification map using high-resolution satellite imagery.	TNFD
Human-wildlife conflict – conflict/risk/sensitive/vulnerable zone mapping based on historic data/multi-criteria analysis	State	To survey locations of wildlife and human conflicts based on data collected by field officers.	TNFD including field officers
Estimation of areas of trees outside of forest areas (Pilot study in technical collaboration with FSI)	One district	To extract areas of trees outside of forest areas using High Resolution Satellite Imagery	TNFD
Soil type mapping for RFs (Pilot study in technical collaboration with TNAU)	One district	To conduct soil type classification within forest areas	Tamil Nadu Agriculture University
Estimation of areas of trees outside of forest areas (replication of pilot study outcome in other areas)	State	To extract areas of trees outside of forest areas using High Resolution Satellite Imagery	TNFD
Soil type mapping for RFs (replication of pilot study outcome in other areas)	State	To conduct soil type classification within forest areas	TNFD
Target villages for ecodevelopment activities	Project Area	To identify the target villages	TNFD
Pre and post intervention sites like plantations, nurseries, assets, and infrastructures	Project Area	To prepare spatial map of interventions for future reference and monitoring using the data provided by the implementing officers.	TNFD
Survey and mapping of marine biodiversity	Project Area	To identify the status of marine biodiversity for future reference and monitoring.	TNFD
Survey and mapping of elephant and other corridors	State	To demarcate the wildlife corridors and affected villages. To plan protection and corridor conservation activities based on the field survey data.	TNFD
Survey and mapping of wildlife habitats	State	To demarcate the wildlife habitats using DGPS and satellite images, mapping of strength of natural resources within core and buffer zones.	TNFD
Survey and mapping of wildlife population	State	To count the site-wise wildlife population for better management using the wildlife census data prepared by the Wildlife Wing.	TNFD
Digital elevation map (The DEM/CartoDEM can be procured from NRSC for high accuracy)	State	To find out the elevations and elevation pattern, watersheds for landscape-based planning using satellite images.	TNFD/NRSC
Mapping of Ecodevelopment activities	Project Area	To prepare spatial map of interventions for future reference and monitoring using the data provided by implementing	TNFD

		officers.	
Mapping of ecotourism facilities and circuits	State	To prepared map of tourist facilities, access roads, tacks and trails, site seeing activities etc.	TNFD
Microplanning maps of Project sites	Project Area	To prepare the spatial map of proposed activities based on PRA for post treatment assessment.	TNFD
Contour maps	State	To prepare map of contour lines using toposheets and DEM for elevation information to be used in landscape-based planning and analysis.	TNFD
Slope maps	State	To prepare map of slope pattern using DEM for gradient information to be used in landscape-based planning and analysis.	TNFD
Mangrove map	State	To estimate the natural mangrove area, mangrove plantations, treatment required, health of mangroves area, tidal calendars etc.	TNFD
Eco-Sensitive zones map	State	Prepared buffer zones of eco sensitive areas to protect wildlife and ecosystem, to issue the NOC, and prohibit industrial activities.	TNFD
NTFP resources map	State	To prepare NTFP resources potential map to link with value chain and supply chain using the working plan resource inputs.	TNFD
Non-Spatial data based thematic maps	As required	To prepare thematic maps using different non-spatial data for analysis and planning.	TNFD

5.3.1 Estimation of Areas of Trees Outside of Forest Areas (Pilot Study)

The state has 30,850 km^2 of area under forest and tree cover which constitutes 23.72 % of the total geographical area of the state. According to the "National Forest Policy 1988", the one-third of the total land area of the country need to be under forest or tree cover. In order to achieve this goal, a massive need-based and time bound programme of afforestation and tree planting, with particular emphasis on fuelwood and fodder development, on all degraded and denuded lands in the country, whether forest or non-forest land, is described to be a national imperative. To achieve the goal of 33 % of green cover as laid down in the National Forest Policy 1988, the tree cover outside forests is considered as the single most important and cost-effective strategy.

The state forest department had started "Tree Cultivation in Private Lands" (TCPL) scheme in 2007-08 to increase the green coven in state, which is the first effort of its kind in the country. The TBGP also started implementing the TCPL activity from 2012-13 onwards.

Now, it is high time to conduct a pilot study for a district using high-resolution satellite imagery, and the sampling method will be followed to asses TOF. The guidance of FSI will be utilized for this purpose. Based on the outcome and standardised procedures, the pilot study will be extended into entire state over a period of time.

5.3.2 Soil Type Mapping for Reserved Forests (Pilot Study)

Soil is the basis for any living organism to establish and survive. Soil within the notified forests is generally classified as Forest Soil, which indicates that soil all over the forest is the same. Technically, however, different vegetation classes require different types of soil. A pilot study for a district may be carried out to map soil types within the notified forests of Tamil Nadu. The expertise of TNAU will be utilized for this purpose. Based on the outcome of the study, the entire State will be covered over a period of time.

5.4 Infrastructure and Mobility

Availability of infrastructure and mobility is a basic requirement for efficient project implementation. However, the necessity of equipment, office buildings, and means of transport need careful consideration at all levels.

5.4.1 GIS Enhancement

Based on the survey results of existing GIS capacities in the implementing agencies and the current MIS environment, procurement plans for relevant offices will be prepared appropriately. In this regard, in order not to delay project interventions, it is important to examine the time required from the order to the delivery and start the procurement in a timely manner.

Table 10.49: Tentative Procurement Plan for GIS Software

Item	Target offices	Quantity	Activities
GIS	Division offices	TBD	To upgrade existing licences to the latest version with maintenance.
	Territorial Division	TBD	
	Working Plan Division	TBD	
	All other divisions	TBD	To newly procure the latest licences with maintenance.
	All other wildlife divisions	TBD	

The Geomatics Centre needs to be up-graded with the latest equipment, including workstations, survey equipment, satellite imagery, and software, and training need to be provided to the centre to keep up with the IT evolution. The GIS team needs to take advanced training to handle specialised map production and spatial data analysis required different activities in TNFD and TBGCP. Resource persons need to be deputed to handle and coordinate the GIS requirement of proposed project. Maps need to be prepared using existing resources on a daily basis and be shared with field offices for use in proposals, micro plans, and pre-treatment maps.

5.4.2 MIS Enhancement

At present, the TNFD uses five modules including Stores and Infrastructure Management System, Plantation Management System, Natural Forest Management System, Forest Working Plan Management System, and Forest Vigilance Information system. In TBGCP, several new modules are developed.

The Management Information System (MIS) is a key tool for information driven decision making in TNFD. It facilitates the automated flow of standardised information between the users in the organisation and enhance productivity, accountability, and transparency. The TNFD also uses TNFMIS web application for data collection, storage, and retrieval. The TNFMIS application includes five main modules such as Stores and Infrastructure Management System, Plantation Management System, Natural Forest Management System, Forest Working Plan Management System, and Forest Vigilance Information system. In TBGP also has its own dedicated MIS, which is an integrated application for GIS and MIS. Due to insufficient facility at TBGP, the application was hosted in vendor's server.

In TBGCP the PMU needs to take control of MIS application for operation and management from the beginning of the project. The MIS information needs to be utilised in planning and making a decision. The existing application needs to customised and strengthened to accommodate additional components in TBGCP. Provisions for planning, activity progress tracking and monitoring also need to be added in application. All stakeholders also need to use MIS application. While the data entry operators will assist in data uploading, the managers and higher officials need to use the application for day-to-day planning, decision making, and monitoring. User profiles, activity calendars, interactive dashboard, alert notification, and progress indicators are the features that need to be added in MIS application.

It is very necessary to enhance the facility to support the proposed activities and achieve the objectives of TBGCP. The enhancement of MIS includes (a) procurement and maintenance of IT equipment and peripherals, (b) procurement and maintenance of office use software applications, (c) customisation and strengthening of existing application used in TBGP, (d) capacity building, and (e) development of MIS framework.

(1) Procurement and maintenance of IT equipment and peripherals

The project needs to arrange maintenance of existing equipment and peripherals for efficient use and also needs to procure new equipment and peripherals wherever required for smooth dispense of office works for implementation of project activities. It is observed that many equipment and peripherals are in operation beyond self-life. It is proposed to prepare list of equipment and peripherals to collect information of operational conditions and self-life. Based on this procurement of equipment and peripherals can be planned further. The project also need to arrange an AMC partner agency for maintenance of equipment and peripherals for all level offices under project.

(2) Procurement and Maintenance of Office Use Software Applications

The office use software applications also need to be procured to enhance the productivity and data security.

(3) Customisation and Strengthening of Existing Application Used in TBGP

Since the TBGP has developed integrated MIS & GIS web application for MIS & GIS data collection, storage, and retrieval. The web application collects approved data and information directly for the DMU offices. The existing application needs to be improved to incorporate the new activities proposed in TBGCP. The application also needs to be strengthened with additional capabilities like interactive dashboard, SMS gateway, query-based report generation, etc.

(4) Capacity Building

The users at different level need to take training programmes for awareness and capacity building for use of MIS for making decisions. An intensive training module needs to be developed by project for use of MIS and improvement of decision-making abilities.

(5) Development of MIS framework

TBGCP also needs to develop MIS framework to operationalise the MIS for entire project activities. The framework shall include roles, responsibilities, and time schedule for data submission.

5.4.3 Equipment

In TBGCP, to implement various activities at different levels, necessary equipment need to be procured. They include but not limited to satellite imagery, workstations, mobile devices, and office supplies.

(1) Procurement of Satellite Imagery

Necessary satellite imagery are procured from the relevant institute in the first year of the project period. Data will be stored in the Geomatics Centre for future reference. The specifications will be discussed with the designated experts of the PMC.

(2) Procurement of Equipment

Necessary equipment are procured in the first year of the project period. The specifications will be discussed with the designated experts of the PMC.

5.4.4 Vehicles

In terms of mobility, enhancing the existing fleet of vehicles needs to be considered. The TNFD appears to have a sufficient number of vehicles for existing personnel. However, the PMU will require the procurement of several vehicles, probably one or two for each office depending on the quantity of project work allocated to these offices.

The exact number of vehicles and types to be procured should be decided by the Executive Committee of the PMU in the first year of TBGCP. This should also be approved by the appropriate members.

The maintenance of vehicles procured for TBGCP, including those procured by TBGP, should be borne by TBGCP during the duration of its implementation.

5.4.5 Construction of Office Buildings

In TBGCP, the following office buildings (quarters) necessary for the project interventions are constructed.

- Chief Forester Quarters (1)
- Forest Range Officer Quarters (14)
- Forester Quarters (45)
- Forest Guard Quarter (8)
- Forest Guard with Watcher Quarters (39)
- Forest Guard with Driver Quarters (8)
- Forest Watcher Quarters (7)

5.4.6 Management Plan Development Cell

Infrastructure development works will be carried out in the Management Plan Development cell in the office of the Principal Chief Conservator of Forests & Chief Wildlife Warden. Machineries, equipment and others will be supplied to the Management Plan Development cell as per needs and requirements.

5.4.7 Preparation for Working Plans

The working plans are the statement of prescriptions for scientific management of forest prepared in every 10 years for each division. The forest management activities in the divisions are being carried out as per the prescription of the working plan. The preparation of working plans includes intensive survey which is very time consuming. In 2014, MOEFCC had issued the national working plan code guideline for sustainable management of forests and biodiversity in India. The working plans need to be prepared and approved on time for systematic follow-up of the prescriptions. To prepare the working plans in a timely manner, the capacity of the Working Plan Division needs to strengthened.

(1)   Hiring Experts

In order to strengthen the capacity of the working plan division, a few technically qualified resource persons such as research fellows, wildlife biologists, social scientists, forest economists, botanists, soil science experts, hydrological experts need to be hired on a full time and part time basis.

(2)   Implementation of Activities

As per the National Wages and Productivity Commission (NWPC) 2014 Guidelines, the new working plans need to be prepared on the basis of several additional scientific assessments such as carbon estimation, bio-diversity assessment, utilization of traditional knowledge of tribal and other forest dwellers, wildlife and tree outside forests, Rare Endangered Threatened (RET) species, regeneration status, soil profile, non timber forest produce, water yield, and etc. These assessment activities need to be supported for timely preparation and approval of working plans.

5.5 Capacity Development

Capacity development is mostly in training, exposure visits, and workshops for the stakeholders who are core members of project implementation and operation and maintenance. The requirements for different kinds of capacity development and their intensity need to be assessed for each stakeholder.

5.5.1 Implementation of Training

Capacity building in the forms of training of trainers (TOT) and general training addresses issues associated with inadequate knowledge, skills, and awareness. If a gap is identified in terms of policies and rules, such matters should be brought to the attention of higher authorities in TBGCP.

Training is necessary for introducing new technologies to the implementing agencies and for updating the existing manpower with knowledge and skills from the previous projects including the TAP1, TAP 2, and TBGP. The following table summarizes necessary training modules for TBGCP.

(1)   TOT

In TBGCP, training needs to be provided to the key resource persons in the Geomatics Centre and MIS Centre in priority considering the importance of the GIS and MIS in the project in order for them to handle the expected activities and support the smooth implementation of the project. These key resource persons will act as master trainers to train other persons in the project and as well as TNFD. To maintain the consistency and quality of trainings, the help of PMC consultant also is required, and standard training manuals and standard operation procedures are developed.

Table 10.50: Tentative Training Modules

Module	Target	Period	Remarks
Diploma in Geo-Information Science and Earth Observation	4	12 months	Training at ITC, Netherlands
Post Graduate Diploma (PGD) in Remote Sensing & GIS (Specialisation in Forest Resources & Ecosystem Analysis)	1	12 months	Training at IIRS Dehradun
Big Geodata Processing	5	1 month	Training at IIRS Dehradun
Web GIS development	5	1 month	Training at BISAG, Ahmedabad
LIDAR Data processing	5	1 month	Training at NIGST, Hyderabad
Certificate course on Satellite Image Analysis & Photogrammetry	5	1 month	Training at IIRS Dehradun

Data handling & analysis	48	1 month	Inhouse by PMC Consultant/TNeGA/ Other
Database Creation, query writing, report generation	48	1 month	
MIS management	48	1 month	

(2) General Training

To improve the technical capacity in GIS, MIS, and computer literacy among the field persons, the capacity development training is very essential. These trainings need to be conduced within in-house capacity through the master trainer. Before conducting these trainings, the standard training manuals and standard operation procedures need to be developed. The target persons need to be selected as per experience and proficiency. As a result, the same training is implemented repeatedly. A training monitor also may be designated to assess the quality of these trainings along with feedbacks from the participants for future qualitative improvement of trainings.

Table 10.51: Tentative Training Modules

Module	Target	Period	Remarks
Application of GIS/RS	1,000	5 days	20 batches, in house by master trainers, for department persons including rangers and foresters.
Use of Web GIS Application	1,000	5 days	
Basic MS Office & Internet (Introductory) (5 days)	1,000	5 days	
MIS (Introductory)	1,200	5 days	24 batches, in house by master trainers for department persons including rangers, foresters, and project staff.
MIS (Follow-up)	1,200	5 days	

5.6 Pilot Studies

Pilot studies will be conducted for strengthening the capacity of the implementing agencies in specific domains/themes.

Table 10.52: Tentative List of Pilot Studies

Name	Target Area	Responsible for	Work Period
Biological Diversity Study	One or two selected district(s)	Outsourcing (a few researchers)	One year (12 months)

5.6.1 Biological Diversity Study

The state forests and protected areas have immense biodiversity and genetic resource in terms of trees, herbs, and shrubs including valuable medicinal plants. These resources have an immense potential for economic and social development. The Western and Eastern Ghats holding innumerable plants and animals offer a scope for bio-prospecting novel genetic resources. A pilot study will be conducted for a district to assess the genetic diversity of the district. This study will be also conducted in other districts in the State based on the experience of pilot study. This study will be conducted with the guidance of the State Biodiversity Board.

5.7 Monitoring and Evaluation

Monitoring and evaluation of TBGCP progress and achievement will tentatively involve the following events:

- Baseline survey;

- Mid-term evaluation;
- Terminal evaluation;
- Annual planning and review meeting/workshop;
- Annual statutory audit;
- Concurrent monitoring;
- Progress Monitoring/ monthly review meetings;
- Activity Monitoring; and
- Thematic studies and documentation

5.7.1 Baseline Survey

To grasp the starting point of TBGCP in terms of physical and economic conditions, and the status of the target area, a baseline survey will be conducted. The types of data to be collected and the method for collection to be used need to be decided in tune with the operation and effect indicators of TBGCP (which will be decided later in the Study). The baseline survey should be designed and conducted in such a manner that the data captured in it can be used for future assessment of TBGCP.

The baseline survey needs to be conducted by a third party agency in the project area before the project intervention during the preparatory phase to access the information on actual socio-economic condition of the beneficiaries, physical and environmental condition of target sites in comparison to nearby control sites. The parameters of baseline study to be fixed in accordance with the project evaluation indicators. The information shall be collected in a random sampling method. The outcome of the baseline study will be used for comparison in future assessment like mid-term evaluation and terminal evaluation to measure the performance of project interventions.

5.7.2 Mid-term Evaluation

In some projects, mid-term evaluation is conducted to monitor progress up to that point. A mid-term evaluation will identify issues and constraints faced by TBGCP and chart a way forward for the remaining duration of TBGCP. In TBGCP, conducting a mid-term evaluation is highly recommended. The evaluation should be conducted by a third party around the fourth year of TBGCP.

A mid-term evaluation needs to be conducted towards the mid of project tenure by the qualified third-party agency to monitor the performance of project activities, performance of proposed pilot studies, physical and financial progress, achievements, issues and constraints in implementation and scope for improvement. The mid-term evaluation shall be conducted in target sites and control sites in project area and compare the outcomes with baseline outcomes and measure the performance. The effect of change in policy and approach also needs to be considered for recommendation of suggestions in a view of project objectives and outcomes. The parameters of the mid-term evaluation will be fixed in accordance with the project evaluation indicators.

5.7.3 Terminal Evaluation

Towards the end or at the end of TBGCP, a terminal evaluation may also be conducted. An evaluation study at the end of TBGCP can take stock of project outputs and achievements in quantitative and qualitative terms. It can also obtain lessons learnt from the experience of TBGCP implementation and document them. Data collected and organized through the terminal evaluation can help prepare the project completion report, which is a requirement for Japanese ODA Loan projects. The same information can also be referred to when ex-post evaluation is conducted by JICA two to three years after project completion.

A terminal evaluation also needs to be conducted in phase-out stage towards end of project tenure to measure the targets and achievements proposed in project. The parameters of terminal evaluation

shall be fixed in accordance with the project evaluation indicators. The evaluation shall conduct in target and control sites and also include all stakeholders in project implementation. The evaluation shall compare the baseline study and mid-term evaluation outcomes with terminal evaluation outputs. The terminal evaluation shall measure the performance of project interventions and accomplishments, yearly physical and financial progress, achievements, lesson learnt, new initiatives, best practices, success stories with case studies, and technical convergences and partnerships.

5.7.4 Annual Planning and Review Meeting/Workshop

(1)   Annual Planning

To plan for the operation in the year ahead, with due consideration to the previous year's performance, annual planning and review meetings will be convened each year. The meetings should be held at the PMU level, but a requirement for the same at the local level will be also considered based on the geographical spread of TBGCP target areas. Progress and specific achievements for the year will be reviewed in the meeting, whilst any issues and challenges may be identified. Based on the progress review, the implementation plan for the following year will be worked out. However, during the first two to three years of TBGCP, emphasis should be given on laying the foundation of TBGCP — for example, motivating the people involved and establishing relationships between project personnel and the people involved, rather than simply meeting physical and financial targets. Therefore, the targets for the initial years of TBGCP should not be ambitious.

The regular review meetings are the integral part of the monitoring process to review effectiveness of implementation strategies for successful implementation activities and to achieve the target on time. The annual planning is the plan of operations for the year ahead in consideration of physical and financial targets. After the 1st year of implementation, the achievements also need to be reviewed and uncompleted targets need to be reconsidered. The annual plans need to be prepared in participation with different field level offices and compiled at DMU and PMU level. The physical targets of the approved micro-plans also need to be considered to prepare annual physical targets.

(2)   Review Meetings

Annual review meeting/workshop needs to be convened at PMU level to discuss the past year performance, targets for current year, implementation plan, and challenges. The project official and implementers from different levels may be requested to attend the review meeting for common understating. The decisions taken in the meeting also need to be published for information of all stakeholders.

(3)   Workshops

Workshops need to be conducted for sharing knowledge on best practices, new initiatives, model activities and showcasing unique interventions. The domain experts may be invited to share the expertise ideas and experience to motivate all stakeholders, beneficiaries, and target groups.

5.7.5 Annual Statutory Audit

Transparency, particularly related to the utilisation of project funds, is important. Implementation bodies at all levels in the proposed TBGCP must have an annual statutory financial audit conducted each year. The project shall also conduct internal audit of all levels through a chartered accounting firm. A qualified chartered accounting firm should be identified and appointed for this purpose.

5.7.6 Concurrent Monitoring

Regular monitoring of project progress is necessary to ensure that implementation is on right track.

Output-related parameters for monitoring should be established that are related to physical and financial progress. The following table shows an indicative interval of concurrent monitoring at different levels of project implementation.

Table 10.53: Tentative Intervals of Concurrent Monitoring at Different Levels

Implementing Body	Frequency
High Level Empowered Committee	Annually
Governing Body	Half yearly
Executive Body	Quarterly
General Body	Annually
PMU	Monthly
DMU	Monthly
FMU	Monthly
District level Coordination Committee	Quarterly
Procurement Committees	To be determined
Codal provisions	To be determined
Others (if applicable)	To be determined

(1)   High Power Committee

The HLEC is the highest decision-making body with in state government for the Project. It will meet at least once a year. The HLEC will approve the operation manual of PMU, the annual plan of action and budget for the implementation of the Project.

(2)   Governing Body

The Governing Body is the highest decision-making body within PMU that provides necessary administrative and policy directions to the Executive Body, DMU, and FMU for smooth implementation of the Project activities. The Governing Body will examine the annual plan of operation (APO) and budget prepared by the Executive Body. The Governing Body will meet once every six months. It will review the functions of the society regularly and prepare proposals for the HLEC, as necessary, for the smooth implementation of the Project.

(3)   Executive Body

The Executive Body 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 the Governing Body to report to HLEC.

(4)   General Body

The General Body of the society will consist of members of the Governing Body, Executive Body, Conservators of Forests, and DMU officers from all the divisions included in the Project. The General Body will meet once a year during the annual review meeting of the Project.

5.7.7 Review Meeting/Process Monitoring

(1)   Development of Standard Formats, General Instructions, and Guidelines

The development of standard formats, general instruction for use the formats and guidelines to collect and maintain information in the standard formats are the key requirements for qualitative quick assessment of progress on each activity. For PMU, DMU, and FMU-level review meetings, standard formats, general instructions to use the formats, source of information, role and responsibility

including data submission timeline and guideline for regular maintenance of information in the formats need to be developed and adopted to measure the progress of all components and activities. The support of PMC may be taken to device reporting formats in accordance of project activities.

(2)   PMU Level Meeting

The PMU level review meetings are held on every month for close monitoring of project implementation and progress of all activities. The review meeting is held to discuss the physical and financial progress, targets and achievements, and challenges. The project officials at PMU and DMUs need to attend the review meeting for common understating. The decisions taken in the meeting also need to be published for information of participants.

(3)   DMU Level Meeting

The DMU level review meetings are held on every month for close monitoring of project implementation and progress of activities in DMU. The review meeting is held to discuss the physical and financial progress, targets and achievements, and challenges. The critical issues need to be taken up with PMU for their decisions. The project officials at DMU and FMUs need to attend the review meeting for common understating. The decisions taken in the meeting also need to be published for information of participants.

(4)   FMU Level Meeting

The FMU level review meetings are held on every month for close monitoring of project implementation and progress of activities in FMU. The review meeting is held to discuss the physical and financial progress, targets and achievements, challenges and support required to the community. The critical issues need to be taken up with DMU for their decisions. The officials at FMU and executive members from the target community groups need to attend the review meeting for common understating. The decisions taken in the meeting also need to be published for information of participants.

(5)   District Level Coordination Committee

The district level coordination committees need to be formed at each district for close coordination and linkage with line departments for synergy in holistic development of community and environment, along with technical convergence and fund convergence. A regular meeting of district level coordination committees needs to be held under the chairmanship of district commissioner. The district level officers of concerned line department also may be invited to attend the meeting.

(6)   MIS based monitoring

The data available on MIS need to be used for progress monitoring. This will ensure the participation of all stakeholders involved in activity implementation and utilisation of MIS for informed decision making. The data need to be uploaded in application within schedule time for better discussion, decisions, and direction. The live reports may be downloaded from MIS application before meetings.

5.7.8 Activity Monitoring

(1)   Internal Monitoring (Codal Provisions)

The codal provisions or physical monitoring by the implementing officer are the inbuilt monitoring mechanism includes in role and responsibilities of the department officials specially for implementing officers. At field level the Beat Guards will do the patrolling every day in his jurisdiction (forest beat) and repot the finding to range office every day. The Foresters at section level will implementing the activity following standard procedures and monitor the activity on daily basis. At range level, the range officer will take care of protection, implementation and monitoring of all activities. The range

officers and foresters are fully responsible of the plantations, nurseries and other activities. The implementing officer have to monitor the 100% of activity, while the controlling officers like DFO and ACF also has responsibility of 100% monitoring of all activities in their jurisdiction through field inspection. They also responsible for suggesting time bound precautions and mitigations.

(2) External Monitoring

Within the TNFD institutional setup, officers for adjacent offices including circle level, DMU level, FMU level, and section level will inspect the physical achievements and assess the quality of activity. A monitoring calendar and dashboard may be prepared at PMU level for progress review. The DMU shall prepare a duty chart indicating the target area, activity and responsibility for activity monitoring.

For uniformity in qualitative assessment, the PMU with help of PMC also may develop standard monitoring guidelines for physical monitoring and qualitative assessment with standard monitoring/assessment forms and instructions to measure each physical asset, infrastructure and activity in accordance with schedule of specifications and standard procedures. These formats need to be circulated to all officers involved in implementation and monitoring of project activities. The implementing offices need to submit the activity completion report along with monitoring or qualitative assessment formats. The inspecting offices also need to submit monitoring format indicating quality and usage. A five-point scale also may be incorporated in monitoring or assessment formats for standard measurements and uniform assessments.

(3) Scientific Spatial Monitoring

In addition to above physical monitoring, the TNFD and PMU also need to use GIS and Remote Sensing technique for scientific spatial monitoring. The facility at Geomatics Centre need to be utilised for 100 % monitoring field activities such as plantations, nurseries, community assets, and infrastructure. The location and tracks (as per requirement) need to be collected for each activity by the field staff and submitted to the Geomatics Center. The Geomatics Center needs to prepare pre-treatment and post treatment maps of the activities. The PMU needs to provide all the details of field activities and coordinate between field and the Geomatics Center for scientific spatial monitoring. The consolidated reports consisting detailed monitoring findings may be prepared for future reference.

5.7.9 Thematic Studies and Documentations

In the course of project implementation, requirements may arise for short-term studies for specific topics. Such necessities can be associated with specific project components in exploring alternative options for implementation. TBGCP should keep some provisions for conducting such studies internally or by external resources.

Moreover, the outcome and impact of TBGCP are important indicators in assessing its success. However, other aspects of TBGCP will prove to be valuable for other projects of a similar nature, but are not necessarily captured in terms of outcome and impacts. More specifically, the processes by which TBGCP was implemented and how certain challenges and issues were overcome can be of great value for learning. Such information is often not tangible and remains the tacit knowledge of project stakeholders. Good practices and tacit knowledge that are worth sharing with others should be formalized and documented from time to time.

(1) Studies for Specific Topics

Several activities proposed in TBGCP will have visible impacts. The scientific assessment of the impacts requires specific studies to record these impacts for other persons for lessons as well as to show the success of the project. As it is a unique project of its kind designed to address the issues of biodiversity, natural resources base improvement, and human wildlife conflict, it is required to conduct regular monitoring and specific studies. The details of the specific studies will be discussed

later.

(2) Documentation of Best Practices and Lessons Learnt

In course of project implementation, the implementing agency may encounter with various issues. To address or overcome these issues, the implementing agency may adopt several innovative/unique strategies. At some local levels, some good indicatives by community or implementing officer through different methods or different approaches will multiply the outcomes. These strategies, initiatives, best practices, and lessons learnt need to be recorded for future reference and learning.

5.7.10 Regular Publication

(1) Annual Report

TBGCP shall publish annual reports every year containing activity calendars, physical and financial progress, targets and achievements, initiatives, and overall performance in the preceding year and next year's APO to all the stakeholders for information and reference.

(2) News Letter

The PMU needs to publish news letters on quarterly basis including activities and physical progress within the quarter as a standard publication tool for information for others.

5.7.11 Procurement Committee Meeting

In course of project implementation, the project may need several equipment and services to be purchased. These procurements may process through the tendering process or other standard procurement processes. The procurement committee will ensure the transparency in procurement and adopt approved procurement processes as per the procurement manual. Three types of committees are proposed to be formed under project such as Lower Purchase Committee (LPC), Higher Purchase Committee (HPC), and Departmental Purchase Committee (DPC). The delegation of powers may be decided later considering the state rules.

5.8 Project Management Unit (PMU)

5.8.1 Staff Cost

(1) Office Staff

The staff cost consists of the salaries of TNFD personnel deputed to PMU, circle offices, DMUs, FMUs, and forest extension centres.

(2) Contractual Staff

The staff cost consists of the salaries or remuneration of all types of contractual personnel hired by the project and deputed to PMU, circle offices, DMUs, FMUs, and forest extension centres.

5.9 PMU Operation Cost

5.9.1 Improvement of MIS Capability in TNFD

The Management Information System (MIS) is going to play a key role in information driven decision making in TNFD. At present, the TNFD uses five modules for real time data collection such as i) Stores and Infrastructure Management System, ii) Plantation Management System, iii) Natural Forest Management System, iv) Forest Working Plan Management System, and v) Forest Vigilance

Information system. It facilitates the automated flow of standardised information between the users in the organisation and enhances productivity, accountability, and transparency.

As per the recent developments in state administration, MIS applications for government to government (G2G) along with other government to citizen (G2C) and government to business (G2B) applications are developed by TNeGA (Tamil Nadu e-Governance Agency). hosted at State Data Centre (SDC) under the Department of IT, and supported by the state government. The TNeGA has conducted a survey and submitted a proposal to develop 14 G2Cs, 9 G2Bs, and 14 G2Gs software applications/modules in compliance with forest and wildlife rules and practices followed at TNFD. However, the TNFD has already started the development of 12 G2Cs and 2 G2Bs software application/modules in coordination with TNeGA. The list of applications is shown in the following table. The maintenance of the applications will be also taken care by concerned offices.

Table 10.54: List of MIS Applications

Sl.	Name of Module	Package	Reference/Description
Certificates/Licenses/Permissions			
1	Certificate of ownership for Wildlife	G2C	Wildlife (protection) Act, 1972 & Tamil Nadu (TN) captive elephants (Maintenance & Management) rule, 2011.
	Certificate of ownership for captive elephants	G2C	
2	Application for transportation of Wildlife	G2C	Wildlife (transit) Tamil Nadu rules, 1991
	Permission on transportation wildlife	G2C	
3	Application for transportation of Elephants	G2C	Wildlife (protection) Act, 1972 & TN captive elephants (Maintenance & Management) rule, 2011.
	Permission on transportation of Elephants	G2C	
4	Grant of permission for hunting of wildlife for special purpose (Education, Scientific Research, Translocation, population management)	G2C	Wildlife (protection) Act, 1972
5	Registaration of certain persons in possession of arms	G2C	Wildlife (protection) Act, 1972
6	Declaration of wildlife articles / animals	G2C	Wildlife (protection) Act, 1972
7	Regulation of transfer of animals or animal articles, etc.	G2C	Wildlife (protection) Act, 1972
8	Application for selling of Sandal wood	G2C	TN sandalwood trees patta land rule, 2008
Registers and Records			
9	Register for Tamil Nadu departmental Camp Elephants	G2C	Wildlife (protection) Act, 1972 & TN captive elephants (Maintenance & Management) rule, 2011.
10	Register for Tamil Nadu departmental private and temple captive elephants	G2C	Wildlife (protection) Act, 1972 & TN captive elephants (Maintenance & Management) rule, 2011.
11	Resister for transit permit of captive elephants	G2C	Wildlife (protection) Act, 1972 & TN captive elephants (Maintenance & Management) rule, 2011.
Others			
12	Sale of forest produce including NTFP	G2C	
	Sale of Form-V items	G2C	
	Sale of seized vehicles	G2C	
	Sale of Timber/ Scheduled Timber	G2C	
	Sale of Seeds, Seedling, Bio-Fertilizers (Nursery details and Stock)	G2C	
13	Accommodation Booking	G2C	G.O.Ms.No.87, Environment and Forests (E&F) (Fundamental Rules (FR)-5) dated 28.06.2018
14	Compensation (Damages caused by wildlife)	G2C	G.O.Ms.No.141, E&F (FR-5) dated 25.11.2016

	Government to Business Services		
1	Trekking Application	G2B	TN forest & wildlife areas (regulation of trekking) rules, 2018
	Trekking Permission	G2B	
2	Application for obtaining licence as manufacturer, taxidermist, dealer, etc.	G2B	Wildlife (protection) TN rules, 1975
	Licence for dealing in and manufacture of animal articles/ trophies/ uncured trophies	G2B	
	Licence for taxidermy	G2B	
	Application for renewal of licence	G2B	
3	Register to be maintained by dealers in animal article/ trophy /uncured trophy	G2B	Wildlife (protection) TN rules, 1975
	Register to be maintained by Taxidermist / Manufacturer of animal aricles	G2B	
4	Application to purchase specified animal, etc.	G2B	The wildlife (transaction and taxidermy) rules 1973
	Permission to purchase specified animal, etc.	G2B	
	Application to transport specified animal, etc.	G2B	
	Permission to transport specified animal, etc.	G2B	
5	Application for license	G2B	TN sandalwood possession rules 1970
	Licence	G2B	
6	Application to establish wood-based industry / renewal	G2B	TN regulation of wood-based industries rules, 2010
	Licence to establish / renew wood-based industry	G2B	
	Delivery challan	G2B	
7	Record of receipt of wood and timber (records and register)	G2B	TN regulation of wood-based industries rules, 2010
8	Application for felling	G2B	The TN hill area (preservation of trees) rules 1957
	Application for cultivation	G2B	
	Inspecting authority (IA) report for felling	G2B	
	IA report for cultivation	G2B	
9	Grant of permission for the photography/ film shooting	G2B	Wildlife (protection) act, 1972
	Grant of permission for the scientific research	G2B	
	Grant of permission for the tourism	G2B	
	Government to Government Services		
A.	**Department Interface**	G2G	
1	Project management	G2G	Monthly physical and financial progress including scheme wise compilation, compilation of data at division/ circle/ HQ level, automatic posting of work register, planting, nursery details and stock, posting of cash register, completion report generation, linking of m-Book recording and check measurement, construction and maintenance of buildings, roads, Check Dams (CDs), PPs, wells and tanks, data regarding location, geo-tagged photograph to be captured from the site with mobile app, App for wildlife census,/ transect lines, death of human caused by wild animals / staff action, EPT / solar fence, wildlife death and post mortem, etc., working plans and management plans
	a. State schemes	G2G	
	b. Central sector schemes	G2G	
	c. Schemes shared between state and centre	G2G	
	d. Externally Aided Projects	G2G	
	e. Others	G2G	
2	Audit / LAQs / Call Attention Motion / Cut Motions	G2G	Accountant General (AG) audit, Comptroller & Auditor General (CAG), Public Accounts Committee (PAC), Internal Audit Party (IAP) audit paras, estimate committee paras, assurance

			committee, LAQs, Call Attention Motion, Cut Motions, etc.
3	Court Case Monitoring	G2G	Services/ Non service matters, supreme courts, high courts, National Green Tribunal (NGT), Other lower courts, etc.
4	Forest Offences	G2G	Illicit felling (sandal wood /other scheduled timbers (ST), other than sandalwood and ST), wildlife offence cases, other offences (encroachment, ganja, illicit arrack, mining, Tamil Nadu Forest Act, 1882, Tamil Nadu Hill Areas (Preservation of Trees) Act, Tamil Nadu Preservation of Private Forests Act, any other
5	Forest Settlement	G2G	
6	Forest consolidation and protection	G2G	Applications to capture geo-coordinates for location of all the cairns and boundary pillars, fire lines, watch towers, etc.
7	Inventory of assets and infrastructure	G2G	Vehicles, arms and ammunitions, articles, roads, buildings, CDs, PPs, wells and tanks
8	Human Resource Development & Capacity building	G2G	Posting / working location, trainings undergone including online Performance Appraisal Report (PAR)/Annual Confidential Report (ACR) of State Forest Service (SFS)/General Service (GS) officers, diary monitoring system, demi-official letter monitoring system, disciplinary cases monitoring system
9	Staff welfare	G2G	Grievances redress, retirement -cum-pension, etc.
10	Timber Depots	G2G	Receipts / disposal of timber and other produce in forest depots, drayage statement, etc.
11	Joint Forest Management (JFM)	G2G	TAP village forest councils (TAP VFCs), revolving fund
B.	**Daily (Flash) reports**	G2G	
12	Opening of fire arms, death of wildlife animals, forest offences	G2G	Illicit felling / poaching/ ganja cultivation/etc., sandalwood / scheduled timber offences > 5 lakhs value, forest fire, human wildlife conflict, rescue and release of wild animals, encroachments
C.	**Miscellaneous**		
13	Tracking urgent /important issues (between government / head office)	G2G	
14	Control manage and maintenance of sanctuaries.	G2G	Permission for constructing roads, bridges, buildings, offences or barrier gates

In view of above situation, the project may focus only on large-scale capacity development officers and institution support like providing IT equipment at all offices.

5.9.2 Operation and Maintenance

The operation and maintenance cost consists of 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.

10.6. Institutional Arrangement

In order to achieve the project objective in a time bound manner, an institutional structure that allows for independent and quick decision-making is essential. Considering the efficiencies of other Japanese ODA Loan forestry projects that have been implemented in a society mode and the experience from earlier project in the state (TAP 1, TAP 2, and TBGP), TBGCP will also be implemented in a society mode. Since the Tamil Nadu Biodiversity Conservation and Greening Society (TNGS) has already been registered under the Tamil Nadu Societies Registration Act 1975, and a certain structure is available, TBGCP will make use of TNGS with some modifications to suit the design of TBGCP.

10.6.1. Restructuring of Existing Society for TNGS

To suit the objective and design of the TBGCP, amendments may be made in the Memorandum of Association of TNGS, and the aims and objectives of the society should also may be changed in line with the project objective. If there need be, the rules and regulations of the society may also be amended accordingly. PMU shall take an initiative to make these necessary changes in line with the requirement of the Society Registration Act 1975 and confirm necessary procedures with the Registrar's Office.

10.6.2. Institutional Arrangement for TBGCP

Management bodies established for the TBGCP may be reconstituted with some addition and modification of bodies to suit the need of the TBGCP and in line with institutional arrangement found in the TBGP and also similar projects in other States. The proposed institutional arrangement is shown below, and role and composition of various bodies and management unit are explained.

(1) High Power Steering Committee

High Power Steering Committee (HPSC) is a body that takes policy decisions and coordinates with other line departments for the project. HPSC would be the highest decision making body for the project at the state level. In TBGP, there was High Level Empowered Committee (HLEC) as the Governing Body, which is the top management body for the society and was headed by the Chief Secretary. The name of HLEC will be changed to HPSC in TBGCP. Although HPSC is a setup for the project, it will exist outside the management of the society, and as it will be headed by the Chief Secretary, the matters beyond the control of the project can be coordinated at this level. The other members of HPSC consists of secretaries in charge of line departments. The formation of HPSC will be proposed by the project and put forth to the Government of Tamil Nadu for its approval. Appropriate notification could be issued by the state government to effect the HPSC.

The suggested composition of HPSC is shown below (Table 10.55). In this composition, the need to coordinate other line departments for better convergence is well considered.

Table 10.55: Composition of HPSC

Sl. No	Title	Rank of Officers and Department
1	Chairperson	Chief Secretary To Govt. Of Tamil Nadu
2	Member	Principal Secretary to Govt. Environment &Forest Department
3	Member	Principal Secretary to Govt. Finance Department
4	Member	Principal Secretary to Govt. Planning and Development Dept.
5	Member	Principal Secretary to Govt. Revenue Department
6	Member	Principal Secretary to Govt. Rural Development Department (P&RD)
7	Member	Principal Secretary, Industries and Commerce Department

8	Member	Principal Secretary to Govt. Tribal Welfare Department
9	Member	Principal Chief Conservator of Forest (HOFF)
10	Member	Principal Chief Conservator of Forest and Chief Wildlife warden
11	Member Secretary	Chief Project Director TBGCP

HPSC will meet at least once in six months; however, if the situation required, the meeting should be convened more frequently. In case the members are not available on the day of the HPSC meeting, they may nominate their representatives to the meetings, but not less than a senior rank officer in their department.

A minimum of six members would form the quorum for the HPSC meeting. Agenda of the meeting and proposals should be circulated by the Member Secretary well in advance to all members, at least seven days ahead of the meeting date. The proceedings of the HPSC meetings should be circulated to all the members/attendees within reasonable timeframe.

PMU will prepare the Operation Manual for the project, and it will be approved by HPSC. APO and budget will be approved in HPSC meeting at the beginning or prior to start of a financial year. Progress of the project will also be reviewed on regular basis.

The roles and responsibilities of the HPSC will be as follows:

- To approve the Operational Manual (OM) prepared by the PMU.
- To endorse APO and annual budget of the project which is approved by the Governing Body of the society.
- To advise/resolve issues and problems related to financial flow from Govt. of Tamil Nadu to project, and with other government departments that are detrimental to the success of project.
- To establish and facilitate convergence and coordination of project with other government departments.
- To suggest and endorse measures and actions to resolve issues raised by JICA, DEA, the Government of India or related to PMC or any other agencies related to the project.
- To take up policy related matters of the project.
- To discuss, suggest actions, resolve issues and conflicts, if any, related to project implementation that require involvement of other government departments.

As and when required, representatives of JICA, MOEFCC, DEA (Ministry of Finance), and PMC may be invited to the HPSC meeting as observers and/or special invitees to share their views and concerns related to the project.

(2) Governing Body

In accordance with the Societies Registration Act 1975, the Governing Body (GB) will be constituted. GB is the highest management body in the society entrusted with the overall affairs of the society. The power to govern by GB is confined within the project areas. GB will be headed by the PCCF (HoFF) since the Society will function as PMU of the project within TNFD. GB will comprise representative from other departments and therefore, will also be responsible for facilitating coordination amongst various departments of the Government and other agencies for achieving the objectives of the Society. Representative from other line departments can be of director level officers.

The suggested composition of the GB is shown in Table 10.56. The Governing Body, which is the highest decision-making body for the project comprised of several members who represented the same department. Keeping in mind that the TBGP has been implemented very successfully and

Governing Body made a crucial role in guiding the successful implementation of TBGP, The existing structure GB of TBGP will remain unchanged.

Table 10.56: Composition of GB

Sl. No	Title	Rank of Officers and Department
1	Chairperson	PCCF/HoFF, TNFD
2	Member	Chief Wildlife Warden, TNFD
3	Member	APCCF (Administration)
4	Member	APCCF Planning and Budgeting
5	Member	APCCF (Forest Conservation Act)
6	Member	APCCF (Working Plan)
7	Member	APCCF, Research
8	Member	APCCF, Social Forestry
9	Member Secretary	Chief Project Director TBGCP

GB will meet at least once in three months; however, if the situation required, the meeting should be convened more frequently, particularly in the preparatory phase of the project. A minimum of six members will form the quorum for the GB meeting. If a member of GB is not available on the day of the meeting, he/she may nominate representative to the meeting, but not less than a senior rank officers in the government. As and when required, PMC members and other third-party representatives such as renowned experts and researchers and civil society representatives may be invited to attend the Governing Body meeting as observer and/or special invitee to share their views and concerns related to the project. Agenda of the meeting and proposals should to be circulated by the Member Secretary at least seven days prior to the meeting date. Proceedings of the meetings should be circulated to all the members and attendees within reasonable timeframe.

The roles and responsibilities of the GB will be as follows:

- To assist PMU to develop the Operations Manual for the project
- To endorse APO and annual budget of the project which is approved by the Executive Body
- To monitor physical and financial progress of the project regularly
- To maintain link with the HPSC
- To empower PMU to disburse funds for project implementation
- To appoint an auditor of the Society
- To approve contractual posts, remuneration, and allowances etc., submitted by the Executive Committee

(3) Executive Body

In TBGP, the Executive Body was constituted as the top management body of PMU. In the new project, the Executive Body will be reconstituted to take up following roles and responsibilities:

- To develop Operational Manual for the project which describes and provides guidelines for preparation of micro-plan, annual plan, fund management, etc.

- To prepare APO in consultation with field level offices of PMU along with financial and physical targets as per the Minutes of Discussion (M/D) of the project and submit to Governing Body for approval (for further approval by GB and finally by HPSC).

- To closely monitor the physical and financial progress of the project by organizing regular meetings with field level offices and suggest next plan of actions.

- To prepare modifications and/or changes in components/subcomponents of the project (as described in M/D) with justification, when required, and submit to Governing Body for onward submission to JICA/DEA, the Government of India for concurrence and approval.

- To enter into agreement for and on behalf of the Society.

- To prepare the Annual report and accounts of the society for presentation together with the Audit report thereon ant the Annual General Body Meeting (AGM) of the society.

Executive Body will be a management body made up by the project related personnel to oversee the day to day implementation of the project. PMU will be headed by Chief Project Director of TBGCP as Chairman of the Committee. Other key personnel who are in managerial positions in PMU will be the members of the Committee.

Composition of the EB is shown in Table 10.57.

Table 10.57: Composition of Executive Body

Sl. No.	Title	Position in PMU
1	Chairman	Chief Project Director
2	Member	Project Director (Admin and Finance)
3	Member	Project Director (Biodiversity)
4	Member	Project Director (TCPL)
5	Member Secretary	Additional Project Director (M&E)
6	Member	Finance Controller

The EB will meet at least quarterly (every three months) starting in April each year to monitor the progress of the project, including the disbursement status. The EB will also review the functioning of PMU and if required, provide suggestions/guidance and prepare proposal to be put up for the consideration in GB. A minimum of five members will form the quorum for the EB meeting.

(4)   General Body

Membership of the Society shall be defined in the Memorandum of Association. In addition to the members comprising the Governing Body and Executive Body, inclusion of key officers of PMU and DMU Chiefs (DFO) of project target District apart from selected field personnel may be considered. In other words, General Body will consist of all members of the Society.

In accordance with the Society Registration Act 1975, AGM must be held each year. To minimize the responsibility of convening the number of different management meetings related to Society, AGM can be held together with the Executive Body meeting at the beginning of the financial year.

Power and duties of General body will be as follows:

- The General Body shall have all such powers and shall perform all such functions as are necessary or proper for the achievement of objectives of Society.
- The General Body shall pursue and carry out the objectives of the society as set forth in the Memorandum of its association.
- The General Body shall make regulations for the management of the affairs of the Society as and when required.
- The General Body shall appoint committees/commission to enquire into and report on the affairs of the Society and pass such orders thereon, as it consider proper.

(5)   Coordination between the TNFD and PMU

Although the purpose of having the project implemented in the society mode is to allow greater autonomy, it is also indispensable to have a proper mechanism for information sharing between the TNFD and PMU so as to ensure coordination between the two institutions. In this regard, PCCF, the head of TNFD, acts as chairperson of the Governing Body of the society. GB is a place where the head of the TNFD can be briefed on the progress and issues of the project. Similarly, because the TNFD holds regular departmental meeting, if need be, representatives from PMU can be called for the departmental meetings as well.

(6)   Field Level Management Unit

In Tamil Nadu, forest administration is divided into the circles, districts, ranges, sections, and beats in this order. TNFD's field level administrative units consist of district forest offices (DFOs), which are corresponding to revenue districts, range offices and beat offices. TBGP aligned the project's field level management units to that of TNFD. In TBGCP, the same pattern of implementation structure is suggested. Involvement of DFO as District Level Project Management Unit (DMU) for the project, and Range Office as Range Level Project Management Unit (RMU) with supplemental human resource has worked out well in TBGP. Details of manpower requirement for field level management units are explained in subsequent section.

(7)   Other Departments/Agencies Involved in the Project

TBGCP has been designed to cover the entire forest divisions under TNFD with a multi-faced approach to integrate the other agencies in the state and the division level. For successful implementation of the project, different state level agency will be integrated at different level for advice and implementation and fund. At the state PMU level, State Biodiversity Board, Chief Wildlife Warden and Tamil Nadu Forest Academy, Wetland Board will be roped in for their valuable advice to the project. At the DMU level, district JFM committees will act as a hub for supporting various project interventions and assist in an inter-sectoral linkage. Resource Organisations, for example, organisations or individual consultants, will be associated mainly to provide technical assistance for implementation.

10.6.3. PMU Structure and Manpower

A structure of PMU with broad functions of each Division is indicated in the following figure (Figure 10.14).
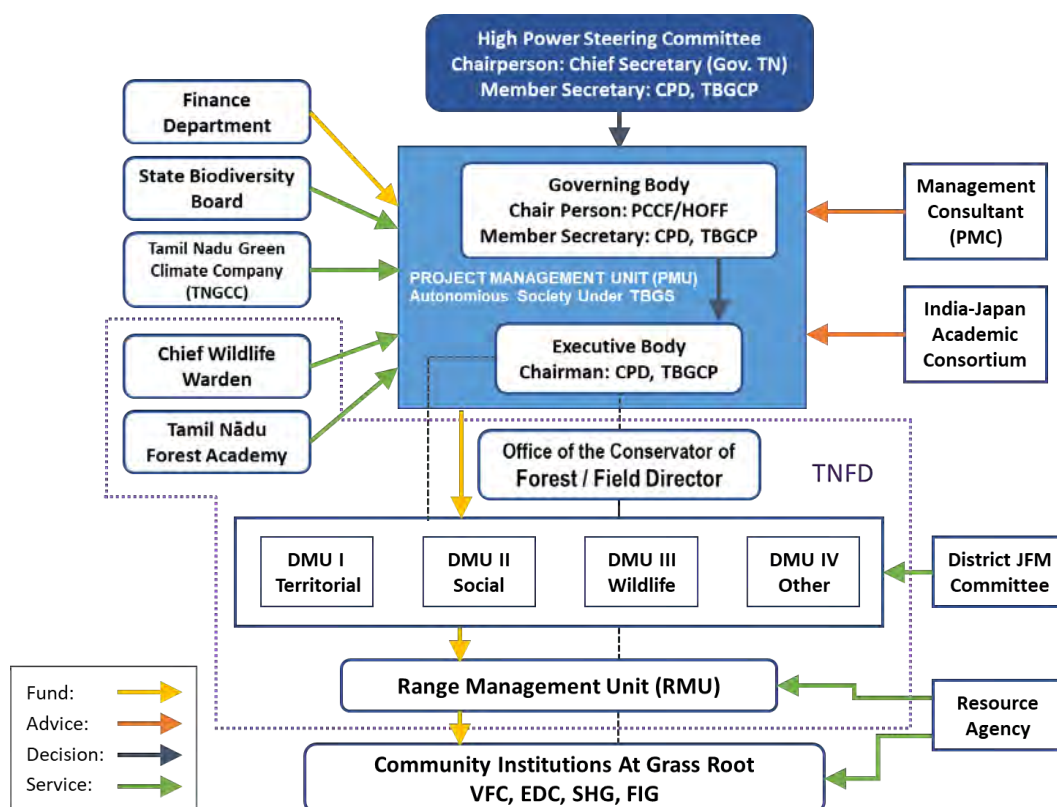
Figure 10.14: Structure of PMU with Broad Functions of Each Division

Expected function of key positions in the project is explained under this section. List of PMU executives required is given below along with Non-executive and contractual staff details (Table 10.58). Indicative rank and Source to fill the position are also indicated. The following key position are expected to be one each and to be engaged full-time in the project. The officials from TNFD who would be posted to TBGCP on deputation basis should be maximum of around five officers considering the availability of manpower in TNFD.

Table 10.58: List of PMU Staff and their Number

No.	Position	Rank	Number	Source
Key Executive Officers (Permanent)				
1	Chief Project Director (PD)	PCCF	1	TNFD
2	Project Director (Admin and Finance)	CCF	1	TNFD
3	Project Director (Bio Diversity)	CCF	1	TNFD
4	Project Director (TCPL)	CCF	1	TNFD
5	Additional Project Director (M&E)	CF	1	TNFD
	Sub Total		5	
Non-Key Support Staff				
1	Financial Controller (CAO)	Deputy Secretary	1	TNFD
2	Assistant Conservator of Forest	ACF	2	TNFD
3	Assistant Director of Statistics		1	TNFD
4	Statistical Officer		2	TNFD
5	Statistical Inspector		4	TNFD
6	Range Officer	RO	3	TNFD
7	Forester	Forester	6	TNFD
8	Computer programmer		1	TNFD
9	Superintendent		2	TNFD
10	Assistant		2	TNFD
11	Steno		5	TNFD

12	Driver		7	TNFD
13	OA		12	TNFD
	Subtotal		48	
List of Contractual Staff				
18	Technical Assistant		06	Open Market
19	Data Entry Operator		06	Open Market
	Subtotal		12	
	Total PMU		65	

(1)   Responsibilities of PMU Officials

The PMU is headed by the Chief Project Director who hold a rank of PCCF and is being assisted by three Project Directors and one Additional Project Director. The detailed roles and responsibilities of the key executive officers are summarized below (Table 10.59).

Table 10.59: Detailed Roles and Responsibilities of the Key Executive Officers

Sl. No	Position	Main Roles and Responsibilities
1	Chief Project Director	• Visualize, plan, implement, manage, and monitor all the activities proposed under the project • Manage and monitor the budget and expenditure • Issue technical, administrative, and financial guidelines, instructions and approval • Performance appraisal of Project Staff • Performance appraisal of PMC. • Manage all the recruitment of contractual staff • Plan and execute procurement as per requirement/proposed plan • Authority and perform as Drawing and disbursing as per need of project • Apprise HPSC and Governing Body on the progress of implementation of the project • Maintain communication and compliance with JICA • CPD shall exercise such powers including facilitating as may be necessary for the benefit of the project. • CPD will have absolute power to replace any key consultant of PMC with the approval of governing body and as per the criteria set out by JICA for replacement of consultant for the benefit of project implementation.
2	Project Director (Admin and Finance)	• PD admin and finance will cater to needs of the project in respect of selection, deployment, transfer, deputation, engagement of service provider in consultation and guidance from CPD. • Assist CPD to plan, implement, manage and monitor all the activities related to Administration and Finance proposed in TBGCP • Assist CPD to manage and monitor Budget , Expenditure as per proposed APO and guideline laid in OM • Assist CPD in appraisal of performance of project staffs • Assist CPD in monitor and manage infrastructure to be procured, build under the project • Manage recruitment of Contractual staffs as directed by CPD • Facilitate the process of preparation of Annual Plan in consultation with CPD • Update and Assist CPD in apprising Governing Body, HPSC as and when required • Monitor the preparation of Claim/reimbursement to JICA • Develop detail procurement plan for the project • Ensure all procurement is as per JICA procurement rules • Any other task as directed by CPD
3	Project Director (Bio Diversity)	• Assist CPD to Plan and monitor all the activities related to Biodiversity conservation component of the project which also includes component

		like Ecosystem Based climate change measures, Human Wildlife Conflict • Assist and Help CPD in guiding and planning of activities in DMU • Assist CPD in capacity development work • Assist CPD in design ,conduct, research activities under Biodiversity Conservation work components • Assist CPD to coordinate with Project Management Consultants (PMC) • Assist CPD in liaisoning with State Biodiversity board • Amy other work as guided by CPD
4	Project Director (TCPL)	• Assist CPD in plan and execute all the work component under TCPL • Assist CPD in planning of activities at DMU level • Assist CPD in design ,conduct, research activities under TCPL • Assist CPD in monitoring the work components under TCPL • Guide DMU in formation and strengthening of Farmer's Interest Group (FIG) • Any other work as guided by CPD
5	Additional Project Director (M&E)	• Assist CPD in developing framework of monitoring for TBGCP in consultation with PMC • Supervision of Monitoring system developed by the Project • Generate reports periodically and update all stakeholder • Detail monitoring of activities taken up in the project • Assist CPD to approve monitoring and evaluation plans for Annual Operation Plan of the DMU • Assist CPD in designing and implementing a robust MIS system in the project • Build capacity of DMU, and RMU in the project on MIS
6	Financial Controller	• Assist PD (A&F) in managing finances of the project • Assist PD (A&F) in judicious utilization of funds • Guide and monitor Internal auditing , annual auditing and CAG auditing • Prepare final Statement of Expenditure (SoE) for reimbursement claim • Maintain and link with finance department and E&F department for smooth transfer of funds to PMU • Any other work as directed by PD (A&F)

(2)   Divisional Management Unit (DMU)

DFO will act as head chief of DMU and be designated as DMU Chief for easy understanding. Under TBGCP, there will be four types of DMU to be formed (Table 10.60). DMU I: It will cover all the territorial forest divisions under the project. DMU II: It will cover all the all the wildlife divisions under TNFD, DMU III: It will cover all Social Forestry divisions. DMU IV: It will cover special institutions including training institutions. There will be 81number of DMUs to be covered under the project. DMU will work as implementation body and will act as devoted project management office for the PMU.

Table 10.60: List of DMU Staffs and their Number

No.	Position	Number	Source
1	DMU Chief	1 per DMU	TNFD
2	Technical Assistant	41 (In selected DMU)	Open Market
3	Data entry Operator	42 (In selected DMU)	Open Market
4	Junior Research Fellow (JRF)	5 (in selected DMU)	Open Market

Roles and Responsibilities of DMU are listed as follows:

- DMU will function as per the methods ,provisions and procedures of the Forest Department
- DMU will receive project funds directly from the PMU for implementation of the project
- DMU will in turn disburse the funds to field implementation agencies under the project like RMU, EDC
- DMU will supervise all activities of those project implementing units and assist the PMU in planning fund management ,work progress monitoring and documentation at the field level
- DMU will be responsible for manage and monitor the budget and expenditure of the division
- DMU will manage recruitment of personnel at the district level   in DMU and RMU level
- DMU will maintain communication with PMU
- Coordinate with District level JFM committee

(3)   Range Management Unit (RMU)

The Head of DMU will identify the ranges to be covered under the project and will send suitable proposal to PMU for inclusion of the same. The Range Forest Officer (RFO) will be the concurrent head of RMU and will be designated as RMU Chief. The RMU will work as implementation body of DMU and will act as devoted project implementation office. Roles and Responsibilities of RMU are shown below:

- RMU will function as per methods, provisions and procedure as followed in department
- RMU will receive project fund from DMU
- RMU will give hand holding and technical support to EDCs, VFCs, SHGs and FIGs
- RMU will be responsible for making site specific plan , estimates and execute the project work
- RMU will be responsible for implement , manage and monitor all the field level activity under TBGCP
- Maintain financial discipline and financial accountability as per existing government, norms and guidelines
- Update DMU on progress of each component
- Maintain all records and register, Journals, parenting to the work executed under TBGCP

10.6.4. Human Resource Requirement under the Project

The TBGCP will be implemented in all the forest divisions under TNFD. An institutional structure has been proposed for better and efficient implementation of the project. Apart from the personnel to be deputed from TNFD for the project, a number of contractual staffs will also be required to support the project. A total list of staffs to be procured from open market for the project is listed below (Table 10.61).

Table 10.61: List of Contractual Staffs and Number

Contractual Staffs				
Sl No	Category	PMU	DMU	Total
1	Technical Assistant	6	41	47
2	Data Entry Operator	6	42	48
3	Junior Research Fellow	0	5	5
	Total			**100**

10.6.5. Infrastructure Proposed under the Project

A number of buildings have been proposed to be built under the component of institutional strengthening of the project. This will help the TNFD to ensure better hold on implementation process and also bridge the infrastructure gap prevailing in the department. A list of proposed infrastructure to be developed under the project is listed below (Table 10.62).

Table 10.62: Details of Buildings to be Constructed under TBGCP

Details of Buildings to be Constructed under TBGCP						
Sl No	Detail	Plinth Area	Unit Cost/Sq. M (INR)	Cost of 1 Unit	Total Unit	Total Cost
1	Construction of Conservator for Forest Quarter	N/A	N/A	6,957,500	1	6,957,500.00
2	Construction of Range Officer Quarters	N/A	N/A	1,562,110	14	21,870,000.00
3	Construction of Forester Quarters	N/A	N/A	1,257,190	45	56,574,000.00
4	Construction of Forest Guard Quarter	N/A	N/A	987,360	8	7,899,000.00
5	Construction of Combined Forest Guard and Forest watcher quarter	N/A	N/A	1,974,720	39	77,014,000.00
6	Construction of Forest Guard cum Driver quarters	N/A	N/A	987,360	8	7,899,000.00
7	Construction of forest watcher quarters	N/A	N/A	987,360	7	6,912,000.00
	Total				**122**	**185125500.00**

10.6.6. Strengthening of Mobility

To strengthen mobility under the project the TBGP will purchase a number of vehicles under the project. The vehicles which were purchased under TBGP will also be used after necessary repair and to those vehicle which are beyond repair will be replaced with new one. A list of proposed vehicles has been attached below (Table 10.63).

Table 10.63: A List of Proposed Vehicles

Sl. No.	Type of Vehicle	Unit	Unit Cost (In Million INR)	Total Cost (In Million INR)
1	Mahindra Jeep- B6	180	1.150	207.000
2	Sedan Car - City VTM	20	1.250	25.000
	Total	**200**		**232.000**

10.6.7. Project Management Consultant (PMC)

Close to the Public

Close to the Public

> *Close to the Public*

10.7. Environmental and Social Considerations

10.7.1. Overview of the Present State of Tamil Nadu State

(1) Pollution Control

1) Ambient Air Quality

Tamil Nadu Pollution Control Board (TNPCB) is operating eight ambient air quality monitoring stations, 3 in industrial areas, 3 in commercial areas and 2 in residential areas, in Chennai under National Air Quality Monitoring Programme (NAMP) funded by Central Pollution Control Board (twice a week, 24 hour based).

The ambient air quality monitoring is also conducted under NAMP at the following areas, Thoothukudi, Coimbatore, Selam, Madurai, Trichy, Cuddalore and Mettur. The result of the NAMP monitoring in Chennai in 2020 and the National ambient air quality standards are shown in the tables below.

Table 10.64: NAMP Monthly Average for the Year 2020 in Chennai

	Anna Nagar (Residentia areal)				Thiyagaraya Nagar (Commercial area)				Nungambakkam (Commercial area)			
	RSPM/ PM10	SO2	NO2	PM2.5	RSPM/ PM10	SO2	NO2	PM2.5	RSPM/ PM10	SO2	NO2	PM2.5
	All the values are in µg/m3											
Jan-20	70	10	20	28	67	9	19	28	52	8	17	24
Feb-20	77	10	22	28	73	9	20	21	56	9	21	26
Mar-20	55	10	19	28	63	10	18	24	56	10	19	25
Apr-20	27	7	10	15	28	8	13	18	28	7	12	17
May-20	34	8	14	15	39	9	15	20	34	9	12	19
Jun-20	51	8	18	23	58	8	19	22	47	8	17	24
Jul-20	57	9	20	23	55	9	19	25	44	8	18	21
Aug-20	63	10	23	27	56	9	20	24	45	9	18	21
Sep-20	59	10	22	26	64	10	22	31	49	10	21	22
Oct-20	65	11	23	28	71	12	25	34	49	11	23	22
Nov-20	64	12	23	30	64	11	22	26	55	11	21	25
Sec-20	53	10	20	21	59	11	22	22	59	11	21	25
Annual Average	56	10	20	25	58	10	20	25	48	9	18	23
Standard	60	50	40	40	60	50	40	40	60	50	40	40

Source: NAMP Monthly Average for the Year 2020

Table 10.65: The National Ambient Air Quality Standards

Pollutant	Time weight average	Industrial Residential, Rural & other areas µg/m3	Ecologically sensitive areas µg/m3	Method of Measurement
SO2	Anural	50	20	– Improved West and Gaeke Method
	24 hour	80	80	– UV fluorescence
NO2	Anural	40	30	– Jacob & Hochheiser modified
	24 hour	80	80	(NaOH-NaAsO2) Method

RSPM/ PM10	Anural	60	60	− Gravimetric	
	24 hour	100	100	− TEOM	
				− Beta attenuation	
PM2.5	Anural	40	40	− Gravimetric	
	24 hour	60	60	− TEOM	
				− Beta attenuation	

Source: CPCB, National Ambient Air Standards Notification, November 2009

2) Ambient Noise Quality

The TNCPB in association with Central Pollution Control Board (CPCB) has established 10 Real Time Ambient Noise Monitoring Stations in Chennai City under National Ambient Noise Monitoring Network Programme.

Table 10.66: Chennai Corporation in Ambient Noise Level for the Year April 2018 to March 2019

Month \ Place	Apr Day	Apr Night	May Day	May Night	Jun Day	Jun Night	Jul Day	Jul Night	Aug Day	Aug Night	Sep Day	Sep Night
Eye Hosp (S)	66	53	66	53	65	56	55	50	56	49	51	46
T. Nagar (C)	75	73	73	71	75	72	74	73	73	72	71	70
Guindy (I)	76	75	76	75	78	73	75	71	75	70	75	73
Velachery (R)	81	65	81	76	63	60	59	53	58	50	58	50

Month \ Place	Oct Day	Oct Night	Nov Day	Nov Night	Dec Day	Dec Night	Jan Day	Jan Night	Feb Day	Feb Night	Mar Day	Mar Night
Eye Hosp (S)	52	46	55	50	59	50	57	56	59	50	57	49
T. Nagar (C)	71	69	72	70	72	69	71	70	72	69	72	70
Guindy (I)	75	71	75	72	75	72	75	70	75	73	76	74
Velachery (R)	56	51	80	73	58	51	64	56	66	60	66	61

Note:-
1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.

Table 10.67: Ambient Noise Standards

Area code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:-
1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.
* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Source: CPCB, the Noise Pollution (Regulation And Control) Rules, 2000

3) Water Quality

TNPCB is monitoring the inland water quality under two major programmes, Global Environmental Monitoring System (GEMS) from 1984 and Monitoring of Indian National Aquatic Resources (MINARS) from 1988 at 32 stations along the four major rivers such as Cauvery, Tamiraparani, Palar and Vaigai and the following three lakes, Ooty, Kodaikanal and Yercaurd. Subsequently, TNPCB started monitoring at 23 additional water quality monitoring stations in 2010 with the fund from CPCB. At present, 55 stations in total are being monitored by TNPCB.

The Cauvery River drain more than one third of the State. This river has been identified as a major river for studying the impact of pollution caused by various activities of the domestic and industrial sectors. The quality of Cauvery river water is being monitored at 33 stations along the river under GEMS (4 stations) and MINARS (29 stations). These stations were selected on the basis of the location of outfalls of industrial effluents, municipal domestic sewage and other outfalls. The water quality of the Palar River is being monitored every month with one monitoring station at Vaniyambadi municipal head works.

The results of the monitoring at the four stations along the Cauvery River and 1 station of the Lalar River, which are located downstream of the ecotourism project sites both at Western and Eastern Ghats, are shown in Table 10.68. The locations of monitoring stations are shown in Figure 10.15. The water quality standard for surface water is also shown in Table 10.69.

Table 10.68: Water Quality of Cauvery River and Palar River (2019 – 2020)

Name of station	D.O mg/L	pH	Conductivity m mhos/cm	BOD at 27 C mg/L	Nitrate mg/L	Nitrite mg/L	Fecal coliform MPN/100 ml	Total coliform MPN/100 ml	Turbidity NTU	Phenophthaline Alkalinity mg/L	Total Alkalinity mg/L	Chloride mg/L	COD mg/L	Total Kjeldahl Nitrogen mg/L	Ammonia-N.as N mg/L	Hardness as CaCO3 mg/L	Calcium as Ca++ mg/L	Magnesium as Mg++ mg/L	Sulphate mg/L	Sodium mg/L	Total Dissolved Solids mg/L	Total Fixed Solids mg/L	Total Suspended Solids mg/L	Phosphate mg/L	Boron mg/L	Potassium mg/L	Fluoride mg/L	DBU Class
CAUVERY RIVER WATER QUALITY																												
Under GEMS Programme																												
1. Mettur	5.80	7.60	353	2.0	0.31	0.260	38	118	14.1	10.0	133	35	16	2.0	0.9	126	46	38	16	24.9	247	230	17	0.15	<0.002	3.04	0.48	B
2. Pallipalayam	6.09	7.61	465	2.7	0.15	0.090	291	691	16.5	13.8	146	59	25	3.4	1.5	134	53	44	14	43.0	333	284	24	0.30	<0.002	4.30	0.49	B
3. Musiri Borewell	6.70	8.03	406	<2	0.0	0.006	<1.8	2	13.0	12.0	152	42	16	2.2	1.1	148	72	76	6	32.0	280	264	20	0.1	<0.002	5.2	1.26	A
Under MINARS Programme																												
4. Bhavani sagar	6.07	7.29	194	<2	0.100	0.050	36	107	9	<1 81	18	11	3	1	.10	64	32	22	7	13	150	136	13	0.200	<0.002	2.7	0.460	B
PALAR RIVER WATER QUALITY																												
Under MINARS Programme																												
Palar	5.90	7.60	1120	2	0.50	<0.05	18	40	1.6	<1	377	112	46	5	2.6	241	29	40.5	127	225	780	551	8.5	1	<0.001	7	<0.1	A

DBU Class-Designated Best Use

Source: TNPCB, Annual Report April-2019 To March-2020
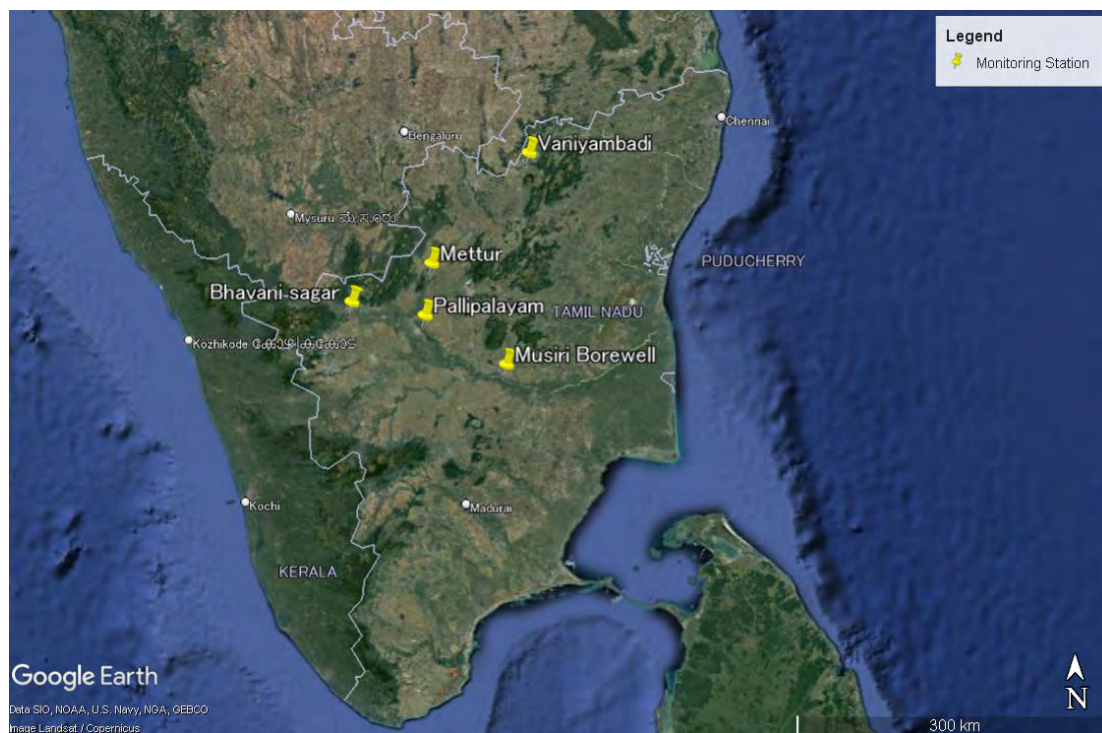
Figure 10.15: Location of Water Quality Monitoring Stations

Table 10.69: Tolerance Limits for Inland Surface Water Quality

Characteristic	Designated Use Class of Inland Waters				
	A	B	C	D	E
pH value	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5	6.0 to 8.5
Dissolved Oxygen mg/l Min.	6	5	4	4	-
Biochemical Oxygen Demand (5 days at 200C) mg/l	2	3	3	-	-
Total coliform organisms MPN/100 ml. Max.	50	500	5000	-	-
Colour Hazen units	10	300	300	-	-
Chlorides (as Cl) mg/l Max.	250	-	600	-	600
Sodium Adsorption ratio Max.	-	-	-	-	26
Boron (as B) mg/l. Max.	-	-	-	-	2
Sulphates (as SO4) mg/l	400	-	400	-	1000
Nitrates (as NO) mg/l Max.	20	-	50	-	-
Free Ammonia (as NH3) mg/l	-	-	-	1.2	-
Conductivity at 25o C microhm/cm Max.	-	-	-	1000	2250
Arsenic (as As) mg/l. Max	0.05	0.2	0.2	-	-
Iron (as Fe) mg/l	0.3	-	50	-	-
Fluorides (as F) mg/l	1.5	1.5	1.5	-	-
Lead (as Pb) mg/l. Max.	0.1	-	0.1	-	-
Copper (as Cu) mg/l	1.5	-	1.5	-	-
Zinc (as Zn) mg/l/ Max.	1.5	-	1.5	-	-
Manganese (as Mn) mg/l	0.5	-	-	-	-
Total Dissolved Solids mg/l	500	-	1500	-	2100
Total Hardness (CaCO3) mg/l	300	-	-	-	-
Magnesium (as Mg) mg/l	100	-	-	-	-
Chlorides (as Cl) mg/l	250	600	-	-	600
Cyanides (as CN) mg/l	0.05	0.05	0.05	-	-

A: Drinking Water Source without conventional treatment but after disinfections;
B: Outdoor bathing organized;
C: drinking water source with conventional treatment followed by disinfections;
D: propagation of wildlife and fisheries;
E: irrigation, industrial cooling, controlled waste disposal.

Source: Central Water Commission

Effluent standards for hotels with less than 20 bedrooms

Table 10.70: Effluent Standards for Hotels with Less Than 20 Bedrooms

Parameter	Inland surface water	On land for irrigation	Methods
pH	5.5 – 9.0	5.5 – 9.0	
BOD 3days 27ºC (mg/l)	100	100	IS 3025-44 (2006)
Total Suspended Solid (mg/l)	100	100	IS 3025-17 (1984)
Oil & Grease (mg/l)	10	10	IS 3025-39 (1991)

Part-A of General Standards for discharge of Environmental Pollutants, GSR 801 (E) EPA 1993
Source: CPCB

(2)   Natural Environment

1) Protected Area

National Park

An area, whether within a sanctuary or not, can be notified by the state government to be constituted as a National Park, by reason of its ecological, faunal, floral, geomorphological, or zoological association or importance, needed to for the purpose of protecting & propagating or developing wildlife therein or its environment. No human activity is permitted inside the national park except for the ones permitted by the Chief Wildlife Warden of the state under the conditions given in CHAPTER IV, WPA 1972.

According to the National Wildlife Database, December, 2019, there are 101 existing national parks in India covering an area of 40,564.00 km2, and among them Tamil Nadu has 5 National Parks.

Table 10.71: List of National Parks in Tamil Nadu

S.No.	Name of Protected Area	Year of Notification	Area (in km^2)
1	Guindy NP	1976	2.7057
2	Gulf of Mannar Marine NP	1980	526.02
3	Indira Gandhi (Annamalai) NP	1989	117.1
4	Mudumalai NP	1990	103.23
5	Mukurthi NP	1990	78.46

Source: National Wildlife Database, December 2019

Wildlife Sanctuary

Any area other than area comprised with any reserve forest or the territorial waters can be notified by the State Government to constitute as a sanctuary if such area is of adequate ecological, faunal, floral, geomorphological, natural, or zoological significance, for the purpose of protecting, propagating or developing wildlife or its environment. Some restricted human activities are allowed inside the Sanctuary area details of which are given in CHAPTER IV, WPA 1972.

There are 553 existing wildlife sanctuaries in India covering an area of 119776.00 km^2, which is 3.64 % of the geographical area of the country, according to the National Wildlife Database, December, 2019. In Tamil Nadu, there are 30 sanctuaries, as of December 2019, as shown below.

Table 10.72: List of Wildlife Sanctuaries in TN

	Name of Protected Area	Year of Notification	Area (in km²)
1	Cauvery North	2014	504.3348
2	Chitrangudi Bird	1989	0.4763
3	Gangaikondam Spotted Dear	2013	2.884
4	Indira Gandhi (Annamalai)	1976	841.49
5	Kalakad	1976	223.58
6	Kanjirankulam Bird	1989	1.04
7	Kanyakumari	2002	402.3955
8	Karaivetti Bird	1999	4.5371
9	Karikilli Bird	1989	0.6121
10	Kodaikanal	2013	608.95482
11	Koonthankulam-Kadankulam	1994	1.29
12	Megamalai	2009	269.10815
13	Melaselvanoor-Keelaselvanoor	1998	5.9308
14	Mudumalai	1942	217.76
15	Mundanthurai	1977	582.0758
16	Nellai	2015	356.7333
17	Oussudu Lake Bird	2015	3.31785
18	Point Calimere	1967	17.2881
19	Point Calimere Block-A & Block-B	2013	124.0727
20	Pulicat Lake Bird	1980	153.67
21	Sakkarakottai Bird	2012	2.3049
22	Sathyamangalam	2008	1411.6094
23	Srivilliputhur Grizzled Squirrel	1988	485.2
24	Theerthangal Bird	2010	0.2929
25	Udayamarthandapuram Lake	1991	0.4528
26	Vaduvoor Bird	1991	1.281
27	Vedanthangal Lake Bird	1936	0.3
28	Vellanadu Blackbuck	1987	16.41
29	Vellode Bird	1997	0.7718
30	Vettangudi Bird	1977	0.384

Source: National Wildlife Database, December 2019

(3)　　Social Environment

1) Scheduled Caste and Scheduled Tribe

Scheduled Caste

The varna or Jati system segregated the Indian society into 4 main categories or castes; however, one category of the society falls outside the caste system, and occupy the lowest rank in the ritual hierarchy of Indian society, due to the age-old practice of un-touchability resulting due to engagements in offensive vocations, thus leading to social, educational, and economical backwardness.

The Census-2011 data shows that the population of SC in Tamil Nadu accounts for 20.01% of its total population, slightly higher than the national average of 16.6%. Seventy-six SCs have been notified in Tamil Nadu by the Scheduled Castes and Scheduled Tribes Order (Amendment) Act, 1976.

Scheduled Tribe

The Constitution of India, Article 366 (25) refers to scheduled tribes (ST) as those communities who are scheduled in accordance with Article 342 of the Constitution. According to this Article, STs are

the tribes or tribal communities or part of or groups within these tribes and tribal communities which have been declared as such by the President through a public notification.

Tamil Nadu is one of the states with the lowest proportion of ST, consisting of 1.1% of the total population. According to the Census 2011, the total ST population is 795,000, and 660,000 are living in rural areas and 134,000 are living in urban areas. There are 36 tribes and sub tribes in the State, and Malayali is the single largest ST group with the population of 358,000, followed by Irular, 190,000, and Kattunayakan, 47,000. In the State, there are six Particularly Vulnerable Tribal Groups (PVTG), Toda, Kota, Kurumbas, Irulur, Paniyan and Kattunayakan. These groups are mainly residing in the Western Ghats.

Under the TBGP2, target villages/hamlets of Eco-tourism and Ecodvelopment will be selected from the Integrated Tribal Development Plan (ITDP) areas in the Eastern Ghats. The ST groups residing in the ITDP pockets of the Eastern Ghats are summarized below.

Table 10.73: ST Groups in the ITDP Pockets in the Eastern Ghats

Districts	ITDP Areas	Description of areas and ST groups
Namakkal	Kolli Hills	Kolli Hills of the eastern Ghats is rich in biodiversity and ST populations. The elevation of the hills ranges between 1000 and 1500 m above mean sea level (MSL). The Kolli hills are majorly inhabited by the Malayali, the Irulas, Malakkuravan, Kattunayakan, and Kurumans in small number Most of the tribes are engaged in collecting Non-Timber Forest Products (NTFP) as their primary occupation. They are also involved in honey hunting engaged in other forest related activities. Some are involved in cultivating agricultural crops, livestock rearing, agricultural labor. All these fall under other forest and agriculture related activities.
Salem	Yercaud Hills	Yercaud is a hill station near Salem, in the Servarayan range of hills (anglicized as Shevaroys), in the Eastern Ghats. It is at an altitude of 1515 metres above the sea level. The Yercaud Hills are majorly inhabited by the Malayali. Malakkuravan and Irulas are also present in small numbers.
	Aranuthumalai & Kalrayan Hills	Aranuthumalai village is located in Vazhapadi Tehsil of Salem district. It is situated 45km away from sub-district headquarter Vazhapadi and 60km away from district headquarter Salem.
Tiruvannamalai	Jawadhu Hills	The Javadhu Hills (also Jawadhi, Jawadhu Hills) are an extension of the Eastern Ghats spread across parts of Vellore and Tiruvannamalai districts Nadu. Jawadhu Hill is inhabited by Malayali, Kattunayakan, Malakkuravan and Irulas.
Viluppuram	Kalrayan Hills	The Kalrayan Hills are a major range of hills situated in the Eastern Ghats. Along with the Pachaimalai, Javadi, and Shevaroy hills, they separate the Kaveri River basin to the south from the Palar River basin to the north. The hills range in height from 600 m to 900 m. The Kalrayan Hills are majorly inhabited by the Malayali, Kattunayakan, Malakkuravan and Irula tribes .
Dharmapuri	Sitheri Hills (Also referred to as Chitheri Hills)	It is a small hill station on the Eastern Ghats at an altitude of 1,097.3 metres, an area of 685 Km, a population of 9045 people and comprising of 63 villages, and is a popular tourist spot. The main tribal population is Malayali and agriculture is their main activity.They are nomadic agriculturists and occasionally engage in animal husbandry, mainly rearing of pigs.
Tiruchirappalli	Pachamalai Hills	The Pachamalai hills are inhabited only by the Malayali and others are not allowed to migrate to this place. The economic conditions of the tribes primarily depended on agriculture, forest and labouring. Similarly, it was found that majority

		(50%) of the people do agriculture and 25 percent of them were engaged in forest work.
Vellore (Tirupathur)	Jawadhu & Yelagiri Hills	Most of the inhabitants of this hills belong to "Malayali Tribes". Agriculture is their major occupation. The hill is known for its sandal wood cultivation. Hence Asia's second Sandalwood godown is constructed in Tirupathur. The Jawadhu & Yelagiri Hills are inhabited by Malayali,Kattunayakan,Malakkuravan and Irulas.

Source: Compiled by JICA Study Team (2021) based on existing literature and data

10.7.2. Legal and Institutional Framework of Environmental and Social Consideration

(1) Legal Framework

1) Union level

The main federal laws of India regarding the protection of the natural environment and pollution control are summarized in the table below.

Table 10.74: Indian Federal Statutes Regarding Environmental Protection

Issues	Name of Legislation	Year
Basic Statutes	The Environment Protection Act/Amendment	1986 1991
	The Environment Protection Rules	1986
	Environment Impact Assessment Notification	1994
	Draft Environment Impact Assessment Notification	2020
Air Quality	The Air (Prevention and Control of Pollution) Act	1981
	The Air (Prevention and Control of Pollution) Rules	1982
	The Air (Prevention and Control of Pollution) (Union Territories) Rules	1983
	Revised National Ambient Air Quality Standards, Notification	2009
Water Quality	The Water (Prevention and Control of Pollution) Act	1974
	The Water (Prevention and Control of Pollution) Rules	1975
	The Water (Prevention and Control of Pollution) Cess Act	1977
	The Water (Prevention and Control of Pollution) Cess Rules	1978
Noise & Vibration	The Noise Pollution (Regulation and Control) Rules	2000
Environmental Tribunals	Public Liability Insurance Act	1991
	Public Liability Insurance Rules	1991
	The National Environment Tribunal Act	1995
	The National Environment Appellate Authority Act	1997
	The National Environment Appellate Authority (Appeal) Rules	1997
	The National Green Tribunal Act	2010
Forest Conservation	The Indian Forest Act	1927
	The Forest (Conservation) Act	1980
	The Forest (Conservation) Rules	2003
	The National Forest Policy	1988
Wildlife Conservation	The Wild Life (Protection) Act	1972
	The Wild Life (Transactions and Taxidermy) Rules	1973
	The Wild Life (Protection) Licensing (Additional Matters for Consideration) Rules	1983
	Recognition of Zoo Rules	1992
	The Wild Life (Protection) Rules	1995
	The Wild Life (Specified Plants Conditions for Possession by Licensee) Rules	1995
	National Zoo Policy	1998
	The Wild Life (Protection) Amendment Act	2002
	The Declaration of Wild Life Stock Rules	2003

	The National Board for Wild Life Rules	2003
Other Conservation	Wetlands (Conservation and Management) Rules	2017
	Coastal Regulation Zone Notification	2011
Biological Diversity	Biological Diversity Act	2002
	Biodiversity Rules	2004
Wastes Management	The Hazardous Wastes (Management and Handling) Rules	1989
	The Bio medical Waste (Management and Handling) Rules	1989
	The Municipal and Solid Wastes (Management and Handling) Rules	2000
Chemical Manufacture/ By-product Management	The Manufacture, Storage, and Import of Hazardous Chemical Rules	1989
	The Ozone Depleting Substances (Regulation and Control) Rules	2000
	The Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells	1989
	The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules	1996
	The Recycled Plastics Manufacture and Usage Rules	1999
	The Plastics Manufacture, Sale and Usage Rules	1999
	The Batteries (Management and Handling) Rules	2001
Other	Protection of Plant Varieties and Farmers' Rights PPVFR) Act	2001
	Ancient Monuments and Archaeological Sites and Remains Rules	1959
	National Green Tribunal Act	2010

The need for the protection and conservation of the environment and the sustainable use of natural resources is reflected in the constitutional framework of India. Article 51-A (g), says that, 'It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wild life and to have compassion for living creatures'. In addition, Article 48A requires the state to protect and improve the environment and to safeguard the forests and wild life of the country.

The Environment Protection Act is the basic environmental law of India. It regulates the power of the central government to take measures to protect and improve the environment through such means as planning, the establishment of environmental quality standards, the examination of manufacturing processes, the collection and dissemination of information, and the preparation of manuals. The Environmental Protection Rules provide standards for emission or discharge of environmental pollutants and makes it possible for the central government to prohibit or restrict the establishment of industries or the carrying out of specific processes or operations based on factors specified in Rule 5.

The Environment Impact Assessment Notification 1994 defines procedures such as screening, scoping, impact assessment, mitigation measures, public consultation, and related issues for various projects that have a substantial impact on the environment.

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 seeks to recognize and vest the forest rights and occupation in forest land in forest dwelling ST and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded. The Act was notified for operation with effect from December 31st, 2007 and the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Rules, 2008 for implementing the provisions of the Act were notified on January 1st, 2008.

In Tamil Nadu, the Act has been implemented in 18 districts and monitored by the following Committees:

    i) State Level Monitoring Committee headed by the Chief Secretary.
    ii) District Level Committee headed by the District Collector.
    iii) Sub-Divisional Level Committee – headed by the Revenue Divisional Officer.

Based on the Geographical information system, the District Collectors are distributing individual and community rights for the lands in which the Scheduled Tribe people are residing.

The application procedures of the Forest Right was suspended from April 2008 to February 2016 due to the court case, and since then 9,056 Individual Rights have been distributed out of the recommended 9,120 applications and 472 Community Rights have been distributed out of the 545 applications recommended.

The National Green Tribunal Act provides for the establishment of a tribunal to exercise the jurisdiction, powers, and authority conferred on it by or under this act. The National Green Tribunal shall have jurisdiction over all civil cases in which a substantial question relating to the environment is involved.

2) State Level

State level laws, regulations, policies, and plans are shown below.

Table 10.75: State Level Laws, Regulations, Policies, and Plans

Issues	Name of Legislation	Year
Forest Conservation	Tamil Nadu Forest Act, 1882	1882
	Tamil Nadu Preservation of Private Forest Act 1949	1949
	Tamil Nadu Hill Areas (Preservation Of Trees) Act, 1955	1995
Biodiversity	Tamil Nadu Biological Diversity Rules	2017
Coastal Conservation	Coastal Zone Management Plan under the Coastal Regulation Zone Notification, 2011	2018

The Tamil Nadu Forest Act, 1882, empowers the government to declare any land at its disposal as a reserved forest in the manner as prescribed under the Act. A notification shall be issued by the government to declare any area under its control as a reserved forest.

A forest settlement officer (FSO) under the Act is responsible for surveying the land to be declared as a reserved forest. Once the land is declared as a reserved forest, the Forest Settlement officer may grant rights of pasture and the right to collect forest produce. These extent to which these rights are granted and exercised are determined by the FSO. These rights can be commuted at any time.

The amendment of the Sec 17A allows for conversion of the land acquired under the Janman abolition Act to be converted into reserved forests through a notification by the government and such a land will be brought under the purview of the TN Forests Act.

The Tamil Nadu Preservation of Private Forest Act, 1949, intends to prevent the indiscriminate destruction of private forests and interference with customary and prescriptive rights therein and for certain other purposes. A committee headed by the District collector and consists of 5 members was established at the Districts.

In case of private forests, owners of such forests shall not without prior sanction from the committee sell, mortgage, lease or otherwise alienate the whole or any portion of the forest. Any alienation done without the sanction of the committee is null and void. No owner or any other person claiming under the owner can fell trees or reeds or do any such Act such as to denude the forest without prior sanction of the committee.

The Tamil Nadu Hill Areas (Preservation Of Trees) Act, 1955, intends to provide for the regulation of the cutting of trees and the cultivation of land in hill areas in the State of Tamil Nadu in order to

prevent deforestation and soil erosion and also to preserve the special characteristics of the hill areas as regards landscape, vegetal cover and climate.

A committee is formed headed by the District collector and comprising of five members. Without the prior sanction of the committee no trees can be cut, branches of any tree cut down. Use of slope land for purposes other than for growing of trees is prohibited. In case of any new cultivation on slope land, the same cannot be done without the prior sanction of the committee.

(2) Environment-related Prior Clearance Procedures in India

The proposed project may not require any prior clearances such as Prior Environment Clearance (EC), Prior Coastal Regulation Zone (CRZ) Clearance, Forest Clearance, and Wildlife Clearance. However, the general processes of the environmental clearance and the forest clearance are described hereunder.

1) Environment Clearance

Under Environmental Impact Assessment (EIA) Notification 2006, amended in 2009, all projects or activities included as Category A shall require prior environmental clearance from the MOEFCC on the recommendations of an Expert Appraisal Committee (EAC), to be constituted by the central government for the purposes of notification. Besides these, all projects or activities included as Category B in the Schedule will require prior environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The SEIAA shall base its decision on the recommendations of a state or union territory (hereinafter referred to as "UT") level Expert Appraisal Committee (SEAC), to be constituted for in the notification. Category B projects are further divided into Category B1 (projects that require submitting an EIA report) and B2 (project activities which do not require an EIA report). In the absence of a duly-constituted SEIAA or SEAC, a Category B project shall be treated as a Category A project.

The following table shows an example of a list of projects or activities which require prior EC. Under the draft EIA Notification, 2020, the MOEFCC proposes a recategorisation of some projects such as river-valley hydroelectric projects, from A to B1 or B2.

Table 10.76: Projects or Activities Requiring Prior Environmental Clearance

Project	Category with Threshold Limits		Conditions
	Category A	Category B	
1. Mining, extraction of natural resources, and power generation			
1(c) River valley projects	(i) >50mw Hydroelectric power generation; (ii) >10,000ha of culturable command area	(i) <50mw > 25mw hydroelectric power generation; (ii) < 10,000 ha of culturable command area	General Conditions shall apply
8.Building/Construction projects/Area Development projects and townships			
8(a) Building and construction projects		>20,000 sq. m and <150,000 sq. m of built-up area#	# Built-up area for covered construction; in cases of facilities open to the sky, it will be the activity area
8(b) Townships and Area Development projects		Covering an area > 50 ha and or built-up area > 150,000 sq. m #	# All projects under item 8(b) shall be appraised as Category B1
General Condition: Any project or activity specified as Category B will be treated as Category A, if it is located in whole or in part within 10 km from the boundary of the following: (i) Protected Area notified under the Wildlife (Protection) Act, 1972; (ii) Critically polluted areas as notified by the Central Pollution Control Board from time to time; (iii) Notified eco-sensitive areas; and (iv) Inter-state boundaries and international boundaries.			

Source: EIA Notification, 2006

The Project may construct rain water harvesting structure, loose boulder check wall, and buildings or rehabilitate check dams, however, these interventions will not be listed as projects which require EC under the EIA Notification. If any buildings as a part of the interventions proposed in the project has an area greater than 20,000 m^2 prior EC shall be required. But the administration buildings are supposed to be much smaller than the 20,000 m^2. For the reference, the detailed stages prior to environmental clearance for Category B projects is shown below.

Figure 10.16: Flow of Obtaining Environmental Clearance for Category Project B

MOEFCC proposed a draft Environmental Impact Assessment Notification, 2020, in March, 2020. The Draft EIA Notification is intended to promote transparency and streamline compliance, as it integrates numerous notification, amendments, office orders, circulars, court and tribunal directions since the last EIA notification in 2006.

The key changes are summarized below.

- Projects in certain sectors re-categorized from A to B1 or B2, such as river valley hydro-electric projects.
- About 40 industries will be classified under category B2, and therefore be exempt from the requirement of EIA study and public consultation process.
- EIA report is not be required in case of modernisation of projects where the intended increase in production capacity is up to 25% and public consultation exempt up to 50% increase in production capacity.
- Construction project up to 150,000 m^2 are exempt from the assessment. EC may be granted, after scrutiny by SEAC alone.

Notice period for public hearing is reduced from 30 days to 20 days and the process to be completed in 40 days, shorten from 45 days.

2) Prior Coastal Regulation Zone Clearance

The CRZ Notification was issued by the Ministry of Environment and Forests, Government of India in 1991 under the Environment Protection Act, 1986, and amended in 2011 and 2019, in order to regulate activities in coastal areas of India, protect livelihood of communities in the coastal, and conserve ecosystem. It also shows the procedures of the prior CRZ Clearance.

In 2018, the Tamil Nadu government formulated the Coastal Zone Management Plan, according to the CRZ Notification, 2011.

Coastal areas are categorized under the CRZ Notification, as shown below. Due to the amendment of 2019, ecotourism activities are allowed in CRZ I. Construction in a CRZ I area shall be permitted subject to a detailed marine or terrestrial (or both) environment impact assessment, to be recommended by the Tamil Nadu Coastal Zone Management Authority (TNCZMA) and approved by the MOEFCC. For construction in a CRZ II area, CRZ II permission is required from the TNCZMA.

Table 10.77: CRZ Categories

Category	Description
CRZ I A	Eco-sensitive Areas. Since the amendment of 2019, ecotourism activities are allowed.
CRZ I B	Inter-Tidal Areas
CRZ II	Areas which have been developed up to or close to the shore
CRZ III A	CRZ-III areas, where the population density is more than 2,161/km^2 per the 2011 population census
CRZ III B	Areas with a population density of less than 2,161/km^2, per the 2011 population census
CRZ IV A	12 nautical miles from the Low Tide Line toward the sea
CRZ IV B	Tidal influenced waterbodies
No Development Zone (NDP)	Under the Notification, 2011, there was an extension up to 200 m from the high tide line (HTL) toward land in the whole CRZ III areas, but now under the Notification, 2019, it is 50 m from the HTL in CRZ III A and 200 m HTL in CRZ III B areas.

Source: CRZ Notification, 2019

The procedure for CRZ Clearance is summarized below.

- The 'Project Proponent' applies with the following documents to the Tamil Nadu Coastal Zone Management Authority to seek prior clearance
  - Project summary details
  - Rapid EIA Report
  - Comprehensive EIA with cumulative studies for projects
  - Risk Assessment Report and Disaster Management Plan

> ➢ CRZ map in 1:4000 scale
> ➢ Project layout superimposed on the CRZ map
> ➢ The CRZ map normally covering a 7 km radius around the project site
> ➢ 'Consent to establish' or a 'No Objection Certificate' from the concerned State Pollution Control Board

- The TNCZMA reviews and makes recommendations within a period of 60 days from the date of receipt of a complete application.
- For projects or activities also attracting the EIA Notification, 2006 number S.O. 1533(E), dated 14 September 2006, the TNCZMA shall forward its recommendations to the MOEFCC or the Tamil Nadu Environment Impact Assessment Authority (TNEIAA) for Category A and Category B projects, respectively.
- The TNCZM shall forward its recommendations to the MOEFCC for projects or activities not covered in the EIA notification, 2006, but which attract this notification and are located in CRZ-I or CRZ-IV areas.
- Projects or activities not covered in the aforesaid EIA Notification, 2006, but which attract this notification and are located in CRZ-II or CRZ-III areas, shall be considered for clearance by the TNCZMA within 60 days of the receipt of the complete proposal from the proponent.
- The MOEFCC shall consider complete project proposals for clearance under this notification, based on the recommendations of the Coastal Zone Management Authority, within a period of 60 days.
- The clearance accorded to projects under this notification shall be valid for a period of seven years, provided that the construction activities are completed and the operations commence within seven years from the date of issue of such clearance.
- Post clearance monitoring.

3) Forest Clearance

Under the Forest Conservation Act, 1980, forest clearance from the statutory authority will be required if the forest area is to be used for non-forest purposes. For this purpose, an application is submitted to the relevant state government, which in turn recommends the case to the MOEFCC.

The Forest Conservation Act stipulates the definition of non-forest purpose as:

'the breaking up or clearing of any forest land or portion thereof for —

(a) the cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticultural crops or medicinal plants;

(b) any purpose other than re-afforestation;

but does not include any work relating or ancillary to conservation, development and forest and management of forests and wildlife, namely, the establishment of check-posts, fire lines, wireless communications and construction of fencing, bridges and culverts, dams, waterholes, trench marks, boundary marks, pipelines or other like purposes.'

The Project shall construct rain water harvesting structure, loose boulder check wall, and buildings, however, these interventions will be carried out for the forest conservation and management under the TNFD. Thus, forest clearance may not be required. For the reference purpose the process of forest clearance on a parivesh site is shown below.

- The proposal (Form A, Form B and Form C), explaining the details of the project, User Agency (UA) and the applicant, land required for the project with a map, displacement

people if any, status of EC, and so on, is submitted by the UA, and the Nodal officer (State Forest Department) examines it for its completeness (Part I). If the all the necessary documents are included, an acknowledgement letter along with the unique proposal number will be sent by the system.

- The proposal is forwarded online from the Nodal Officer to District Forest Office (DFO) for review. After filling up the Part II of Form A, Form B and Form C, the proposal, along with the site inspection report and recommendations are uploaded and forwarded to concerned Circle Officer (CF/CCF).
- After reviewing and filling up the Part III of Form A, Form B and Form C, the proposal along with the site inspection report and recommendations is uploaded and automatically backed to the Nodal Officer.
- After receiving the proposal online from Nodal Officer, the concerned State Secretary can view the proposal (Form-A/Form-B/Form-C submitted by UA) and recommendations of DFO, Circle and Nodal Officer and then may upload his/her Recommendations.
- The uploaded proposal by State Secretary is forwarded to either Regional Office (RO) or Head Office (HO) of MOEFCC, depending upon the category, area and Shape of forest land proposed to be diverted.

  ➢ The case of less than 5 ha forest area except Mining, Hydel, Encroachments
    Diversion of Forest Land is decided at RO without State Advisory Group (SAG) / Regional Empowered Committee (REC) meeting
  ➢ The case of land up to 5 ha (Mining and regularization of encroachments only) and all other projects related with diversion of forest land from 5 to 40 ha
    The proposal along with recommendations of SAG/REC is forwarded from RO to RO (HQ), Delhi, for approval of Competent Authority of MOEFCC.
    After receiving the proposal and all the recommendations, HO can conduct Forest Advisory Committee (FAC) meeting.
    Recommendations of FAC along with decision by the Competent Authority and agenda and minutes of the meetings are uploaded on portal.
  ➢ The case of diversion of forest land for more than 40 ha. excluding linear projects
    The proposal along with all the recommendations is directly forwarded to HO, Delhi, for the processing at Head Office (MOEFCC, Delhi)..

- After the submission by the UA, the proposal is forwarded from the Nodal Officer to District Collector (DC) as well as District Forest Office. After viewing the proposal, DC has to upload FRA document.

4) Wildlife Clearance

According to the Wildlife (Protection) Act, 1972, any diversion of land or produce including water, from PA, such as wildlife sanctuaries and national parks, needs the recommendation of the State Board for Wildlife. No construction of commercial tourist lodges, hotels, zoos, and safari parks can be undertaken inside PA except with prior approval of the Standing Committee of the National Board for Wildlife (NBWI).

If projects require Environmental Clearance and are located within the eco-sensitive zone around the PA or within a distance of 10 km from the boundaries of the PA, the UA or project proponent is required to obtain recommendations of the Standing Committee of NBWL.

The procedure for Wildlife Clearance on a parivesh site is shown below.

- The proposal submitted by the UA will be forwarded to the concerned DFO/Wild Life Warden.
- The DFO scrutinizes the proposal and sends an acceptance letter to the UA, if all relevant documents are uploaded properly by the UA. Proposal details are forwarded

automatically to all the DFOs involved in the proposal for their necessary action. (Five days.)

- After review, the DFO uploads part-II of Form-A on the portal, along with his/her recommendation and Site Inspection Report. The proposal details are forwarded automatically to concerned Chief Wildlife Warden (CWLW) for the necessary action. (30 days).
- After review, the CWLW uploads his/her recommendation and Site Inspection Report (if the site inspection has been done) and the proposal will be forwarded to the state government (SG) level. (20 days.)
- After reviewing the recommendations of the DFO and CWLW, the SG level user uploads recommendation of the State Board of Wildlife (SBWL) on the portal along with the SG report/recommendation. The proposal is forwarded to the Head Office (Wildlife), New Delhi.
- After reviewing the proposal from state level user, the MOEFCC (head office) level user processes the received documents for the approval of the 'Competent Authority' of the MOEFCC.
- After taking the approval of the Competent Authority, the MOEFCC (head office) level user has to update the status of the proposal and upload the recommendation letter of the NBWL on the portal.

(3)   Differences between Indian Environmental Legislation and JICA Guidelines

a.   Outline of the JICA Guideline

It is necessary to ensure that the project is implemented in compliance with JICA Environmental and Social Consideration. JICA encourages JICA's partners, including host countries, borrowers, and project proponents, to implement the appropriate measures for environmental and social considerations when engaging in cooperation activities. At the same time, JICA provides support for and examinations of environmental and social considerations in accordance with the guidelines. The outline of the guideline is summarized below.

I. General

- Assessment of wide range of environmental and social impacts will be carried out in the JICA projects/programs.
- Environmental and social issues should be taken into consideration during the initial design and planning stages throughout the project cycle.
- JICA is responsible for accountability and transparency in project execution.
- Stakeholder consultation/participation is required in consideration of environmental/ social issues.
- Proper information disclosure systems should be prepared.
- Considering the guidelines in project planning and execution should contribute to institutional capacity building of the implementing agencies for proper implementation of environmental and social safeguards as envisioned in the JICA Policy.
- JICA is committed to addressing environmental and social issues in a prompt/ timely manner.

II. Indigenous People

These considerations address the issue of indigenous People in the project area. They are as mentioned below:

- Avoiding implementation of interventions that may have adverse impacts on indigenous peoples in the planning stage itself.

- Ensuring that there is minimum impact and all steps are taken to mitigate any adverse impact that may arise in case of an unavoidable situation.
- Taking all steps possible to uphold all the rights of the indigenous people pertaining land and resources in accordance with the respective international declarations and treaties like the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).
- Implementing the process of free, prior and informed consultation for obtaining the consent of indigenous peoples for implementation of the project.
- Preparing an Indigenous Peoples Plan in order to achieve the above stated objectives, for which JICA guidelines prescribe the World Bank Safeguard Policy OP 4.10 Annexure B as the appropriate policy document.

World Bank Operational Policy 4.10 (OP4.10) on Indigenous Peoples

In order not to have many different standards, JICA refers to international policies, procedures and standards such as those of the World Bank in part. For the current project in spite of the fact that JICA has special concerns for the Indigenous Peoples, it does not have a separate detailed policy, but refers to the World Bank Operational Policy 4.10 (OP4.10) on Indigenous Peoples.

b.   Key Process Elements

JICA's key process elements for environmental and social considerations is summarised below:

Project Categorisation

Projects are categorized according to the scope/severity of the environmental and social impacts or risks, as follows:

Table 10.78: Project Category

Category	Description
Category A	Significant adverse impacts e.g. Large-scale development/ infrastructure Large-scale involuntary resettlement, projects in sensitive areas e.g. National Park
Category B	Generally site-specific impacts, few impacts are irreversible, normal mitigation measures can be designed
Category C	Minimal/little adverse impact
Category FI (Financial intermediary)	Substantial selection and appraisal of intervention after JICA approval of funding

Source: JICA Guideline for Environment and Social Considerations

At this stage, the TBGCP is categorized as FI, but after finalizing the loan agreement and contents of the sub-projects, each sub-project will be reviewed based on the result of the impact assessment and categorized as A, B, or C based on the result of the review.

If some of sub-projects are categorized as B, it is necessary for PMU to prepare and implement the Environment Management Plan (EMP) and Environment Monitoring Plan (EMoP), according to the JICA Guideline. In addition, based on the result of the monitoring, a report of environment and social consideration has to be prepared and submitted to JICA, separately from the project management report.

Impacts Assessment

In order to assess the impacts a wide range of environmental and social considerations are taken into account with view towards both enhancing positive benefits and avoiding/ mitigating negative impacts.

Table 10.79: Possible Project Impacts by Type

Type of Impact	Description
Environmental Impact	Natural Environment - air, water, land Systems - water usage, climate change, ecosystems Scale – local, regional, boundary/ global scale impacts
Social Impact	On community/people's - lands, economies, livelihoods, employment, natural resources; − resettlement, local conflicts − gender, vulnerable groups, indigenous peoples, children − social institutions, health, cultural heritage, existing social infrastructures and services, equality of benefits and losses, local conflicts, working conditions, etc.

Information Disclosure and Consultation:

JICA requests that proponents disclose information on the environmental and social impact of the Project both to JICA as well as local stakeholders well in advance of implementation. Frameworks for consultation and information disclosure need to be developed and agreed.

c.   Project Categorisation by the JICA Guidelines

(1)   Categorization of the Project:

The Project is currently categorized as 'FI' in accordance with the JICA Guidelines (2010). The 'FI' classification remains valid for the following reasons:

1) JICA's funding of projects will be provided to a financial intermediary or executing agency.
2) The selection and appraisal of the sub-projects will be substantially undertaken by the executing agency only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding.
3) Sub-projects will be selected in participatory mode by communities and as such cannot be specifically defined at this stage.
4) Sub-projects with significant adverse environmental or social impacts requiring environmental clearance will be eliminated through screening procedures. However, certain potential environmental and social impacts are perceived, and there is the potential that the Project may damage protected areas and involve forest dependents (ST, SC and other forest dependents).

The Project is overall expected to have a mainly positive impact on the environment given that its primary objective is to enhance biodiversity, increase forest coverage and to improve livelihood of forest dependent people in the project areas. Although it is not possible to precisely state exactly what sub-projects will be implemented in which specific location and scale, the Project will exclude "Category A" sub-projects with a significant environmental impacts or risks.

At the time of selection, finalisation and approval of sub-projects, respective sub-projects to be categorised as either "Category B" or "Category C" according to the scope/severity of the environmental and social impacts or risks.

(4)   Key Gaps and Shortfalls between JICA Guidelines and TNFD Standards on Environment and Social Considerations

Key gaps and shortfalls identified in each institution in comparison to international standards as indicated in the JICA Guidelines are as below. Even though the TNFD implemented three ODA loan projects, this is the first time for the TNFD to follow the JICA Guideline fully to its loan project.

Table 10.80: Gaps and Shortfalls JICA Guidelines and TNFD Standards on E&S Considerations

No.	Executing Agency	Key Gaps and Shortfalls	Recommendations
1	TNFD	There is not Environmental and social safeguard policy and procedure	If there is no relevant policy and procedure, use EIAF and STPF.
		Person in charge of environmental and social considerations not there	Need assignment of Environmental and Social Consideration Expert(s) / Specialist
		Limited procedures for environmental screening and subsequent management of environmental risks associated with small-scale construction and other activities with potential adverse impacts.	Implementation of Capacity Development Plan for Environmental and Social Safeguard
		No monitoring of safeguard processes and procedures.	Prepare and implement an Environmental and Social Safeguards Implement. Plan
		Free, Prior and Informed Consultations at village level were implemented under the TBGP. No GAP	In order to improve skills, conduct training programs for TNFD staff and assist them in preparing tools and arranging for consultation at village level before commencing micro planning
2	People Organization	State Forest Policy addresses the concerns of women or vulnerable people and necessity of their participation. No Gap	Inclusion of vulnerable section of the society by efficient implementation of EIAF and STPF
		Limitation in awareness of potential adverse environmental impacts.	If so, increase awareness at the time of providing Consultation at village level and proper implementation of the EIAF and STPF
		Limitation in understanding of safeguard processes and procedures?	Implementation of Capacity Development Plan for Environmental and Social Safeguards
		Limitation in conflict management and benefit sharing.	Implementation of Capacity Development Plan for Environmental and Social Safeguards

(5)   Related Organization to Environmental and Social Considerations

1) Union level: Central level: MOEFCC and CPCB

<u>Ministry of Environment, Forest and Climate Change (MOEFCC)</u>

The MOEFCC is the nodal agency in the administrative structure of the central government for the planning, promotion, co-ordination, and oversight of the implementation of India's environmental and forestry policies and programmes.

The broad objectives of the MOEFCC are:
- Conservation and survey of flora, fauna, forests, and wildlife;
- Prevention and control of pollution;
- Afforestation and regeneration of degraded areas;

- Protection of the environment; and
- Ensuring the welfare of animals

Central Pollution Control Board (CPCB)

The CPCB, a statutory organization under the MOEFCC, was constituted in September 1974 under the Water (Prevention and Control of Pollution) Act, 1974. Further, the CPCB was entrusted with powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

The principal functions of the CPCB, as spelled out in the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981 are as follows: (i) to promote the cleanliness of streams and wells in different areas of the states by the prevention, control, and abatement of water pollution; and (ii) to improve the quality of air and to prevent, control, or abate air pollution in the country.

2) State Level

The main organizations related to prior clearance are shown below. The details of their functions will be summarized in the next report.

Tamil Nadu Pollution Control Board (TNPCB)

The state pollution control board is constituted under the Water (Prevention and Control of Pollution) Act, 1974 to enforce the provisions of the above mentioned legislation along with the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the rules made under these Acts.

The functions of the board are planning of programs for prevention, control and abatement of water and air pollution, advising the SG on the same. Collection and dissemination of information relating to water, air pollution, ways to control and prevent them. Inspection, review and specifying corrective measures for sewage and trade effluent treatment plants. Inspection of industrial plants and power to issue directions to take steps on prevention of air pollution. To evolve best economically viable treatment of technology for sewage and trade effluents.

TNPCB issues consent to new industries in two stages. Consent to establish is issued depending upon the suitability of the site before the industry takes up the construction activities and consent to operate is issued after installation of pollution control measures by the unit to satisfy the standards.

State Environment Impact Assessment Authority (SEIAA) Tamil Nadu

The SEIAA Tamil Nadu has been constituted by Government of India authorising to deal with environmental Clearance for projects falling under category "B" of schedule in EIA notifications 2006. The State Expert Appraisal Committee (SEAC) Tamil Nadu has also been constituted by Government of India to assist SEIAA Tamil Nadu.

The present SEIAA was constituted by MOEFCC, through the notification S.O. 5652(E) dated 5th November 2018), comprising of a three members SEIAA, Chairman, Member, Member Secretary, and 12 Members SEAC for Tamil Nadu for a term of three years.

Tamil Nadu Coastal Zone Management Authority (TNCZMA)

In June 1998, the Government of Tamil Nadu constituted Coastal Management Authorities at three levels: state, district and Chennai Metropolitan Development Authority (CMDA) under the CRZ

Notification, 1991. While the State Coastal Management Authority (SCZMA) constituted by the Ministry of Environment and Forests (MoEF) in November 1998 replaced the SCZMA constituted by the State Government, the authorities at the district level and for the CMDA area continued to exist.

As per the decision by National Coastal Zone Management Authority (NCZMA) in 2004, the composition of SCZMA s should include 1 NGO (by name), 4 experts (by name) and 5-6 ex-officio members from the various Departments viz Department of Environment, Urban Development, Fisheries, Industry, Pollution Control Board, local bodies." Other than this, it was decided that the Secretary and Director of the Department of Environment of the concerned state will function as the Chairman and Member Secretary of the SCZMA, respectively. The Member Secretary of the Pollution Control Board of a state can also be the Member Secretary (MS) of its SCZMA .

The main functions of TNCSMA are shown below.

- Examination of proposals for changes/modifications in classification of Coastal Regulation Zone received from TN State Government.

- Review and Inquiry into cases of alleged violations and actual violations of the provisions of the Act and issue directions post examination and inquiry.

- Identification and formulation of area specific management plans for the following, ecologically sensitive areas in CRZ, coastal areas highly vulnerable to erosion/degradation and economically important stretches.

- The Authority shall ensure compliance of all specific conditions that are laid down in the approved Coastal Zone Management Plan of Tamil Nadu.

Tamil Nadu Biodiversity Board

This board is constituted under Section 22 of the Biological Diversity Act, 22 (Central Act 18 of 2003). The board ensures effective implementation of Biological Diversity Act, 2002 and the Biological Diversity Rules, 2004, for conservation of biodiversity, sustainable use of its components and fair and equitable sharing of benefits arising out of utilization of genetic resources.

The Functions of the Board are summarized below.

- Advise the State Government, subject to any guidelines issued by the Central Government, on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilisation of biological resources;
- Regulate by granting of approvals or otherwise requests for commercial utilisation or bio-survey and bio-utilisation of any biological resource by Indians;
- Perform such other functions as may be necessary to carry out the provisions of this Act or as may be prescribed by the State Government.

Any citizen of India or a body corporate, organisation or association registered in India intending to undertake any activity referred to in section 7 shall give prior intimation in such form as may be prescribed by the State Government to the State Biodiversity Board. Upon receiving the same the board, in consultation with local bodies concerned, can prohibit or restrict such activity if it deems that such activities are against conservation.

10.7.3. Environment Impact Assessment Framework (EIAF)

The objective and structure of the Environment Impact Assessment Framework (EIAF) are describe below.

(1) Objective of EIAF

The purpose of the EIAF is to be used to provide guidance to the executing agency of a project for the environmental assessment process to be followed in evaluating that project, including sub-projects to be considered for financial support.

(2) Structure of EIAF

The EIAF consists of the following parts:
- Summary of the project
- Environmental and Social Safeguard Policies of JICA.
- Definitions and Selection of Safeguard Frameworks
- Beneficiaries Identification
- National and State Environmental and Social Management Systems
- Environmental and Social Risks and Mitigation Measures
- Frameworks and Procedures for EIAF
- Institution Strengthening and Capacity Building for EIAF Implementation

10.7.4. Resettlement Action Plan Framework (RAPF)

The RAPF will be developed, if necessary, and incorporated into the Draft Final Report. The draft structure of RAPF is shown below.

- Project objective and necessity of involuntary resettlement and land acquisition;
- Reason why resettlement plan cannot be prepared before loan approval;
- Preparation and approval process of resettlement plan;
- Estimated number of resettlements (including economic transfers that cause the loss of major livelihoods due to an influence on owned land and structures);
- Compensation and entitlements for affected assets/properties;
- Compensating procedure for lost assets based on reacquisition price;
- Means for livelihood rehabilitation which can improve or at least restore livelihoods and living standard of eligibility of benefits;
- Grievance redress mechanism;
- The organisational framework for implementing resettlement, including the identification of agencies responsible for the delivery of resettlement measures and provision of services;
- Implementation schedule to initiate physical relocation after completion of compensation payment for asset losses;
- Costs and budget;
- Arrangements for monitoring of resettlement activities by the implementing agency supplemented by independent monitors; and
- Strategy for consultation with and participation of resettlers and hosts in the design and implementation of the resettlement activities

However, the RPF will not be prepared because any voluntary/involuntary resettlement is planned in the proposed project.

10.7.5. Scheduled Tribes Plan Framework (STPF)

The Scheduled Tribes Plan Framework (STPF) will be prepared as an additional framework that works together with the EIAF, if necessary. The STPF is specifically applied in situations where ST, SC, Other Backward Classes, forest dwellers, and other forest dependents are affected by the project activities and provides guidance for specific measures, which may be required in addition to the provisions of the EIAF.

The structure of the STPE is shown below.

- Definition of 'Scheduled Tribes' as 'Indigenous People' and as the Target of the STPF;
- Safeguard Policies of JICA on ST and Forest Dependents;
- Legal and Policy Framework for ST and Forest Dependents;
- Environmental and Social Risks and Mitigation Measures; and
- Framework and Procedures/Detail Procedures of STPF

EIAF and Scheduled Tribe and Forest Dweller Plan (STFDP), Environmental Checklist, and ESMS Checklist are attached in Annexure 10.4, Annexure 10.5, and Annexure 10.6 respectively.

10.8. Gender Mainstreaming

Gender mainstreaming is a process to identify development issues, needs, and impacts from a gender perspective, in all stages of planning, implementation, monitoring, and evaluation of development policies, programs, and projects.

As seen in other states in India, women are taking an important role in the forest management, in particular NTFP related works. Under the TAP and TBGP, JFMCs and EDCs were formulated according to the JFM policy/guideline and women participation in executive committees, as well as in project activities from the planning stage, was encouraged. Various programmes such as organization of SHGs, skills training, and microcredit, were arranged to provide opportunities for women to increase income and increase livelihood. The result of the Fact-finding Survey on Natural Resource Use for Preparatory Study on TBGCP, however, shows there is still lack of livelihood opportunities for women in the target villages. In most cases, women are entirely dependent on income from the 100 days of work provided under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), which they say is insufficient. They showed their interest to work with TNFD.

Based on the results of the previous ODA loan projects and the State Forest Policy 2018, which aims at uplifting the role of forest dependent women significantly in forest management, the Project shall enhance gender mainstreaming in its institutional arrangement, along with all the stages of project cycle, in order to make it possible for the project to reach those who are entitled to the project benefits. The Project shall develop gender mainstreaming strategy and action plan during the preparatory stage. Appropriate gender training shall also be proposed for all levels of project implementation units and stakeholders. The gender monitoring system shall also be institutionalised in the Project.

For this purpose, the project shall engage gender specialist during the preparatory phase to prepare a Gender Action Plan (GAP) for the project including monitoring and evaluation (M&E) mechanism, as well as project implementation measures. In the subsequent support for implementation and M&E of GAP shall be assisted by PMC. The indicative Terms of Reference (TOR) of the national specialist on gender and indicative outline of GAP are given in Annexure 10.7 and Annexure 10.8 respectively.

10.9. Project Cost Estimate

10.9.1. Project Cost Estimate

(1) Preconditions for Cost Estimate

The Project cost shall be estimated based on the following preconditions:

1) Preconditions for Project cost estimate as of November 2021 Provided by JICA

- The project period is ten (10) years, and the unit costs were estimated based on the constant price of June 2021 in Indian Rupees.

- The following exchange rates were applied:

INR 1 = JPY 1.53   USD 1 = INR 74.5   USD 1 = JPY 114

The average inflation rate (the average wholesale price index (WPI) and consumer price index (CPI) from 2011 to 2020) was estimated as 4.65%, and the average exchange fluctuation rate was 1.92% in the same years. As a result, the price escalation rate for the local currency portion was estimated as 2.73% (= 4.65% - 1.92%). It is following to use the above values to JICA instruction as "Precondition for JICA loan in 2021", and the below tables are the database of the calculation for the above rate.

Table 10.81: Estimated Average Inflation Rate from 2011 to 2020 in Borrowing Country

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
WPI		109.47	117.47	123.83	127.98	123.01	122.94	127.17	132.59	135.09	146.35
	Rate of Change		107%	105%	103%	96%	100%	103%	104%	102%	108%
	Mean Rise Rate	103.28%									
CPI		108.86	119	132.16	140.95	147.87	155.18	160.35	166.67	172.88	184.33
	Rate of Change		109%	111%	107%	105%	105%	103%	104%	104%	107%
	Mean Rise Rate	106.03%									

Source: IFS (Prices, Producer Price Index, All Commodities, Index, Prices, Consumer Price Index, All items, Index)

Table 10.82: Estimated Average Exchange Fluctuation Rate from 2011 to 2020

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual Average Exchange Rate (Domestic currency/ USD)	46.7	53.4	58.6	61.0	64.2	67.2	65.1	68.4	70.4	74.1
Annual Average Exchange Rate (Domestic currency/ Yen)	0.585	0.670	0.600	0.576	0.530	0.618	0.581	0.619	0.646	0.694
Rate of Change		115%	90%	96%	92%	117%	94%	107%	104%	107%

Source: IFS (Exchange Rates, Domestic Currency per US Dollar, Period Average, Rate)

Average currency exchange fluctuation (against Japanese Yen) = 1.92%

Similarly, the price escalation rate for the foreign currency portion was estimated as 1.86%.

A 5% physical contingency was applied.

2) GST (Goods and Services Tax)

GST (Goods and Services Tax) has been calculated according to the contents in Goods and Services.

(2) Price Adjustment

A value of a unit cost in a past base year shall be adjusted to the value for 2021 with the following price indices: The unit cost referred from a past base year shall be multiplied by the price index in the table below to adjust for 2021 price. The price indices were calculated based on the average inflation rate (the average WPI and CPI between 2011 and 2020) as mentioned above. The price indices to adjust for 2021 price from 2010 are shown in the Table 10.83.

Table 10.83: Price Indices Used for Price Adjustment to the Value for 2021

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Price Indices		1.58	1.43	1.34	1.28	1.22	1.18	1.13	1.09	1.02	1.00

Source: Compiled by the Study Team based on the preconditions provided by JICA

10.9.2. Project Cost

(1)   Summary of Cost Estimate

Close to the Public

Table 10.84: Summary of Costs

Close to the Public

(2)   Project Component (Base Cost)

Close to the Public

(3)   Price Escalation

Close to the Public

(4)   Physical Contingency

Close to the Public

(5)   Consulting Services

Close to the Public

(6)   Taxes and Duties

Close to the Public

(7)   Annual Fund Requirement

Close to the Public

Table 10.85: Annual Fund Requirement

Close to the Public

(8)   Currency Component

Close to the Public

Table 10.86: Division of Foreign and Local Currencies

Close to the Public

Close to the Public

(9)   Financial Plan

Close to the Public

Table 10.87: Summary of the Financial Plan by Component

Close to the Public

10.10.   Project Evaluation

This section illustrates the results of the cost benefit analysis and the calculation of CO_2 emission reduction.

10.10.1. Cost Benefit Analysis

(1)   CO$_2$ Reduction

Based on the CO$_2$ reduction estimation result, the economic value of CO$_2$ reduction is estimated. For the valuing of reductions of CO$_2$ emissions in monetary terms, the price per ton of CO$_2$e is conservatively set at US$3.0, based on a study of opportunity cost per ton of CO$_2$e.[20] The CO$_2$ reduction estimation results are shown in Table 10.88.

Table 10.88: Value Calculation for CO$_2$ Reduction

Year	Component A Reduction (tCO$_2$/year)	Component B Reduction (tCO$_2$/year)	Total Reduction (tCO$_2$/year)	Unit Price (INR/tCO$_2$)	Value (1,000INR/year)
2	2,322	236,553	238,875	148.52	35,480
3	6,966	236,553	243,519	148.52	71,303
4	9,287	236,553	245,840	148.52	106,782
5	9,287	236,553	245,840	148.52	150,666
6	9,287	236,553	245,840	148.52	185,800
7	9,287	236,553	245,840	148.52	220,933
8	9,287	236,553	245,840	148.52	304,067
9	9,287	236,553	245,840	148.52	403,201
10	9,287	236,553	245,840	148.52	1,085,585
11	9,287	236,553	245,840	148.52	1,256,469
12	9,287	236,553	245,840	148.52	1,411,603
13	9,287	236,553	245,840	148.52	1,534,737
14	9,287	236,553	245,840	148.52	1,655,870
15	9,287	236,553	245,840	148.52	2,543,004
16	9,287	236,553	245,840	148.52	2,582,388
17	9,287	236,553	245,840	148.52	2,702,272
18	9,287	236,553	245,840	148.52	2,727,406
19	9,287	236,553	245,840	148.52	2,724,540
20	9,287	236,553	245,840	148.52	1,343,674
21	9,287	236,553	245,840	148.52	1,892,807
22	9,287	236,553	245,840	148.52	1,789,191
23	9,287	236,553	245,840	148.52	1,750,325
24	9,287	236,553	245,840	148.52	1,713,459
25	9,287	236,553	245,840	148.52	1,692,593
26	9,287	236,553	245,840	148.52	1,097,727
27	9,287	236,553	245,840	148.52	1,090,860
28	9,287	236,553	245,840	148.52	1,097,994
29	9,287	236,553	245,840	148.52	1,093,128
30	6,966	236,553	243,519	148.52	1,415,917
31	2,322	236,553	238,875	148.52	1,426,361
32	-	236,553	236,553	148.52	3,381,150
33	-	236,553	236,553	148.52	3,392,284
34	-	236,553	236,553	148.52	3,427,418
35	-	236,553	236,553	148.52	5,763,552
36	-	236,553	236,553	148.52	5,798,686
37	-	236,553	236,553	148.52	3,889,820
38	-	236,553	236,553	148.52	3,924,954
39	-	236,553	236,553	148.52	3,960,087
40	-	236,553	236,553	148.52	3,995,221

Source: Developed by the Study Team

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[20] "The Financial Costs of REDD: Evidence from Brazil and Indonesia", IUCN, 2009.

(2)   Cost Benefit Analysis

The economic internal rate of return (EIRR), net present value (NPV), and cost-benefit ratio (B/C) of the TBGCP were calculated to assess the economic viability of the project based on the projected economic cash flow. The EIRR 13.3%, which is higher than the discount rate of 12%, and the NPV and B/C are 2,668,598 thousand INR and 6.969, respectively (Table 10.89), so that the can be said to be economically viable.

Table 10.89: Results of Cost-Benefit Analysis

Year	Economic Cost (Rs. 1,000) Investment Cost	O&M Cost[1]	Total Economic Cost (Rs. 1,000)	Net Economic Benefit (Rs. 1,000) D Component B Teak/Other broadleave CO2 reduction	Timber & seed	Component A Mangrove CO2 reduction	Total	D-(Total Economic cost) (Rs. 1,000)
1	869,195	0	869,195		0		0	-869,195
2	1,575,016	0	1,575,016	35,133	0	345	35,478	-1,539,538
3	1,382,496	0	1,382,496	70,266	0	1035	71,300	-1,311,196
4	1,229,511	0	1,229,511	105,399	0	1379	106,778	-1,122,733
5	1,063,962	0	1,063,962	140,531	8,750	1379	150,661	-913,302
6	751,762	0	751,762	175,664	8,750	1379	185,794	-565,969
7	377,063	0	377,063	210,797	8,750	1379	220,926	-156,136
8	175,601	0	175,601	245,930	56,750	1379	304,059	128,459
9	99,015	0	99,015	281,063	120,750	1379	403,192	304,177
10	0	75,236	75,236	316,196	768,000	1379	1,085,575	1,010,339
11	0	75,236	75,236	351,329	903,750	1379	1,256,458	1,181,222
12	0	75,236	75,236	386,461	1,023,750	1379	1,411,591	1,336,355
13	0	75,236	75,236	421,594	1,111,750	1379	1,534,724	1,459,487
14	0	75,236	75,236	456,727	1,197,750	1379	1,655,856	1,580,620
15	0	75,236	75,236	491,860	2,049,750	1379	2,542,989	2,467,753
16	0	75,236	75,236	526,993	2,054,000	1379	2,582,372	2,507,136
17	0	75,236	75,236	562,126	2,138,750	1379	2,702,255	2,627,019
18	0	75,236	75,236	597,258	2,128,750	1379	2,727,388	2,652,152
19	0	75,236	75,236	632,391	2,090,750	1379	2,724,521	2,649,284
20	0	75,236	75,236	667,524	674,750	1379	1,343,654	1,268,417
21	0	75,236	75,236	702,657	1,188,750	1379	1,892,786	1,817,550
22	0	75,236	75,236	737,790	1,050,000	1379	1,789,169	1,713,933
23	0	75,236	75,236	772,923	976,000	1379	1,750,302	1,675,066
24	0	75,236	75,236	808,056	904,000	1379	1,713,435	1,638,199
25	0	75,236	75,236	843,188	848,000	1379	1,692,568	1,617,332
26	0	75,236	75,236	878,321	218,000	1379	1,097,701	1,022,464
27	0	75,236	75,236	913,454	176,000	1379	1,090,833	1,015,597
28	0	75,236	75,236	948,587	148,000	1379	1,097,966	1,022,730
29	0	75,236	75,236	983,720	108,000	1379	1,093,099	1,017,863
30	0	75,236	75,236	1,018,853	396,000	1035	1,415,887	1,340,651
31	0	75,236	75,236	1,053,986	372,000	345	1,426,330	1,351,094
32	0	75,236	75,236	1,089,118	2,292,000	0	3,381,118	3,305,882
33	0	75,236	75,236	1,124,251	2,268,000	0	3,392,251	3,317,015
34	0	75,236	75,236	1,159,384	2,268,000	0	3,427,384	3,352,148
35	0	75,236	75,236	1,194,517	4,569,000	0	5,763,517	5,688,281
36	0	75,236	75,236	1,229,650	4,569,000	0	5,798,650	5,723,414
37	0	75,236	75,236	1,264,783	2,625,000	0	3,889,783	3,814,546
38	0	75,236	75,236	1,299,916	2,625,000	0	3,924,916	3,849,679
39	0	75,236	75,236	1,335,048	2,625,000	0	3,960,048	3,884,812
40	0	75,236	75,236	1,370,181	2,625,000	0	3,995,181	3,919,945
			9,855,945 (Sum of economic cost)				EIRR	13.3%

*1 The O&M cost is estimated at 1% of the economic investment cost.

NPV   2,668,598

B/C   6.969

Source: Developed by the Study Team

10.10.2. Calculation of CO_2 Emission Reduction

Forest management activities in Component A and B regarding afforestation, will contribute to reduction of CO_2 emissions through increases in the carbon stock because of growing trees. The following parts explain the procedure of the estimation of amount of CO_2 emission reduction.

(1)   Methodology

Forest carbon stocks were measured for mangrove plantation in Component A using the guideline of Intergovernmental Panel on Climate Change (IPCC) Chapter 4: Coastal Wetlands Tropical Dry, and for teak/broad-leaved tree afforestation in Component B through JICA Climate Finance Impact Tool for Mitigation Draft Ver.3.0 (September 2019). The amount of CO_2 sequestration was estimated at the point of 40 years after planting trees and starting planting trees.

a. CO_2 Sequestration by mangrove plantation

JICA Climate Finance Impact Tool for Mitigation is developed for inland forest, not for wetland forests like mangroves. Thereby CO_2 Sequestration in mangrove plantation in Component A was estimated using the default values indicated in the guideline of IPCC Chapter 4: Coastal Wetlands in the following calculation (Table 10.90).

Table 10.90: Steps for the CO_2 Sequestration estimation of mangrove plantation

No.	Items of Calculation	Formula	Unit
1.	Above-ground biomass at time t under the project scenario	T(t)i	t d.m./ha
2.	Carbon stocks in above-ground biomass at time t under the project scenario (NA(t)i)	T(t)i x 0.451	t C/ha
3.	Carbon stocks in below-ground biomass at time t under the project scenario (NB(t)i)	NA(t)i x 0.29	
4.	Total carbon stocks at time t	(NA(t)i + NB(t)i)	
5.	Baseline net Greenhouse Gas (GHG) removals by sinks (ΔCproj,t)	Conversion ratio from C to CO_2 is 44/12	t CO_2/ha
6.	Leakage attributable to the project activity at time t (Lt)	ΔCproj,t x 0.15	
7.	Net anthropogenic GHG removals by sinks	ΔCproj,t - Lt	

Source: Developed by the Study Team

b. CO_2 Sequestration by Afforestation of Component B

CO_2 sequestration by afforestation of teak and broad-leaved trees in component B was calculated with JICA Climate Finance Impact Tool for Mitigation. In this tool, the amount of CO_2 sequestration is automatically calculated just by entering the planted area into the tree type. Default values of the tool were cited from IPCC Good Practice Guidance for Land Use, Land-use Change, and Forestry (LULUCF) Annex 3A. The calculation is based on the following grounds.

The amount of CO_2 sequestration in afforestation in the Project was estimated by the following equation.

$$ER_{AR,y} = C_{PJ,y} - C_{BL,y}$$

Where,
$C_{PJ,y}$: CO_2 sequestration with the Project in year 40 (t-CO_2)
$C_{BL,y}$: CO_2 sequestration without the Project in year 40; Baseline (t-CO_2) = 0

The amount of CO_2 in each activity area was produced in the following calculation.

$$C = C_s \times SD \times A \times 44/12$$

Where,
C   : CO_2 stock in the Project site (t-CO_2)
C_s : Carbon stock per tree (t-C/tree)
SD   : Tree stand density (trees/ha)
A   : Area (ha)

$$C_s = (AGB + BGB) \times C_c = AGB \times (1 + R) \times C_c$$

Where,
AGB : Above ground biomass (t-dm/tree)
BGB : Below ground biomass (t-dm/tree)
R : Root/Shoot Ratio
C_c : Carbon content (%)

$$ABG = V \times WD$$

Where,
V   : Tree volume of above ground (m^3/tree) gained by the volume equation
WD : Wood density (t-dm/m^3)

c.   **Total area, volume equations and variables used in the estimation**

Aboveground biomass growth in mangrove forests (tonnes d.m. ha-1 yr^{-1}) was set for 3.3[21][22][23] which is the default value in Tropical Dry region where Tamil Nadu state is located. Biomass growth rates are from forests of varying age so that the default value was applied only pertain to forests until the C biomass stock (=92 tonnes d.m. ha^{-1})[24][25][26][27][28][29][30] is reached. In Tamil Nadu, 30 years are the year where C biomass stock reached 90 tonnes d.m. ha^{-1} so that project period was set for 30 years (Table 10.91).

Tables below list the tree species, volume equations and variables used in the estimation.

[21] Ajonina, G.M. 2008. Inventory and Modelling Mangrove Forest Stand Dynamics Following Different Levels of Wood Exploitation Pressures in the Douala-Edea Atlantic Coast of Cameroon, Central Africa. Ph.D. Dissertation, Freiburg im Breisgau, Germany, 232 p.

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Table 10.91: Total Area and Tree Species for the CO_2 Sequestration Estimation

Type of plantation	Total area (ha)	Tree Species used for calculation
Mangrove plantation	1,400	*Not specified*
Teak plantation	800	*Tectona grandis Azadirachta 800ha, Ailanthus*
Broad-leaved plantation	3,200	*excelsa 800ha, Milea dubia 800ha, Others 800ha*

Source: Developed by the Study Team

(2)   Result of CO_2 emission reduction in the Project

The estimation results indicate that the Project will contribute to a total of 9,722,160 t-CO_2 sequestration and emissions reduction in 40 years (Table 10.86).

Table 10.92: CO_2 Sequestration and Emissions Reduction in the Project

Project activity	Area (ha)	Project period (year)	Total CO_2 sequestration/reduction (t-CO_2)	Average annual CO_2 sequestration/reduction (t-CO_2/y)
Mangrove plantation	1,400	30	260,046	6,501
Teak +Broad-leaved afforestation	4,000	40	9.462,120	236,553
Total	5,400		9,722,166	243,054

Source: Developed by the Study Team

10.11.   Security Management (Risk Management and Safety Management)

10.11.1. Risk Management

During the implementation of TBGCP, there will be several risks that might hamper the progress and achievement of TBGCP. These risks include multiple aspects such as capacity, governance, finance, and crime. The outline of risk management flow is shown below and is also summarised in Annexure 10.11, using a format provided by JICA.

- Identify risks
- Conduct qualitative/quantitative analysis
- Plan risk responses and monitoring method

10.11.2. Safety Management

This section corresponds to the appraisal material of Attachment 23: Measurement for Security Management.

(1)   Safety Management Survey

An interview survey was conducted to understand the actual local situation of security in the state by collecting information by the series of questions through both having interviews with officers of TNFD and TBGP. As a result of the interviews with relevant officers, it was found that there is no region or event that negatively impacts the project implementation of TBGCP as of November 2021. However, since the mobilization of experts was limited, it will be required to update and elaborate these information whenever needed.

(2)   Measures against Insecurities

Although the state does not have serious security risks at present, measures to avoid and mitigate risks should be taken. In the following parts, measures to ensure safety in the field, residences, and trips to the field are explained.

General and Before Journey

The following measure will be required in general and before journey.

i. Collect and analyze information on rebels, as well as on political situations, through local newspapers and television programs to avoid any conflicts and danger.
ii. Seek neutral third-parties' inputs and advice regarding on-ground political alignments from nodal officers while interacting with local groups regarding the project and its activities.
iii. Contact the concerned institutions (e.g. Range Forest Officers) regarding security, and ask for guidance before visiting the Project site
iv. Appoint reliable security guards who are equipped with arms and have had official training facilitated by the government
v. Plan routes to the Project site that Project members know ahead departure and arrival
vi. Plan an alternative route in case of necessity
vii. Report travel details, including persons who travel, routes, time of departure and arrival, transportation, assigned drivers, contact information of Project members, and submit these to the security department
viii. Hire or appoint reliable drivers who have had training for security as well as first aid
ix. Develop an emergency evacuation plan and security management procedure and nominate persons for security and safety management with clear roles and responsibility
x. Undergo security management and awareness training on arrival in India or the state
xi. Avoid any criticism of the government, political parties, religious or indigenous groups
xii. Avoid overnight stay at the field level/forest guesthouses that are away from the town.
xiii. Wear comfortable attires during the visit

During Journey

The following measure will be required during journey.

i. Work and move in day-time before getting dark
ii. Ensure all vehicles display the emergency numbers of the police, fire station, ambulance etc.
iii. Use a system or apps that can track the location of persons in the field
iv. Report arrival to security personnel in charge, and if no report is received by the expected arrival time, security personnel thereafter alerts a manager at a higher level
v. Avoid mining sites and areas neighbouring different tribes unless it is necessary, since aggressive groups or persons likely often appear at coal mining sites and conflicts might happen.
vi. avoid asking or speaking negative statements/comments about local culture/government while interacting with communities
vii. Avoid providing any gifts or money for the project/work done to the communities
viii. Always travel along with the local Forest Department officials and never alone

Safety Practices in emergency

The following measure will be required during journey.

i. In case of an attack by insurgent groups, move away from the place immediately
ii. When an insurgent event happens outside a hotel or place of residence, close the drapes, stay away from the windows, and turn off the lights
iii. In confronting extortion, give all valuables and do not resist or attempt to pursue the rebel

Annexures

Annexure 10.1: List of the Target Division Management Units

S.No	DMU	CODE	Circle
1	DFO, Puthukkottai	DFO	TIRUCHIRAPPALLI
2	DFO, Ariyalur	DFO	TIRUCHIRAPPALLI
3	FE, Perambalur	FE	TIRUCHIRAPPALLI
4	FE, Trichy	FE	TIRUCHIRAPPALLI
5	DFO, Perambalur	DFO	TIRUCHIRAPPALLI
6	DFO, Trichy	DFO	TIRUCHIRAPPALLI
7	Forest Extension Office, Thoothukudi	FE	TIRUNELVELI
8	DFO, Chengalpattu, SF	SF	CHENNAI
9	DFO, Thiruvallur	DFO	CHENNAI
10	DFO, Chengalpattu	DFO	CHENNAI
11	FE, Kanchipuram	FE	CHENNAI
12	FEO, Thiruvallur	FE	CHENNAI
13	DFO, Vellore	DFO	VELLORE
14	DFO, Tiruvannamalai	DFO	VELLORE
15	DFO, Tirupattur Division	DFO	VELLORE
16	FE, Vellore	FE	VELLORE
17	FE, Tiruvannamalai	FE	VELLORE
18	DFO, Dharmapuri	DFO	DHARMAPURI
19	DFO&SF, Dharmapuri	DFO	DHARMAPURI
20	WLW, HOSUR	WLW	DHARMAPURI
21	DFO, Krishnagiri	DFO	DHARMAPURI
22	DFO, SF Krishnagiri	SF	DHARMAPURI
23	Circle/DFO, Salem Office	DFO	SALEM
24	DFO&SF, Salem	SF	SALEM
25	Sidharkoil FE Office	FE	SALEM
26	Athanur FE Office	FE	SALEM
27	DFO, Namakkal	DFO	SALEM
28	DFO, COIMBATORE	DFO	COIMBATORE
29	DFO, Gudalur	DFO	COIMBATORE
30	DFO, Nilgiris	DFO	COIMBATORE
31	FE, Coimbatore	FE	COIMBATORE
32	DFO, Cuddalore	DFO	VILLUPURAM
33	FE, Cudddalore	FE	VILLUPURAM
34	Neyveli FE Office	FE	VILLUPURAM
35	DFO Villupuram	DFO	VILLUPURAM
36	Ulundurpet FE office	FE	VILLUPURAM
37	DFO, Thiruvarur	DFO	THANJAVUR
38	FE office, Thiruvarur	FE	THANJAVUR
39	DFO, Thanjavur	DFO	THANJAVUR
40	WLW, Nagapattinam	WLW	THANJAVUR
41	Forest Extension Office, Nagapatinam	FE	THANJAVUR
42	Forest Extension Office, Thanjavur	FE	THANJAVUR
43	DFO, Dindigul	DFO	DINDIGUL
44	DFO, Karur	DFO	DINDIGUL
45	SF, Dindigul	SF	DINDIGUL
46	FE Office, Karur	FE	DINDIGUL
47	WL Kodaikanal	WLW	DINDIGUL

48	Dinigul Forest Extension Office	FE	DINDIGUL
49	DFO, Theni	DFO	MADURAI
50	WLW, Megamalai	WLW	MADURAI
51	DFO, Madurai	DFO	MADURAI
52	FE, Madurai	FE	MADURAI
53	DFO, Sivagangai	DFO	VIRUDHUNAGAR
54	WLW, Srivilliputtur	WLW	VIRUDHUNAGAR
55	FEO Srivilliputtur	FEO	VIRUDHUNAGAR
56	DFO, Ramnathapuram	DFO	VIRUDHUNAGAR
57	WLW, Ramanathapuram	WLW	VIRUDHUNAGAR
58	SF, Virudunagar	SF	VIRUDHUNAGAR
59	FE, Sivaganga	FE	VIRUDHUNAGAR
60	District Forest Officer, Tirunelveli	DFO	TIRUNELVELI
61	DFO, Thoothukudi	DFO	TIRUNELVELI
62	WLW, Kanniyakumari	WLW	TIRUNELVELI
63	Forest Extension Office, Thoothukudi	FE	TIRUNELVELI
64	Forest Extension Office, Ponnagudi	FE	TIRUNELVELI
65	DFO, Erode	DFO	STR
66	Erode FE Office	DFO	STR
67	DD, Sathyamangalam	DFO	STR
68	Director's Office, AAZP	DFO	AAZP
69	DD,ATR Udumalpet	DFO	ATR
70	Forest Extension Office, Tiruppur	FE	ATR
71	DD, ATR Pollachi	DFO	ATR
72	DD, MTR, Udagai	DFO	MTR
73	Ambasasamudram DD Office	DFO	KMTR
74	Kalakad DD office	DFO	KMTR
75	Coimbatore TNFA DMU	TNFA	TNFA
76	VAIGAIDAM DMU	TNFA	TNFA
77	Nursery, Thoppur Central	RW	RESEARCH
78	Kolapakkam SFRI DMU	RW	RESEARCH
79	Madurai Agro DMU	RW	RESEARCH
80	Trichy industrial wood	RW	RESEARCH
81	PCCF OFFICE(DCF BUDGET)		HO

Source: TNFD

Annexure 10.2: Indicative Qualification of Project Management Consultant

Close to the Public

Close to the Public

Close to the Public

Close to the Public

Close to the Public

Annexure 10.3: Indicative Scope of Works for the Respective Experts

Close to the Public

Close to the Public

Close to the Public

Close to the Public

Close to the Public

Annexure 10.4: Environment Impact Assessment Framework (EIAF)

Environment Impact Assessment Framework (EIAF) and Scheduled Tribe Forest Dweller Plan Framework (STDFPF)

For

Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project

Chapter 1.   Outline of the EIAF and STFDPF

The Environmental Impact Assessment Framework (EIAF) for the Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project (TBGCP) is the primary reference document outlining how environmental and social considerations will be addressed in project design and implementation.

The Scheduled Tribes and Forest Dependents Plan Framework (STFDPF) is to be applied as an additional framework that works together with the EIAF. The STFDPF is specifically applied in situations where Scheduled Tribes (ST), Scheduled Castes (SC), Other Backward Classes (OBC), forest dwellers and other forest dependents are affected by project activities and provides guidance for specific measures which may be required in addition to the provisions of the EIAF.

EIAF and STFDPF refer to the other safeguards tools which are intended to concentrate on or elaborate specific aspects (i.e., micro plan, social assessment plan etc.).

1.1.   Objective of the EIAF and STFDPF

EIAF helps to establish a process for environmental and social safeguards which enables JICA and the executing agency (EA) of the Project better manage environmental and social risks of projects and to improve development outcomes. In the process, the framework also determines the institutional measures to be taken during the program implementation.

The objectives of the EIAF and STFDPF are summarized as:

1) To provide a broad framework for the identification, management and monitoring of potential environmental and social risks arising under the Project;

2) To enhance the Project's positive environmental and social impacts and avoid or otherwise mitigate associated negative impacts;

3) To ensure that the rights and needs of forest dependents and their communities affected by or involved in the Project, are respected and met in the design and implementation of project interventions; and

4) To ensure the protection of local ecosystems and environmental resources in the design and implementation of project interventions.

1.2.   Structure of the EIAF and STFDPF

The structure of the EIAF is as follows:

1) Summary of the Project: It briefly describes the project framework and sub-projects.

2) Environmental and Social Safeguard Policies of JICA: It briefly describes JICA's environmental and social safeguard policies, and clarifies how the Project shall be categorized and what types of measures will be required.

3) Clarifying Definition and Selection of Safeguard Frameworks: It analyses and defines the key technical terms, and select appropriate safeguard frameworks to be applicable for the Project.

4) Target Groups of EIAF and STFDPF: It defines beneficiaries.

5) Existing Environmental and Social Management Systems: Outline of the legal and policy

context for environmental and social safeguard in India as well as in the Tamil Nadu State.

6) Environmental and Social Risks and Mitigation Measures: An assessment of potential positive and negative environmental and social aspects associated with the Project, as well as measures for the mitigation of adverse risks in project design and implementation.

7) Framework and Procedures/ Detail Procedures of EIAF: It indicates the institutional framework and identifies procedures for management and mitigation of environmental and social risks of the project cycle. Social assessment to determine community needs and priorities, to obtain their views on the design and proposed implementation mechanisms of the Project is also covered here.

8) Framework and Procedures/ Detail Procedures of STP: It indicates the preparation of STP and the detail procedures of STP.

9) Capacity Development Requirements for EIAF and STP Implementation: The capacity development and training rrequirements for effective implementation of the EIAF are identified.

Chapter 2. Summary of the Project

2.1. Project Goal

Project goal and outputs of the TBGCP are described in the following table.

Project Goal and Objectives

Project Goal	To mitigate and adapt to climate change and improve biodiversity conservation by ecosystem improvement, human wildlife conflict mitigation measures, strengthening supply chain development for forest produce, livelihood improvement activities and institutional strengthening in Tamil Nadu
Project Purposes	1) To mitigate and adapt to climate change and improve biodiversity conservation through improvement of marine and land ecosystems. 2) To mitigate human wildlife conflict 3) To strengthen supply chain development for forest produce 4) To improve livelihood of local communities 5) To strengthen management capacity of forest department
Outputs	1) Mitigation and adaptation to climate change are increased by ecosystem improvement. 2) Biodiversity is maintained or increased by conservation of critical and sensitive ecosystems and/or removal of invasive species. Ecological services originated from ecosystems are improved and human-wildlife conflicts are reduced through improvement of management systems and effectiveness. 3) Wood and forest resources and their utilization are increased in the eco-development areas, rural areas and urban- peri urban areas. 4) Livelihood of households that engage in ecotourism and ecodevelopment activities are improved. 5) Management capacity of the government agencies is strengthened with training, infrastructure development and placing systems in place.

2.2. Project Phase

The proposed project has 8 years project period: 2022-2030. It has three stages, namely one-year preparatory phase, five-year implementation phase and two-year phasing out stage.

Project Phases

Phase	Year	Project Activities
Preparatory phase	2022 - 2023	Setting up PMU and other required units, selection of Project Management Consultants (PMC), preparation of all manuals including Operational & Accounting procedures (Operation Manual providing detailed guidelines for project implementation), procurement and micro planning manuals, compendium of on-going government programs/schemes, selection of resource organizations/teams of NGOs, preparation of maps and datasets necessary to implement the TBGCP, finalization of selection criteria, orientation of PMU and other required units, initiating required strengthening/development of infrastructure, site preparation, and selection of sites for raising nurseries for quality planting material and baseline surveys
Implementation phase	2023 - 2028	Preparing implementation plans in the first batch, including ecosystem based climate change measures and promoting supply chain development of forestry products, as well as livelihood improvement activities, selection of remaining project village, and implementing project activities in subsequent batch of villages in phased manner.
Phasing-out phase	2028- 2030	Ensuring sustainability of assets created under the Project, internalizing Project learning, experiences, procedures, and best practices evolved in the course of Project implementation, and transferring charges of all assets created under the project and documents.

2.3. Project Component Structure

The proposed project has the following structure.

Project Component

	Project Component	Activities
1	Ecosystem Based Climate Change Measures	Climate Change Measures (Mitigation and Adaptation) utilizing marine and land ecosystems.
2	Human Wildlife Conflict Measures	Mitigation of human-wildlife conflict
3	Promoting Supply Chain Development	Promotion of supply chain development, Forest research
4	Livelihood Improve Activities	Ecotourism (Genepool Garden in Gudalurs and four circuits in the Eastern Ghats), Ecodevelopment, Soil and Moisture Conservation, Preservation of Traditional Knowledge Among Tribal and Local People, Heritage Conservation, Soil and Conservation Measures
5	Management Capacity Development	Map preparation, Infrastructure and mobility, Capacity Development, Pilot study, Monitoring and Evaluation

Chapter 3. Environmental and Social Safeguard Policies of JICA

3.1. JICA Principles for Environmental and Social Considerations

It is necessary to ensure that the project is implemented in compliance with JICA Environmental and Social Consideration. JICA encourages JICA's partners, including host countries, borrowers, and project proponents, to implement the appropriate measures for environmental and social considerations when engaging in cooperation activities. At the same time, JICA provides support for and examinations of environmental and social considerations in accordance with the guidelines. The outline of the guideline is summarized below.

I. General

- Assessment of wide range of environmental and social impacts will be carried out in the JICA projects/programs.

- Environmental and social issues should be taken into consideration during the initial design and planning stages throughout the project cycle.

- JICA is responsible for accountability and transparency in project execution.

- Stakeholder consultation/participation is required in consideration of environmental/ social issues.

- Proper information disclosure systems should be prepared.

- Considering the guidelines in project planning and execution should contribute to institutional capacity building of the implementing agencies for proper implementation of environmental and social safeguards as envisioned in the JICA Policy.

- JICA is committed to addressing environmental and social issues in a prompt/ timely manner.

II. Indigenous People

These considerations address the issue of indigenous People in the project area. They are as mentioned below:

- Avoiding implementation of interventions that may have adverse impacts on indigenous peoples in the planning stage itself.

- Ensuring that there is minimum impact and all steps are taken to mitigate any adverse impact that may arise in case of an unavoidable situation.

- Taking all steps possible to uphold all the rights of the indigenous people pertaining land and resources in accordance with the respective international declarations and treaties like the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).

- Implementing the process of free, prior and informed consultation for obtaining the consent of indigenous peoples for implementation of the project.

- Preparing an Indigenous Peoples Plan in order to achieve the above stated objectives, for which JICA guidelines prescribe the World Bank Safeguard Policy OP 4.10 Annexure B as the appropriate policy document.

World Bank Operational Policy 4.10 (OP4.10) on Indigenous Peoples

In order not to have many different standards, JICA refers to international policies, procedures and standards such as those of the World Bank in part. For the current project in spite of the fact that JICA has special concerns for the Indigenous Peoples, it does not have a separate detailed policy, but refers to the World Bank Operational Policy 4.10 (OP4.10) on Indigenous Peoples.

3.2. Key Process Elements

JICA's key process elements for environmental and social considerations is summarised below:

Project Categorisation:

Projects are categorized according to the scope/severity of the environmental and social impacts or risks, as follows:

Category	Description
Category A	Significant adverse impacts e.g. Large-scale development/ infrastructure Large-scale involuntary resettlement, projects in sensitive areas e.g. National Park
Category B	Generally site-specific impacts, few impacts are irreversible, normal mitigation measures can be designed
Category C	Minimal/little adverse impact
Category FI (Financial intermediary)	Substantial selection and appraisal of intervention after JICA approval of funding

Source: Compiled based on the JICA Guidelines for Environmental and Social Considerations 2010

At this stage, the TBGCP is categorized as FI, but after finalizing the loan agreement and contents of the sub-projects, each sub-project will be reviewed based on the result of the impact assessment and categorized as A, B, or C based on the result of the review.

If some of sub-projects are categorized as B, it is necessary for PMU to prepare and implement the Environment Management Plan (EMP) and Environment Monitoring Plan (EMoP), according to the JICA Guideline. In addition, based on the result of the monitoring, a report of environment and social consideration has to be prepared and submitted to JICA, separately from the project management report.

Impacts Assessment

In order to assess the impacts a wide range of environmental and social considerations are taken into account with view towards both enhancing positive benefits and avoiding/ mitigating negative impacts.

Type of Impact	
Environmental Impact	Natural Environment - air, water, land Systems - water usage, climate change, ecosystems, Scale – local, regional, boundary/ global scale impacts
Social Impact	On community/people's - lands, economies, livelihoods, employment, natural resources; − resettlement, local conflicts − gender, vulnerable groups, indigenous peoples, children; − social institutions, health, cultural heritage, existing social infrastructures and services, equality of benefits and losses, local conflicts, working conditions, etc.

Information Disclosure and Consultation:

JICA requests that proponents disclose information on the environmental and social impact of the Project both to JICA as well as local stakeholders well in advance of implementation. Frameworks for consultation and information disclosure need to be developed and agreed.

3.3. Compatibility with International Standards

The JICA Guidelines for Environmental and Social Considerations state that JICA's projects must not deviate significantly from the World Bank's Safeguard Policies, and that JICA should refer to the internationally recognized standards and good practices, including those of the international financial organizations, when appropriate.

JICA refers to international policies, procedures and standards such as those of the World Bank in

part so as to avoid further proliferation of safeguards approaches and standards. Of relevance to the Project, although JICA has special concerns related to Indigenous Peoples, it does not have a detailed policy with explicit procedures for situations where such peoples are affected by projects and refers to the World Bank Operational Policy 4.10 (OP4.10) on Indigenous Peoples. Thus, the contents and format of the safeguards framework elaborated for the Project follows that indicated in the World Bank OP 4.10, as requested by JICA for the preparation of the Project.

3.4. Project Categorisation by the JICA Guidelines

(1)   Categorization of the Project:

The Project is currently categorized as 'FI' in accordance with the JICA Guidelines (2010). The 'FI' classification remains valid for the following reasons:

1) JICA's funding of projects will be provided to a financial intermediary or executing agency.
2) The selection and appraisal of the sub-projects will be substantially undertaken by the executing agency only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding.
3) Sub-projects will be selected in participatory mode by communities and as such cannot be specifically defined at this stage.
4) Sub-projects with significant adverse environmental or social impacts requiring environmental clearance will be eliminated through screening procedures. However, certain potential environmental and social impacts are perceived, and there is the potential that the Project may damage protected areas and involve forest dependents (Scheduled Tribes (ST), Scheduled Castes (SC) and other forest dependents).

The Project is overall expected to have a mainly positive impact on the environment given that its primary objective is to enhance biodiversity, increase forest coverage and to improve livelihood of forest dependent people in the project areas. Although it is not possible to precisely state exactly what sub-projects will be implemented in which specific location and scale, the Project will exclude "Category A" sub-projects with a significant environmental impacts or risks.

At the time of selection, finalisation and approval of sub-projects, respective sub-projects to be categorised as either "Category B" or "Category C" according to the scope/severity of the environmental and social impacts or risks.

(2)   Definition and outline of Sub-Project:

In this document, the word of sub-project is used to represent a bunch of the activities of the Project pursuant to the JICA Guidelines. Screening and categorisation shall be carried out for each sub-project and the result shall be submitted to JICA. The list of the sub-projects are shown as below;

Sub-Projects

1. Ecosystem Based Climate Change Measures
1) Climate change measures through improvement of marine ecosystem
Coral
•   Reef Building Planning of selected site
•   Facilitation of Reef Building Planning in Communities
Seagrass/seaweed
•   Assessment of seagrass habitats
•   Seagrass transplantation work in degraded areas
•   Awareness programme for local fishermen's communities
Dugongs
•   Population survey

•	Protection by engaging anti-poaching watchers
•	Awareness programme for local fisherman communities
•	Inter-departmental co-ordination
Sea turtles	
•	Protection by engaging anti-poaching watchers
•	Mobile application for grant of rewards/compensation to fisherfolk
•	Inter departmental co-ordination
2) Climate change measures through improvement of land ecosystem	
Invasive alien species	
•	Survey and demarcation of all-inclusive species in Protected Areas
•	Removal of invaded alien species
•	Nursery establishment of indigenous/native fodder species
•	Restoration of naturalvegetation
•	Trial on utilisation of invasive species
•	Carbon management in invaded areas
Mangrove plantation	
•	Site assessment
•	Site preparation
•	Propagules preparation
•	Tending
•	Blue carbon monitoring
Promoting urban and peri-urban forestry	
•	Afforestation operation of urban and peri-urban forestry
•	Strengthening forest extension and Extension Centres
•	Central nursery establishment in each district
•	SHEP
Research and implementation of climate change measures (mitigation, adaptation) utilizing land and marine ecosystems	
India-Japan research consortium	
Wildlife research	
•	Forensic work
•	Animal care science studies
•	Wildlife policy research and development
2. Human Wildlife Conflict Measures	
Measures for human-wildlife conflict	
•	Mitigation planning
•	Improvement of corridors
•	Development of mobile application for grant of rewards/compensation to fisherfolk
•	Ecological countermeasures for pandemic prevention
Infectious diseases measures	
3. Promoting Supply Chain Development of Forestry Products	
Forest research	
•	Afforestation technology for urban and peri-urban forestry
•	Tree improvement
•	Bio-productivity enhancement
Promoting supply chain development	
•	NTFP supply chain development
•	Timber supply chain development
4. Livelihood Improvement Activities	
Ecotourism	
Genepool Garden in Gudalur	
•	Preparatory work
•	Capacity building and skill development for stakeholders
•	Development of infrastructure
•	Participatory assessment of impacts of interventions
Four circuits in the Eastern Ghats	
•	Preparatory work
•	Capacity building and skill development for stakeholders
•	Development of infrastructure
•	Participatory assessment of impacts of interventions

Ecodevelopment activities	
Ecodevelopment	
• Organization of state-level workshop	
• Orientation for communities on scope and purpose of the project	
• Training of field staff teams to design and facilitate participatory processes using appropriate tools	
• Facilitation of participatory planning for ecodevelopment plans	
• Formation of EDCs and their executive committees	
• Study tours to expose EDCs to other successful groups	
• Creation of SHGs	
• Preparation of ecodevelopment plans, addressing socio-economic and ecological requirements and opportunities including skills training	
• Implementation of ecodevelopment plans	
• Participatory assessment of impacts of interventions	
Soil and Moisture Conservation	
• Reclamation and improvement of tribal lands	
• Stone paving of paths, steps, and community utility area	
Preservation of Traditional Knowledge Among Tribal and Local People	
Heritage Conservation	
Soil and Conservation Measures	
• Construction of loose boulder check wall vegetative barrier, etc.	
• Construction of rain water harvesting structure	
5. Management Capacity Development	
Map preparation	
Infrastructure and mobility	
• GIS/MIS enhancement	
• Procurement of equipment and vehicles	
• Construction of office building	
Capacity Development	
• Identification of a Nodal Officer	
• Implementation of capacity building	
Pilot study	
Monitoring and Evaluation	
• Baseline survey;	
• Annual planning and review meeting/workshop;	
• Concurrent monitoring	
• Annual statutory audit	
• Mid-term evaluation	
• Terminal evaluation	
• Thematic studies and documentation	

3.5.   Requirements by the JICA Guidelines

As per the JICA guidelines, JICA will examine the following conditions in relations to the project implementation. The financial intermediary or the executing agency (Tamil Nadu Forest Department, TNFD) will be required to comply with the requirements of JICA as stated below.

1) Whether the related financial intermediary or executing agency will ensure appropriate environmental and social considerations as stated in the guidelines.
2) Whether institutional capacity in order to confirm environmental and social considerations of the financial intermediary or executing agency is sufficient, or if requires adequate measures be taken to strengthen the capacity.
3) Whether the financial intermediary or executing agency will examine the potential positive and negative environmental impacts of sub-projects and takes the necessary measures to avoid, minimize, mitigate, or compensate for potential negative impacts, as well as measures to promote positive impacts if any such measures are available.
4) JICA will disclose the results of environmental reviews on its website after concluding

agreement documents.
5) Over a certain period of time, JICA will confirm with the project proponents etc. the results of monitoring the items that have significant environmental impacts. This will be done in order to confirm that the project proponents etc. are undertaking environmental and social considerations for projects that fall under Categories A, B, and FI.

Chapter 4. Clarifying Definitions and Selection of Safeguards Frameworks

4.1. Defining Environmental and Social Vulnerabilities

(1) Social Vulnerability:

Social vulnerability is the status of a group of people who are typically socially excluded, frequently disadvantaged by discriminatory practices and are limited in their capacity to access benefit of development or opportunities offered in development programs. This often happens because of their social characteristics such as culture, identity, economic systems and social institutions. They are often victims of environmental vulnerability too since their land-based subsistence and livelihood may be at risk due to change in land use practices, degradation of the environment, etc.

(2) Environmental Vulnerability:

Environmental vulnerability is a condition when ecosystem integrity is threatened by anthropogenic and/or natural hazards. This could happen over spatial or temporal scales of ecosystems. Factors that impact the environment negatively and thereby reduce the resilience of the environment to sustain varies spatially. Vulnerability may increase with the intensity and frequency of human interventions and/or natural hazards.

4.2. Defining Terms

(1) "Indigenous People" in the Context of "Scheduled Tribes and Forest Dependents Plan Framework (STFDPF)" for the Project:

STFDPF is to be prepared referring to the format provided in the World Bank's OP 4.10 Annex C on Indigenous Peoples Plan Framework (IPPF). In consideration of the Word Bank's OP 4.10, the Forest (Recognition of Rights) Act 2006, and the Indian/ Tamil Nadu contexts, following categories of the people who will be affected, particularly adversely affected, by project activities to be regarded as the target of IPPF for the Project.

- Scheduled Tribes (ST)
- Scheduled Castes (SC)
- Other Backward Classes (OBC) minorities
- Forest Dwellers and Other Forest Dependents

Basically, so called "Indigenous Peoples" as per the Word Bank's definition, "Forest Dwellers" as per The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, and other forest dependents are included since the proposed Project will be mainly implemented in the forest areas through community institutions which by nature are the forest dependent communities/institutions.

The proposed Project regards both tribal and non-tribal communities who reside within and on the fringes of the forest areas and adversely affected by project activities to be the target of the IPPF. Since the targets of IPPF for the Project are not only "Indigenous Peoples" but also "Forest Dwellers/ Dependents", therefore, the term "Scheduled Tribes and Forest Dependents Planning Framework (STFDPF)" will be adopted instead of the "Indigenous Peoples Plan Framework (IPPF)". In case

there are scheduled tribes and forest dependents who may have adverse impacts of the Projects to be the target of STFDPF, "Scheduled Tribes and Forest Dependents Plan (STFDP" to be prepared for such stakeholders.

There are issues related to how tribes, castes and other minorities are defined, which may be academic in nature but have very real implications in terms of who or which groups are actually safeguarded by the national legal and policy framework as well as their eligibility for various social welfare benefits and programmes. Recognizing the historical discrimination and deprivation, list of caste and tribe were identified in government schedule as a target group for reservation policies. Anyone who does not find mention in the list of ST (in terms of Article 342 of the Indian Constitution) is considered a non-tribe and vice-versa. This is important in the case of the Project and this particular safeguard document because it means that by simply following the Government of India's classification system, some of the disadvantaged and marginalized groups may be left out.

(2)   Scheduled Tribe

The Constitution of India, Article 366 (25) refers to scheduled tribes (ST) as those communities who are scheduled in accordance with Article 342 of the Constitution. According to this Article, STs are the tribes or tribal communities or part of or groups within these tribes and tribal communities which have been declared as such by the President through a public notification.

Tamil Nadu is one of the states with the lowest proportion of ST, consisting of 1.1% of the total population. According to the Census 2011, the total ST population is 795,000, and 660,000 are living in rural areas and 134,000 are living in urban areas. There are 36 tribes and sub tribes in the State, and Malayali is the single largest ST group with the population of 358,000, followed by Irular, 190,000, and Kattunayakan, 47,000. In the State, there are six Particularly Vulnerable Tribal Groups (PVTG), Toda, Kota, Kurumbas, Irulur, Paniyan and Kattunayakan. These groups are mainly residing in the Western Ghats.

Under the TBGCP, target areas of Eco-tourism and Ecodvelopment will be selected from the Integrated Tribal Development Plan (ITDP) areas in the Eastern Ghats. The ST groups residing in the ITDP pockets of the Eastern Ghats are summarized below.

ST Groups in the ITDP Pockets in the Eastern Ghats

Districts	ITDP Areas	ST groups
Namakkal	Kolli Hills	Kolli Hills of the eastern Ghats is rich in biodiversity and ST populations. The elevation of the hills ranges between 1000 and 1500 m above mean sea level (MSL).
		The Kolli hills are majorly inhabited by the Malayali, the Irulas, Malakkuravan, Kattunayakan, and Kurumans in small number
		Most of the tribes are engaged in collecting Non-Timber Forest Products (NTFP) as their primary occupation. They are also involved in honey hunting engaged in other forest related activities. Some are involved in cultivating agricultural crops, livestock rearing, agricultural labor. All these fall under other forest and agriculture related activities.
Salem	Yercaud Hills	Yercaud is a hill station near Salem, in the Servarayan range of hills (anglicized as Shevaroys), in the Eastern Ghats. It is at an altitude of 1515 metres above the sea level.
		The Yercaud Hills are majorly inhabited by the Malayali. Malakkuravan and Irulas are also present in small numbers.
	Aranuthumalai & Kalrayan Hills	Aranuthumalai village is located in Vazhapadi Tehsil of Salem district. It is situated 45km away from sub-district headquarter Vazhapadi and 60km away from district headquarter Salem.
Tiruvannamalai	Jawadhu Hills	The Javadhu Hills (also Jawadhi, Jawadhu Hills) are an extension of the Eastern Ghats spread across parts of Vellore and Tiruvannamalai districts Nadu. Jawadhu Hill is inhabited by Malayali, Kattunayakan, Malakkuravan and Irulas.

Viluppuram	Kalrayan Hills	The Kalrayan Hills are a major range of hills situated in the Eastern Ghats. Along with the Pachaimalai, Javadi, and Shevaroy hills, they separate the Kaveri River basin to the south from the Palar River basin to the north. The hills range in height from 600 m to 900 m.
		The Kalrayan Hills are majorly inhabited by the Malayali,Kattunayakan,Malakkuravan and Irula tribes .
Dharmapuri	Sitheri Hills (Also referred to as Chitheri Hills)	It is a small hill station on the Eastern Ghats at an altitude of 1,097.3 metres, an area of 685 Km, a population of 9045 people and comprising of 63 villages, and is a popular tourist spot.
		The main tribal population is Malayali and agriculture is their main activity.They are nomadic agriculturists and occasionally engage in animal husbandry, mainly rearing of pigs.
Tiruchirappalli	Pachamalai Hills	The Pachamalai hills are inhabited only by the Malayali and others are not allowed to migrate to this place.
		The economic conditions of the tribes primarily depended on agriculture, forest and labouring. Similarly, it was found that majority (50%) of the people do agriculture and 25 percent of them were engaged in forest work.
Vellore (Tirupathur)	Jawadhu & Yelagiri Hills	Most of the inhabitants of this hills belong to "Malayali Tribes". Agriculture is their major occupation. The hill is known for its sandal wood cultivation. Hence Asia's second Sandalwood godown is constructed in Tirupathur.
		The Jawadhu & Yelagiri Hills are inhabited by Malayali,Kattunayakan,Malakkuravan and Irulas.

Source: Compiled by JICA Study Team (2021) based on existing literature and data

(3)   Scheduled Castes (SC):

The varna or Jati system segregated the Indian society into 4 main categories or castes; however, one category of the society falls outside the caste system, and occupy the lowest rank in the ritual hierarchy of Indian society, due to the age-old practice of un-touchability resulting due to engagements in offensive vocations, thus leading to social, educational, and economical backwardness.

The Census-2011 data shows that the population of SC in Tamil Nadu accounts for 20.01% of its total population, slightly higher than the national average of 16.6%. Seventy-six SCs have been notified in Tamil Nadu by the Scheduled Castes and Scheduled Tribes Order (Amendment) Act, 1976.

(4)   Other Backward Classes (OBC):

OBC is a collective term used by Government of India to categorize caste groups which are socially and economically backward and disadvantaged, which includes the SCs and STs. The Indian Constitution describes the OBCs as 'socially and educationally backward classes'.

In Tamil Nadu, the two thirds of the population belongs to Backward classes, Most backward classes, and Denotified communities, and nearly 95% of Muslim minorities are in the list of Backward classes and among Christian minorities nearly 80% are in the list of Backward classes and Most backward classes.

(5)   "Forest Dwellers" in Recognition of Forest Right Act:

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 defines "the Forest Dwelling Scheduled Tribes and the Other Traditional Forest Dwellers" as members or communities who primarily reside in and who depend on the forests or forest lands for bona fide livelihood needs (Section 2 Part c of the Act). It is noteworthy to mention that the term "Forest Dweller" has a specific meaning in the context of the Indian forest legislation.

4.3. Selection of an Appropriate Frameworks for Environmental and Social Considerations

The Project will not involve any sub-projects with significant adverse environmental impacts, nor will involve any loss of land, resettlement or livelihoods, it is proposed to ensure maximum positive and no negative environmental impact, and to guarantee social safeguard measures. Considering these points, for the purposes of developing a safeguards framework suitable to the Project and the local context, EIAF and STFDPF are found to be appropriate. These frameworks are applicable to a broad range of socially marginalized, vulnerable and forest-dependent community groups. The EIAF explains for a broad environmental and social framework, while the STFDPF is specifically applicable to the ST, SC, forest dwellers, and other forest dependents found within and surrounding the Project area.

Required Framework for the Project

Name of Framework	Brief Explanation
1. Environmental Impact Assessment Framework (EIAF)	To meet the requirements of the JICA Guidelines, a broad EIAF is prepared to ensure that environmental/ social issues are considered and that various socially disadvantaged and forest dependent groups are recognized and consulted; their needs met and their rights recognized.
2. Scheduled Tribes and Forest Dependents Plan Framework (STFDPF)	To meet the requirements of the JICA Guidelines and in reference to OP 4.10 of the World Bank on Indigenous Peoples, STFDPF needs to be additionally prepared to be applied where the Project affects or interacts with such groups identified as "Scheduled Tribes and Forest Dependents" for the Project.

Chapter 5. Target Group of EIAF and STFDPF

The EIAF and STFDPF will be applicable to all forest dependents within the Project area and to all the project components identified within the Project area. The Project must provide its benefits equally to the all affected persons. Followings are the key groups that the EIAF and STFDPF exercise particular cautions.

- Poor People/ Households
- Women Headed Households
- Landless
- Other Vulnerable People/ Households
- Forest Dependents (ST, SC, OBC, forest dwellers, other forest dependents)

The table below indicates indicative beneficiary selection criteria of target groups of the EIAF to address environmental and social considerations.

Indicative Beneficiary Selection Criteria of EIAF Target Groups

Activity	Proposed Beneficiary Selection Criteria	Implementing Body
Human Wildlife Conflict Measures	Some of target villages of Mitigation of human and wildlife conflict will be also selected as target villages of ecodevelopment. In this case, the selection criteria	
Livelihood Improvement Activities	1. Fundamental Criteria Needed to be Satisfied: − -Have a keen interest in a business activity − -Have a willingness to work as a group − -Have a keen interest in a forest conservation and biodiversity conservation − -Have a keen interest in a community development activity 2. Additional Selection Criteria Needed to be Matched (at least one): − An adult man or woman who cannot take part in full day manual labour but can do light work	EDCs, SHGs

	– A woman head of household, widow, unwed mother – An adult man and woman whose unemployed period is more than 3 months in the preceding 12 months 3. Additional Selection Criteria Needed to be Matched (based on specific project components/activities): – Those who can dedicate stipulated number of hours per day for project related activities, e.g. biodiversity conservation, forest product supply chain forest management, etc. – Those who live in an area within or in the fringe areas of forest areas (including protected areas such as wildlife sanctuaries)	

Chapter 6.   Existing Environmental and Social Management Systems

6.1.   Legal and Policy Framework for Environmental and Social Considerations in India

Overall, environmental and social safeguards policies and related implementing legislation in India do not deviate from the requirements of JICA Guidelines. The following tables outline key legislation and policy in India and Tripura and relevant to the Project.

Legal and Policy Framework in India

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
A. Environment Protection and EIA		
Environment (Protection) Act, 1986 and Amendment 1991	The Environment Protection Act is the basic environmental law of India. It regulates the power of the central government to take measures to protect and improve the environment through such means as planning, the establishment of environmental quality standards, the examination of manufacturing processes, the collection and dissemination of information, and the preparation of manuals.	MoEF&CC Central and/or State Pollution Control Boards
Environment (Protection) Rules 1986 and Amendments	The Environmental Protection Rules provide standards for emission or discharge of environmental pollutants and makes it possible for the central government to prohibit or restrict the establishment of industries or the carrying out of specific processes or operations based on factors specified in Rule 5.	MoEF&CC, Central and/or State Pollution Control Boards
EIA Notification 2006 and Amendments 2007, 2008, 2009, 2011, 2012, and (2020)	The Environment Impact Assessment Notification 1994 defines procedures such as screening, scoping, impact assessment, mitigation measures, and public consultation, to obtain prior EC for various projects that have a substantial impact on the environment.	MoEF&CC,
The National Green Tribunal Act 2010	The National Green Tribunal Act provides for the establishment of a tribunal to exercise the jurisdiction, powers, and authority conferred on it by or under this act. The National Green Tribunal shall have jurisdiction over all civil cases in which a substantial question relating to the environment is involved.	National Green Tribunal (NGT; under MoEF&CC)
B. Forest & Wildlife		
Indian Forest Act 1927	This Act was enacted to preserve forest cover and significant wildlife. It defines procedure for declaring Reserved Forest, Protected Forest and Village Forest. Further, describes power to impose duty on timber and other forest-produce and to make rules to regulate transit of forest-produce, and collection of drift and stranded timber. The Act also has provision to impose penalties and procedures thereof.	MoEF&CC State level Environment and Forest departments Implementing Agency
The National Forest Policy 1988	The policy principally aims at ensuring environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms, human,	MoEF&CC, State level Environment

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
	animal and plant. The derivation of direct economic benefit must be subordinate to this principal aim. The principal aim is supported by several objectives: to increase the forest and tree cover (a minimum of 1/3 of the total land area of the country), to maintain and restore ecological balance, to preserve natural forest with variety of flora and fauna, to conserve soil and water, to check the extension of sand dunes, and to increase the productivity and efficiency of the natural use.	and Forest departments
Forest Conservation Act 1980 and Amendment 1988	The Forest Conservation Act was adopted in 1980 to protect and conserve forests. It strictly restricts and regulates the use of forest land for non forest purposes without the prior approval of Central Government. For this purpose the Act lays down the pre-requisites for the diversion of forest land for non fprest purpose.	MoEF&CC, State level Environment and Forest departments
Forest Conservation Rule 2003	The rule is set up following by Section 4 of the Forest Conservation Ac. 1980 to stipulates the procedure for forest clearance etc.	MoEF&CC, State level Environment and Forest departments
Wildlife (Protection) Act 1972 and Amendment 1993, 2003, 2006	This Act provides for protection of wild animals, birds and plants, prohibition on hunting any wild animal specified in Schedule I, II, III and IV, prohibition on picking, uprooting, of specified plants, constitution of Sanctuaries, National Parks and Closed Areas, prohibition on trade or commerce of wild animals, in Trophies, Animal Articles derived from Certain Animals. The Act also empowers certain officials to investigate and impose penalties.	MoEF&CC, State Forest Department (or Wildlife department)
Biological Diversity Act 2002	This is umbrella legislation aimed at conservation of biological resources and associated knowledge as well as facilitating access to them in a sustainable manner and through a just process.	National Biodiversity Authority, Chennai State bio-diversity board
C. Coastal and Wetland Management		
Wetlands (Conservation and Management) Rules, 2017 and its guideline, 2020	The rules were notified under the provisions of the Environment (Protection) Act, 1986 as regulatory framework for conservation and management of wetlands in India. The guideline supports the State/UT to Preparing a list of wetlands, to Identify wetlands for notification, to develop a list of activities to be regulated and permitted, and to develop Integrated Management Plan	MoEF&CC, Tamil Nadu State Wetland Authority
Coastal Regulation Zone Notification 2011 and 2019	The CRZ Notification was issued by the Ministry of Environment and Forests, Government of India in 1991 under the Environment Protection Act, 1986, and amended in 2011 and 2019, in order to regulate activities in coastal areas of India, protect livelihood of communities in the coastal, and conserve ecosystem. It also shows the procedures of the prior CRZ Clearance. In 2018, the Tamil Nadu government formulated the Coastal Zone Management Plan, according to the CRZ Notification, 2011.	MoEF&CC, State Coastal Zone Management Authority
D. **Water, Air and Pollution**		
Water (Prevention and Control of Pollution) Act 1974 and Amendment 1988	This Act aims at prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. The Act resulted in the establishment of the Central and State Level Pollution Control Boards whose responsibilities 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.	Central and/or State Pollution Control Boards
Air (Prevention and Control of Pollution) Act 1981	This Act provides for prevention, control and reduction of air pollution. The Act further provides for establishment of Boards, and assigning them with powers and functions towards prevention, control and reduction of air pollution.	Central and/or State Pollution Control Boards
Rules and Notifications framed under the Environment (Protection) Act 1986	The Hazardous Waste (Management & Handling) Rules, 1989 amended in 2000 The Manufacture, Use, Import, Export, Storage of Hazardous Microorganism, Genetically Engineered Organisms or Cells Rules, 1989.	Central and/or State Pollution Control Boards

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
	The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989, amended in 2000. The Environment Audit Notification, 1993 The Coastal Regulation Zone Notification, 1991 The Chemical Accidents (Emergency Planning, Preparedness & Response) Rules, 1996 The Biomedical Waste (Management & Handling) Rules, 1998 The Municipal Solid Wastes (Management & Handling) Rules, 2000 Recycled Plastics Manufactures and Usage Rules, 1998 amended in 1999 · Notification on Flyash (14th September 1999) · The Noise Pollution (Regulation and Control Rules, 2000 · Ozone Depleting Substance (Regulation) Rules, 2000 · Batteries (Management & Handling) Rules, 2001	
E. Scheduled Tribe and Scheduled Caste		
The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006	The Act, known as Forests Rights Act (FRA), recognizes and vests the forest rights and occupation in forest land in forest dwelling ST and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded. The Act also recognizes the responsibilities and authority for sustainable use, conservation of biodiversity and maintenance of ecological balance and thereby strengthening the conservation regime of the forests while ensuring livelihood and food security of the forest dwellings ST and other traditional forest dwellers. The Act defines 13 types of forest rights, and outlines the procedures for vesting such rights Under the Act, Gram Sabha is the primary institution to decide on the forest rights claims.	Ministry of Tribal Affairs State Government
The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Rules, 2008, and 2012	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Rules, 2008 were notified in order to implement the provisions of the FRA, and defines the procedure for vesting Forest Rights and roles and functions of key institutions such as Gram Sabha, and state, district, and sub-district level of committees. The Rules were amended in 2012, in order to ensure effective implementation of the Act and	Ministry of Tribal Affairs State Government
Social Audit Policy	Social audits were made statutory in a 2005 Rural Employment Act and government also issued the Social Audit Rules in 2011 under the MGNREGA Act. The Social audits are normally supervised by autonomous bodies consisting of government and non-government representatives. Gram Sabhas were empowered to conduct Social Audits, after the 73rd Amendment of the Constitution, in addition to their other functions. No central policy or regulation exists that makes accounting audit and social audit mandatory.	Ministry of Rural Development

Legal and Policy Framework in Tamil Nadu

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
A. Environment Protection and EIA		
	The State Government will adhere to the National Laws, Rules, and Notifications pertaining to environment protection and EIA.	Tamil Nadu State Pollution Control Board
B. Forest, Wildlife and Information Disclosure		
State Forest Policy, 2018	The objective of the state policy is to preserve natural forests, wildlife conservation, involving tribal communities in protection, conservation and wildlife management, eco-tourism for providing livelihood opportunities for the local people, especially tribal communities and mitigating climate change among other goals. Biodiversity conservation is promoted by strict enforcement of existing forest laws, establishing eco-sensitive zone around the protected areas. Rehabilitation and restoration of degraded forests is	Tamil Nadu Environment, Climate Change and Forests Department

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
	to be done with the involvement of the people in venture with the JFM and VFCs. The customary rights and privileges of the tribal communities would be protected by providing them the Non Timber Forest Produce collection, sale rights supported by adequate market avenues. The Forest Right Act, 2006, would be implemented for the better Socio-Cultural and economic conditions, considering the balance between the between environment conservation and tribal welfare	
Tamil Nadu Forest Act, 1882	The Act empowers the government to declare any land at its disposal as a reserved forest in the manner as prescribed under the Act. A notification shall be issued by the government to declare any area under its control as a reserved forest. A forest settlement officer under the Act is responsible for surveying the land to be declared as a reserved forest. Once the land is declared as a reserved forest, the Forest Settlement officer may grant rights of pasture and the right to collect forest produce. These extent to which these rights are granted and exercised are determined by the FSO. These rights can be commuted at any time.	Tamil Nadu Environment, Climate Change and Forests Department
Sec 16A, amended in 2019	This amendment of the Sec 17A allows for conversion of the land acquired under the Janman abolition Act to be converted into reserved forests through a notification by the government and such a land will be brought under the purview of the TN Forests Act.	
The Tamil Nadu Preservation of Private Forest Act 1949	The Act intends to prevent the indiscriminate destruction of private forests and interference with customary and prescriptive rights therein and for certain other purposes. A committee headed by the District collector and consists of 5 members was established at the Districts. In case of private forests, owners of such forests shall not without prior sanction from the committee sell, mortgage, lease or otherwise alienate the whole or any portion of the forest. Any alienation done without the sanction of the committee is null and void. No owner or any other person claiming under the owner can fell trees or reeds or do any such Act such as to denude the forest without prior sanction of the committee.	Tamil Nadu Environment, Climate Change and Forests Department
The Tamil Nadu Hill Areas (Preservation Of Trees) Act, 1955	The Act intends to provide for the regulation of the cutting of trees and the cultivation of land in hill areas in the State of Tamil Nadu in order to prevent deforestation and soil erosion and also to preserve the special characteristics of the hill areas as regards landscape, vegetal cover and climate. A committee is formed headed by the District collector and comprising of five members. Without the prior sanction of the committee no trees can be cut, branches of any tree cut down. Use of slope land for purposes other than for growing of trees is prohibited. In case of any new cultivation on slope land, the same cannot be done without the prior sanction of the committee.	Tamil Nadu Environment, Climate Change and Forests Department
Tamil Nadu Biological Diversity Rules	The Tamil Nadu Biological Diversity Rules were notified in 2017 to implement the provisions of the Biological Diversity Act 2002. The rules provide overall guidance for establishment and operationalisation of Biodiversity Management Committees and stipulate the procedure for access to or collection of biological resources from Tamil Nadu amongst other aspects.	Tamil Nadu State Biodiversity Board
The Coastal Zone Management Plan	In order to realize the CRZ Notification 2011, the draft of Coastal Zone Management Plan (CZMP) with 117 maps for Tamil Nadu was prepared by the National Center for Sustainable Coastal Management (NCSCM), Chenna, finalized based on the results of public comments and district level of public hearings at all the 13 Coastal districts, and approved at the 35th National Coastal Zone Management Authority (NCZMA) meeting in 2018.	Tamil Nadu Coastal Zone Management Authority
C. Water and Air		
	The State Government will adhere to the National Laws, Rules, and Notifications pertaining to water and air pollution control.	Tamil Nadu State Pollution Control Board

6.2. Environmental Related Clearance Procedures in India

The proposed project may not require any prior clearances such as Prior Environment Clearance (EC), Prior Coastal Regulation Zone (CRZ) Clearance, Forest Clearance, and Wildlife Clearance. However, the general processes of the environmental clearance and the forest clearance are described hereunder.

(1)   Environment Clearance

Under EIA Notification 2006, amended in 2009, all projects or activities included as Category A shall require prior environmental clearance from the MOEFCC on the recommendations of an Expert Appraisal Committee (EAC), to be constituted by the central government for the purposes of notification. Besides these, all projects or activities included as Category B in the Schedule will require prior environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The SEIAA shall base its decision on the recommendations of a state or union territory (hereinafter referred to as "UT") level Expert Appraisal Committee (SEAC), to be constituted for in the notification. Category B projects are further divided into Category B1 (projects that require submitting an EIA report) and B2 (project activities which do not require an EIA report). In the absence of a duly-constituted SEIAA or SEAC, a Category B project shall be treated as a Category A project.
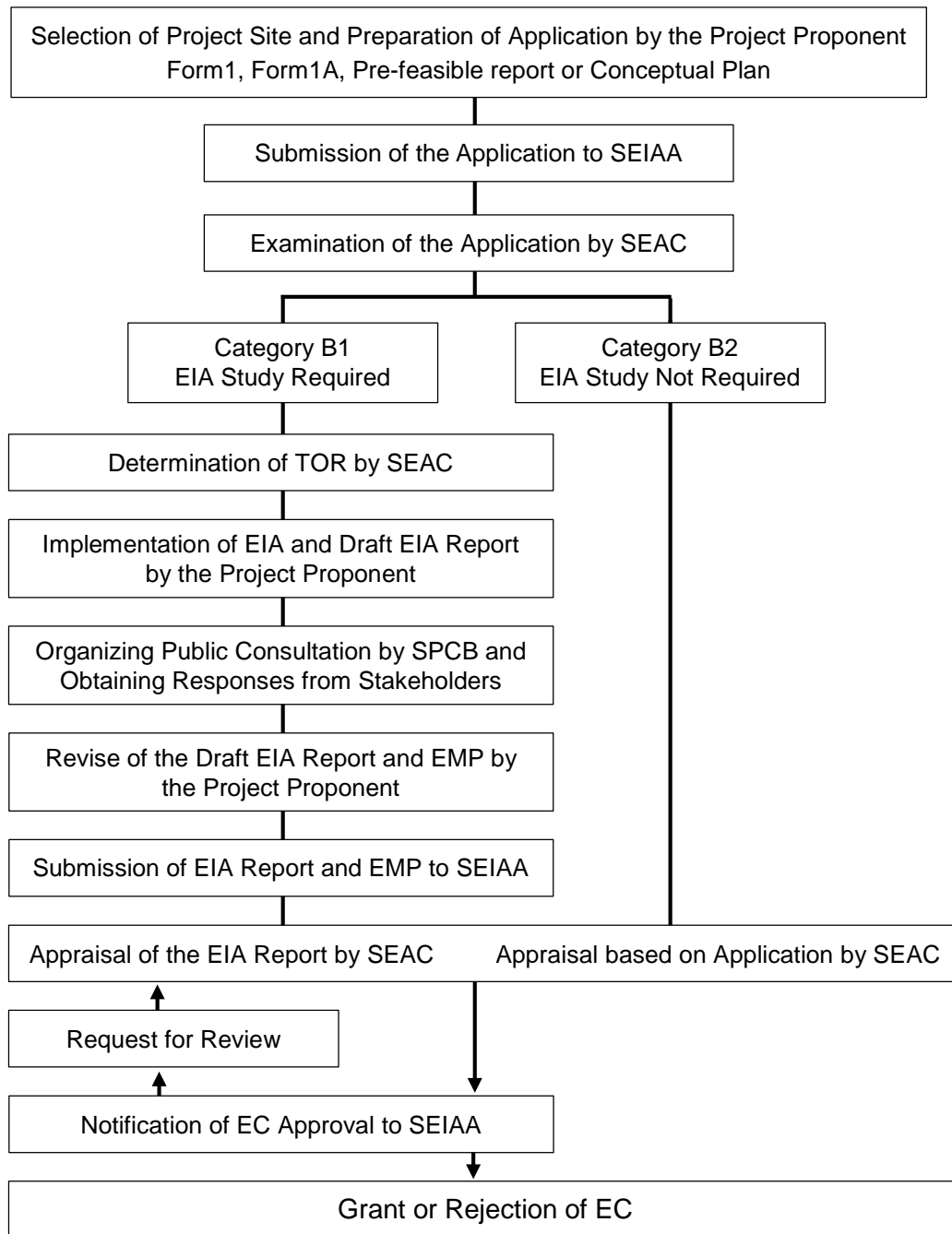
The following table shows an example of a list of projects or activities which require prior EC. Under the draft EIA Notification, 2020, the MOEFCC proposes a recategorisation of some projects such as river-valley hydroelectric projects, from A to B1 or B2.

Projects or Activities Requiring Prior Environmental Clearance

Project	Category with Threshold Limits		Conditions
	Category A	Category B	
1. Mining, extraction of natural resources, and power generation			
1(c) River valley projects	(i) >50mw Hydroelectric power generation; (ii) >10,000ha of culturable command area	(i) <50mw > 25mw hydroelectric power generation; (ii) < 10,000 ha of culturable command area	General Conditions shall apply
8.Building/Construction projects/Area Development projects and townships			
8(a) Building and construction projects		>20,000 sq. m and <150,000 sq. m of built-up area#	# Built-up area for covered construction; in cases of facilities open to the sky, it will be the activity area
8(b) Townships and Area Development projects		Covering an area > 50 ha and or built-up area > 150,000 sq. m #	# All projects under item 8(b) shall be appraised as Category B1
General Condition: Any project or activity specified as Category B will be treated as Category A, if it is located in whole or in part within 10 km from the boundary of the following: (i) Protected Area notified under the Wildlife (Protection) Act, 1972; (ii) Critically polluted areas as notified by the Central Pollution Control Board from time to time; (iii) Notified eco-sensitive areas; and (iv) Inter-state boundaries and international boundaries.			

Source: EIA Notification, 2006

The Project may construct rain water harvesting structure, loose boulder check wall, and buildings or rehabilitate check dams, however, these interventions will not be listed as projects which require EC under the EIA Notification. If any buildings as a part of the interventions proposed in the project has an area greater than 20,000 m2 prior EC shall be required. But the administration buildings are supposed to be much smaller than the 20,000 m2. For the reference, the detailed stages prior to environmental clearance for Category B projects is shown below.

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┌─────────────────────────────────────────────────────────────────────┐
│ Selection of Project Site and Preparation of Application by the Project Proponent │
│ Form1, Form1A, Pre-feasible report or Conceptual Plan │
└─────────────────────────────────────────────────────────────────────┘
                    ┌──────────────────────────────────────┐
                    │ Submission of the Application to SEIAA │
                    └──────────────────────────────────────┘
                    ┌──────────────────────────────────────┐
                    │ Examination of the Application by SEAC │
                    └──────────────────────────────────────┘
        ┌──────────────────────────┐      ┌──────────────────────────┐
        │ Category B1              │      │ Category B2              │
        │ EIA Study Required       │      │ EIA Study Not Required   │
        └──────────────────────────┘      └──────────────────────────┘
    ┌──────────────────────────────────┐
    │ Determination of TOR by SEAC     │
    └──────────────────────────────────┘
    ┌──────────────────────────────────┐
    │ Implementation of EIA and Draft EIA Report │
    │ by the Project Proponent         │
    └──────────────────────────────────┘
    ┌──────────────────────────────────┐
    │ Organizing Public Consultation by SPCB and │
    │ Obtaining Responses from Stakeholders │
    └──────────────────────────────────┘
    ┌──────────────────────────────────┐
    │ Revise of the Draft EIA Report and EMP by │
    │ the Project Proponent            │
    └──────────────────────────────────┘
    ┌──────────────────────────────────┐
    │ Submission of EIA Report and EMP to SEIAA │
    └──────────────────────────────────┘
  Appraisal of the EIA Report by SEAC      Appraisal based on Application by SEAC
    ┌──────────────────────┐
    │ Request for Review   │
    └──────────────────────┘
    ┌──────────────────────────────────┐
    │ Notification of EC Approval to SEIAA │
    └──────────────────────────────────┘
    ┌─────────────────────────────────────────────────┐
    │ Grant or Rejection of EC                        │
    └─────────────────────────────────────────────────┘
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Flow of Obtaining Environmental Clearance for Category Project B

MoEFCC proposed a draft Environmental Impact Assessment Notification, 2020, in March, 2020. The Draft EIA Notification is intended to promote transparency and streamline compliance, as it integrates numerous notification, amendments, office orders, circulars, court and tribunal directions since the last EIA notification in 2006.

The key changes are summarized below.

- Projects in certain sectors re-categorized from A to B1 or B2, such as river valley hydro-electric projects.

- About 40 industries will be classified under category B2, and therefore be exempt from the requirement of EIA study and public consultation process.
- EIA report is not be required in case of modernisation of projects where the intended increase in production capacity is up to 25% and public consultation exempt up to 50% increase in production capacity.
- Construction project up to 150,000 m2 are exempt from the assessment. EC may be granted, after scrutiny by SEAC alone.
- Notice period for public hearing is reduced from 30 days to 20 days and the process to be completed in 40 days, shorten from 45 days.

(2)   Prior Coastal Regulation Zone Clearance

The CRZ Notification was issued by the Ministry of Environment and Forests, Government of India in 1991 under the Environment Protection Act, 1986, and amended in 2011 and 2019, in order to regulate activities in coastal areas of India, protect livelihood of communities in the coastal, and conserve ecosystem. It also shows the procedures of the prior CRZ Clearance.

In 2018, the Tamil Nadu government formulated the Coastal Zone Management Plan, according to the CRZ Notification, 2011.

Coastal areas are categorized under the CRZ Notification, as shown below. Due to the amendment of 2019, ecotourism activities are allowed in CRZ I. Construction in a CRZ I area shall be permitted subject to a detailed marine or terrestrial (or both) environment impact assessment, to be recommended by the Tamil Nadu Coastal Zone Management Authority (TNCZMA) and approved by the MOEFCC. For construction in a CRZ II area, CRZ II permission is required from the TNCZMA.

CRZ Categories

Category	Description
CRZ I A	Eco-sensitive Areas. Since the amendment of 2019, ecotourism activities are allowed.
CRZ I B	Inter-Tidal Areas
CRZ II	Areas which have been developed up to or close to the shore
CRZ III A	CRZ-III areas, where the population density is more than 2,161/km^2 per the 2011 population census
CRZ III B	Areas with a population density of less than 2,161/km^2, per the 2011 population census
CRZ IV A	12 nautical miles from the Low Tide Line toward the sea
CRZ IV B	Tidal influenced waterbodies
No Development Zone (NDP)	Under the Notification, 2011, there was an extension up to 200 m from the high tide line (HTL) toward land in the whole CRZ III areas, but now under the Notification, 2019, it is 50 m from the HTL in CRZ III A and 200 m HTL in CRZ III B areas.

Source: CRZ Notification, 2019

The procedure for CRZ Clearance is summarized below.

- The 'Project Proponent' applies with the following documents to the Tamil Nadu Coastal Zone Management Authority to seek prior clearance
  - ➢ Project summary details
  - ➢ Rapid Environment Impact Assessment (EIA) Report
  - ➢ Comprehensive EIA with cumulative studies for projects
  - ➢ Risk Assessment Report and Disaster Management Plan
  - ➢ CRZ map in 1:4000 scale
  - ➢ Project layout superimposed on the CRZ map
  - ➢ The CRZ map normally covering a 7 km radius around the project site

> ➢ 'Consent to establish' or a 'No Objection Certificate' from the concerned State Pollution Control Board

- The TMCZMA reviews and makes recommendations within a period of 60 days from the date of receipt of a complete application.

- For projects or activities also attracting the EIA Notification, 2006 number S.O. 1533(E), dated 14 September 2006, the TMCZMA shall forward its recommendations to the MOEFCC or the Tamil Nadu Environment Impact Assessment Authority (TNEIAA) for Category A and Category B projects, respectively.
- The TMCZM shall forward its recommendations to the MOEFCC for projects or activities not covered in the EIA notification, 2006, but which attract this notification and are located in CRZ-I or CRZ-IV areas.
- Projects or activities not covered in the aforesaid EIA Notification, 2006, but which attract this notification and are located in CRZ-II or CRZ-III areas, shall be considered for clearance by the TNCZMA within 60 days of the receipt of the complete proposal from the proponent.
- The MOEFCC shall consider complete project proposals for clearance under this notification, based on the recommendations of the Coastal Zone Management Authority, within a period of 60 days.
- The clearance accorded to projects under this notification shall be valid for a period of seven years, provided that the construction activities are completed and the operations commence within seven years from the date of issue of such clearance.
- Post clearance monitoring.

(3)   Forest Clearance

Under the Forest Conservation Act, 1980, forest clearance from the statutory authority will be required if the forest area is to be used for non-forest purposes. For this purpose, an application is submitted to the relevant state government, which in turn recommends the case to the MOEFCC.

The Forest Conservation Act stipulates the definition of non-forest purpose as:

'the breaking up or clearing of any forest land or portion thereof for —

(a) the cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticultural crops or medicinal plants;

(b) any purpose other than re-afforestation;

but does not include any work relating or ancillary to conservation, development and forest and management of forests and wildlife, namely, the establishment of check-posts, fire lines, wireless communications and construction of fencing, bridges and culverts, dams, waterholes, trench marks, boundary marks, pipelines or other like purposes.'

The Project shall construct rain water harvesting structure, loose boulder check wall, and buildings, however, these interventions will be carried out for the forest conservation and management under the TNFD. Thus, forest clearance may not be required. For the reference purpose the process of forest clearance on a parivesh site is shown below.

- The proposal (Form A, Form B and Form C), explaining the details of the project, UA and the applicant, land required for the project with a map, displacement people if any, status of EC, and so on, is submitted by the UA, and the Nodal officer (State Forest Department) examines it for its completeness (Part I). If the all the necessary documents are included, an acknowledgement letter along with the unique proposal number will be sent by the system.

- The proposal is forwarded online from the Nodal Officer to District Forest Office (DFO) for review. After filling up the Part II of Form A, Form B and Form C, the proposal, along with the site inspection report and recommendations are uploaded and forwarded to concerned Circle Officer (CF/CCF).
- After reviewing and filling up the Part III of Form A, Form B and Form C, the proposal along with the site inspection report and recommendations is uploaded and automatically backed to the Nodal Officer.
- After receiving the proposal online from Nodal Officer, the concerned State Secretary can view the proposal (Form-A/Form-B/Form-C submitted by U.A.) and recommendations of DFO, Circle and Nodal Officer and then may upload his/her Recommendations.
- The uploaded proposal by State Secretary is forwarded to either Regional Office (RO) or Head Office (HO) of MoEFCC, depending upon the category, area and Shape of forest land proposed to be diverted.
  - ➢ The case of less than 5 ha forest area except Mining, Hydel, Encroachments
    Diversion of Forest Land is decided at RO without State Advisory Group (SAG) / Regional Empowered Committee (REC) meeting
  - ➢ The case of land up to 5 ha (Mining and regularization of encroachments only) and all other projects related with diversion of forest land from 5 to 40 ha
    The proposal along with recommendations of SAG/REC is forwarded from RO to RO (HQ), Delhi, for approval of Competent Authority of MoEFCC.
    After receiving the proposal and all the recommendations, HO can conduct Forest Advisory Committee (FAC) meeting.
    Recommendations of FAC along with decision by the Competent Authority and agenda and minutes of the meetings are uploaded on portal.
  - ➢ The case of diversion of forest land for more than 40 ha. excluding linear projects
    The proposal along with all the recommendations is directly forwarded to HO, Delhi, for the processing at Head Office (MoEFCC, Delhi).
- After the submission by the UA, the proposal is forwarded from the Nodal Officer to District Collector (DC) as well as District Forest Office. After viewing the proposal, DC has to upload FRA document.

(4)   Wildlife Clearance

According to the Wildlife (Protection) Act, 1972, any diversion of land or produce including water, from PA, such as wildlife sanctuaries and national parks, needs the recommendation of the State Board for Wildlife. No construction of commercial tourist lodges, hotels, zoos, and safari parks can be undertaken inside PA except with prior approval of the Standing Committee of NBWI.

If projects require Environmental Clearance and are located within the eco-sensitive zone around the PA or within a distance of 10 km from the boundaries of the PA, the User Agency (UA) or project proponent is required to obtain recommendations of the Standing Committee of the National Board for Wildlife (NBWL).

The procedure for Wildlife Clearance on a parivesh site is shown below.

- The proposal, explaining the details of the project, UA and the applicant, land required for the project with a map, displacement people if any, status of EC, and so on, submitted by the UA will be forwarded to the concerned District Forest Office (DFO)/Wild Life Warden
- The DFO scrutinizes the proposal and sends an acceptance letter to the UA, if all relevant documents are uploaded properly by the UA. Proposal details are forwarded automatically to all the DFOs involved in the proposal for their necessary action. (Five days.)
- After review, the DFO uploads part-II of Form-A on the portal, along with his/her recommendation and Site Inspection Report. The proposal details are forwarded automatically to concerned Chief Wildlife Warden (CWLW) for the necessary action. (30 days).

- After review, the CWLW uploads his/her recommendation and Site Inspection Report (if the site inspection has been done) and the proposal will be forwarded to the state government (SG) level. (20 days.)
- After reviewing the recommendations of the DFO and CWLW, the SG level user uploads recommendation of the State Board of Wildlife (SBWL) on the portal along with the SG report/recommendation. The proposal is forwarded to the Head Office (Wildlife), New Delhi.
- After reviewing the proposal from state level user, the MOEFCC (head office) level user processes the received documents for the approval of the 'Competent Authority' of the MOEFCC.
- After taking the approval of the Competent Authority, the MOEFCC (head office) level user has to update the status of the proposal and upload the recommendation letter of the NBWL on the portal

6.3. Environmental and Social Management System of the Executing/Related Agencies

TNFD, as the executing agency (EA), is responsible for entire project implementation, while the EDCs control and support project activities in their lands from community perspective.

(1) Tamil Nadu Forest Department:

Even though TNFD has experiences in implementing Japanese loan projects, following the JBIC Guidelines for Confirmation of Environmental and Social Considerations, it does not have a comprehensive ESMS in place for the screening, management and monitoring of environmental and social risks of its standard operations and programmes. There is participation of communities in implementation of various activities, and there is some evaluation of programmes including covering the involvement of communities.

Under the TBGP1, EDCs were formed according to the TN JFM policy and guideline. The interim results of the impact survey, which was conducted in 2021 in order to review the status of the TBGP1, shows that among 10 sample ECDs the average household participation rate was 44% and average women representation in Executive Committee is 36%, with a minimum of 25% (2 villages) and maximum of 62%. At the sample villages, the micro-plans were prepared in consultation with their executive members and other villagers in a participatory mode. Each DMU involved NGO to facilitate and prepare microplan.

(2) Tamil Nadu biodiversity board

This board is constituted under Section 22 of the Biological Diversity Act, 22(Central Act 18 of 2003). The board ensures effective implementation of Biological Diversity Act, 2002 and the Biological Diversity Rules, 2004, for conservation of biodiversity, sustainable use of its components and fair and equitable sharing of benefits arising out of utilization of genetic resources.

The Functions of the Board are summarized below.

- advise the State Government, subject to any guidelines issued by the Central Government, on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilisation of biological resources;
- regulate by granting of approvals or otherwise requests for commercial utilisation or bio-survey and bio-utilisation of any biological resource by Indians;
- perform such other functions as may be necessary to carry out the provisions of this Act or as may be prescribed by the State Government.

Any citizen of India or a body corporate, organisation or association registered in India intending to undertake any activity referred to in section 7 shall give prior intimation in such form as may be

prescribed by the State Government to the State Biodiversity Board. Upon receiving the same the board, in consultation with local bodies concerned, can prohibit or restrict such activity if it deems that such activities are against conservation.

(3)   Joint Forest Management Committee

Joint Forest Management Committee (JFMC) is a democratic, decentralized grass root level forest protection and management institutions jointly formed by communities and the Forest Department. JFMC is part of the Gram Sabha fully or partially and set up as per the provisions of applicable JFM rules/guidelines of the state.

Typically, there is one JFMC in one revenue village. However, in special situations, e.g. historical collaboration between neighbouring villages, or where it doesn't make sense to divide the forest, a JFMC may cover two or more villages. On the other hand, especially in tribal areas, there may be situations where one village may have several dispersed hamlets, JFMCs may be set up at sub-revenue village or hamlet level.

(4)   Eco-Development Committee

An Eco-Development Committee (EDC) is similar to JFMCs, a democratic, decentralized grass root level forest protection and management institutions jointly formed by communities and the Forest Department, but meant for villages in Protected Areas and their buffer zones. For the management of the Wildlife Protected Areas, Eco Development Committees (EDCs) are also formed to ensure people participation in wildlife conservation. Their area of operation is restricted to protected Areas, and forest and non-forest areas near protected areas. EDCs are set up with twin objectives – to protect wildlife and other biodiversity, and also undertake eco-development activities in the villages.

6.4.   Review of Environmental and Social Considerations of theTBGP1 and TAP

The impact assessment survey of the TBGP1 was conducted in August, 2021, and the interim result of the survey is summarized from the environment and social aspect, as follows.

- Ten (10) villages were selected as samples and their EDC formulation and EC compositions were reviewed.
- ECDs were formulated, according to the State JFM policy and State JFM Guideline, with the support of NGOs, and registered under Tamil Nadu Society Registration Act, 1975.
- The State JFM policy recommends that there should be a representation of all household with one male and one female member. The women participation in executive committee of all type of institutions formed under forestry projects shall be at least one thirds.
- The average household participation rate is 44%, ranging from 13% to 87%. The average women representation in Executive Committee is 36%, with a minimum of 25% (2 villages) and maximum of 62%. Three villages did not reach the requirement level of 33%.
- At the sample villages, the micro-plans were prepared in consultation with their executive members and other villagers in a participatory mode. Each DMU involved NGO to facilitate and prepare microplan.
- Around 40% of villagers responded that there were training/meetings during the initial year (2013-2014) on project objectives, though there are no supporting documents
- Most of respondents were aware that the project activities were limited to community development work and livelihood fund support

The results of TAP1 and TAP2 were also evaluated by the Impact Assessment Survey in 2015. According to the survey result, during the preparation period, VFCs function in accordance with JFM guidelines and this increased the level of women participation. Woman based SHGs were formed with the support of NGOs during the preparation period. Since the support of NGOs were provided only during the preparation period, many of SHGs defunct later due to the lack of management skills

including marketing, while VFCs continued their functions.

6.5. Key Gaps and Shortfalls in Comparison to the Standards in the JICA Guidelines

Key gaps and shortfalls identified in each institution in comparison to international standards as indicated in the JICA Guidelines are as below. Even though the TNFD implemented three ODA loan projects, this is the first time for the TNFD to follow the JICA Guideline fully to its loan project.

Gaps and Shortfalls JICA Guidelines and TNFD Standards on E &S Considerations

	Executing Agency	Key Gaps and Shortfalls	Recommendations
1	TNFD	There is not Environmental and social safeguard policy and procedure	If there is no relevant policy and procedure, use EIAF and STPF.
		Person in charge of environmental and social considerations not there	Need assignment of Environmental and Social Consideration Expert(s) / Specialist
		Limited procedures for environmental screening and subsequent management of environmental risks associated with small-scale construction and other activities with potential adverse impacts.	Implementation of Capacity Development Plan for Environmental and Social Safeguards
		No monitoring of safeguard processes and procedures.	Prepare and implement an Environmental and Social Safeguards Implement. Plan
		Free, Prior and Informed Consultations at village level were implemented under the TBGP 1. No GAP	In order to improve skills, conduct training programs for TNFD officers/ staff and assist them in preparing tools and arranging for consultation at village level before commencing micro planning
2	People Organization	State Forest Policy addresses the concerns of women or vulnerable people and necessity of their participation. No Gap	Inclusion of vulnerable section of the society by efficient implementation of EIAF and STPF
		Limitation in awareness of potential adverse environmental impacts.	If so, increase awareness at the time of providing Consultation at village level and proper implementation of the EIAF and STPF
		Limitation in understanding of safeguard processes and procedures?	Implementation of Capacity Development Plan for Environmental and Social Safeguards
		Limitation in conflict management and benefit sharing.	Implementation of Capacity Development Plan for Environmental and Social Safeguards

Chapter 7.   Environmental and Social Risks and Mitigation Measures

The Project will have mainly positive environmental and social impacts. The below describes broad project benefits and positive environmental and social impacts.

a. Forest / Natural and Physical Capital Benefits
- Increased biodiversity by improving wildlife habitat conditions (both land and sea)
- Increased forest coverage throughout the state (including urban and peri-urban areas)
- Improved ambient air environment by promoting urban and peri-urban forestry
- Construction/Improvement of community infrastructure and facilities
- Better awareness toward forest protection and promotion

b. Social Capital Benefits
- Strengthened community institutions
- Improved access to the market and market information for local producers including SHGs
- Empowerment of women and forest dependent people
- Judicious use of land, water, and etc. due to the project interventions safeguarding the environment

c. Financial Capital Benefits
- Increased incomes
- Direct and indirect employment opportunities arising from project activities
- Diversification of income sources and reduced financial risk
- Value addition and better marketing for their produces

d. Human Capital Benefits
- Increased technical capacity for sustainable management of forests and marine ecosystem
- Increased technical capacity of marketing and product development
- Increased entrepreneurial and business management capacity of women and forest dependent people

e. Improved Structures and Processes
- Increased participation in community development planning and activities
- Increased participation of local people in forest management and marine ecosystem
- Improved capacity of government departments and extension service delivery

However, the Project potentially could also bring a number of adverse environmental impacts. The following table presents environmental and social risks and mitigation measures by component.

Summary of Adverse Environmental / Social Risks and Mitigation Measures

Activities	Potential Environmental and Social Impact	Possible Mitigation Measures
Planning (Project Planning, EDC formation, micro planning)	Social Impact: – Conflicts at community level – Micro planning could lead to increased conflict over the sustainable usages of natural resources and women may be excluded from planning process	– Participatory procedures for micro planning, screening of sub-projects and avoidance of major impacts – Procedural steps for ensuring adequate consultation and participation of vulnerable groups in micro planning, ensuring women's contribution in micro-planning – Promotion of best-practice participatory approaches in the microplanning (conducting study tours) – Prioritization of vulnerable groups as beneficiaries
Forest Management and Biodiversity Conservation	Waste problem by excavating canals and other areas at the site preparation for mangrove plantation	– Specific measures and disposal for dealing with waste produced
	Social impact: Marine Ecosystem [In the short term] – inconvenient for fishing activities [In the long term] – Necessary to discuss appropriate finishing gears and methods	– Early consultation with Department of Fishery and fisher folks – Community-based/participatory planning
Infrastructure Development	Environmental Impact: -Loss of endangered species and	– Participatory procedures for micro planning, screening of subprojects and avoidance of

Activities	Potential Environmental and Social Impact	Possible Mitigation Measures
	important habitats (nursery, spawning ground, nest)	– major impacts – Carrying out of ecological baseline survey – Proper design and planning of infrastructure activities to minimize environmental risks – Community-based/Participatory land/resource use planning
	– Litter/waste, soil/water pollution from building or processing facilities – Litter/waste and water pollution from operation of lodge, canteens and other eco-tourism facilities	– Specific measures and disposal for dealing with litter and other waste produced – Carrying out monitoring
	– Water quality deterioration (especially siltation) by rain water harvesting structures – Change of ground water level	– Carrying out water quality and ground water level monitoring
	Social Impact: – Potential loss of customary/religious/traditional knowledge as communities are trained in formal management approaches – Loss of customary and religious land/resource access and use – Resource use conflicts e.g. over wells and other water supply/sanitation facilities – Increased developmental dependency – Possibility of loss of access to customary lands and resources	– Participatory procedures for planning, social assessment, screening of sub-projects and avoidance of major impacts – Proper design and planning of activities to minimize environmental risks – No use of private land or resettlement for Community infrastructures – Community involvement and employment in all aspects of construction, operation and maintenance – Prioritization of vulnerable groups as beneficiaries – Local regulations
Ecodevelopment (at present, activities are not decided yet. Main activities might be skills developmen)	Environmental Impact: Up to activities	–
	Social Impact: – Increased dependency – Loss of traditional livelihood – Loss of traditional knowledge/skill – Social exclusion/elite capture – Inequitable benefit sharing – Resource use conflicts Others depend on activities	– Community involvement and employment in all aspects of construction, operation and maintenance – Clear and equitable beneficiary selection and prioritizing forest dependent poor and vulnerable households – Selection of female beneficiaries with deliberate attempts to empower women – Documentation and utilization of traditional knowledge/ practices

Chapter 8.   Framework and Procedures of EIAF

8.1.   Overview of the EIAF Procedures

The proposed procedure for environmental and social considerations in the Project is summarised in the table below.

Overview of EIAF Procedures

	Project Stage	Safeguard Activity	Suggested Guidance to be Developed	Developer of Guidance
1	Target village selection, and preliminary consultation	- Beneficiary Selection - Explanation of the Project overview - Information Disclosure and Free Prior Informed Consultation - Establishment of broad community support	- Ecodevelopment Committees Management Manual - Guidance Note to ensure social and environmental safeguard. - Selection criteria reflecting the social-environmental safe guard perspective - Selection to be done in a public meeting of people's institution placed by the Project (e.g., EDC)	- PMU will develop required guidance documents with an expert of Project Management Consultant
2	Baseline Surveys	- Social Assessment - Biodiversity Assessment (at construction site)	- Social Assessment Plan - Biodiversity Assessment Plan	
3	Sub-project Planning	- Process of micro plans to be participatory to reflect on the voices of the community members - Screening and selection of the activities with reference to the subproject exclusion criteria - Subproject categorisation as per the JICA Guidelines. - Participatory environmental and social assessment for confirmation of the screening results and finalization of the activities to be undertaken by EDCs	- Micro Planning Manual - Participatory Environmental and Social Assessment (ESA) Plan (if necessary) - Screening criteria	
4	Approval of sub-project	- Activities in sub-projects shall be reviewed by RMU from the viewpoints of environmental and social safeguard and submit to DMU for review and approval.	- Screening criteria - Guidance Note to ensure social and environmental safeguard	
5	Sub-project Implementation	- Community participation in project activities	- Guidance Note to ensure social and environmental safeguard.	
6	Monitoring and Reporting	- Through participatory M&E mechanism the impact of the project activities will be monitored by the executing agency	- Guidance Note to ensure social and environmental safeguard. - Monitoring Sheet	
7	Grievance Procedures	- Through the project's institutional structure	- Institutional responsibilities for addressing grievances	

8.2.   Institutional Framework for EIAF

EIAF will be implemented through existing institutional structure of the Project. The table below highlights institutional structure for EIAF with key environmental and social management roles and responsibilities. The implementation structure for the Project is shown in Annex1.

Institutional Structure for EIAF

Institution	Role in the Project	Role and/or Responsibility in EIAF
High Level Empowered Committee	- Highest decision making body	- Approve the Operational Manual prepared by the PMU - Endorse Annual Plan of Operation(APO) and annual budget of the Project which approved by the GB - Suggest and endorse measures and actions to resolve issues raised by JICA, Government of India or any other agencies related to the project
Governing Body (GB)	- Decision making body	- Facilitation and coordination with various line departments and other agencies - Review functioning of PMU, with regards to implementation of environment and social assessments, management plans and monitoring programs - Approve APO and annual budget prepared by EB - Approve/ change/modification/revision in project components/sub components on the proposal prepared and submitted by EB before submission to JICA for concurrence
Executive Body (EB)	- Supervision and monitoring of all activities	- Develop Operational Manual for the project which describes and provides guidelines for preparation of micro-plan, annual plan, fund management etc. - Prepare APO in consultation with field level offices of PMU - Closely monitor the physical and financial progress of the Project by organizing regular meeting with field level offices - Prepare modifications and/or changes in components/sub components of the project with justification, when required, and submit to GB for onward submission to JICA, GoI for concurrence and approval
Project Management Unit (PMU)	- Project implementation, supervision and monitoring of all activities. - Documentation and reporting.	- Owner and implementation of the EIAF/ STFDPF - Report to concerned departments in the State Government as well as to JICA in relation to environmental and social consideration in Annual Report in case environmental negative impact identified. - Information disclosure including elaboration of project information brochures and project homepage. - Consultation and guidance to DMUs/RMUs, and field level officers on information disclosure and consultation. - Ensure free, prior and informed consultation. - Development of Management Information System (MIS). - Development of approach and guidance for micro planning. - Training on micro planning to field level officers. - Technical guidelines for beneficiary selection, design of component technical approaches, safeguard checks/guidelines for particular activities (if required) - Development of monitoring forms, review of monitoring data, reporting, assistance with evaluations - Review of participatory Environmental and Social Assessments - Performance of due diligence follow-up - Guide, instruct, prepare guidelines, establish and operate M&E, GIS/ MIS, dissemination of project information, hand-holding support in the field for all project activities
Divisional Management Unit (DMUs)	- Assist PMU in implementation of project activities -	- Supervise project activities of RMUs - Supervise works carried-out by partner NGOs and Resource organizations - Report the result of categorization of subprojects by the monitoring form, to PMU - Facilitate convergence at divisional level
Field Management Unit (RMUs)	- Assist DPMUs and SPMU in implementation of project activities -	- Undertake project monitoring and reporting, provide logistical support for independent evaluations. - Coordinate with Gram Sabha to select sub-projects with screening procedures and to conduct participatory Environmental and Social Assessments (ESA). - Support and encourage the target villages for micro planning at village levels, finalization of micro plans. - Conduct free, prior and informed consultation, and due diligence checks

Institution	Role in the Project	Role and/or Responsibility in EIAF
Implementing organizations such as EDC, working groups, SHGs	- Assist the Project in selecting target beneficiaries - Clarify local needs and expectations on the Project	- Conceive and raise local awareness on environmental and social considerations. - Provision of support in micro planning activities at village level. - Participating in Environmental and Social Assessments (ESA). - Supporting TBGCP for free, prior and informed consultation, and due diligence checks.

Overall coordination and support for EIAF will be provided through the PMU at TNFD and information related EIAF will be centrally managed by the PMU. PMU will be responsible to report to concerned departments in the State Government as well as to JICA in relation to environmental and social consideration

Within TNFD, the Project Director (PD) will serve as Environmental and Social Safeguard Director and hold central responsibility for ensuring EIAF in the Project. Additional Project Director will serve as Environmental and Social Safeguard Manager to conduct overall management of EIAF monitoring and EIAF related information for the Project at the PMU level.

Further, DFOs of selected DMU will serve as Environmental and Social Safeguard DMU Chief for the project implementation at DMU level. FRO of selected RMU will serve also as Environmental and Social Safeguard RMU Chief for the project implementation at RMU level to provide hands-on assistance to members of Sub-committee who will be the Environmental and Social Safeguard Focal Person.

Individual Role and Responsibility for EIAF

Organization	Position	For EIAF	Role and Responsibility
PMU	Project Director (Chief Project Director)	Environmental and Social Safeguard Director	- Overall coordination and promotion of EIAF compliance - Overall responsible for ensuring EIAF in the Project. - Responsible to centrally manage information related to EIAF. - Responsible to report to concerned departments in the State Government as well as to JICA in relation to environmental and social consideration
PMU	Project Director (Admin and Finance)	Environmental and Social Safeguard Manager	- Responsible for implementation of EIAF for their activities in each designated work field. - Responsible for monitoring all the field level activities relating EIAF. - Responsible for examination of safeguards compliance.
DMU	DFO	Environmental and Social Safeguard DMU Chief	- Responsible for conducting overall management of EIAF monitoring and EIAF related information within DMU. - Responsible for regular collection of EIAF information as a part of MIS format.
RMU	FRO	Environmental and Social Safeguard RMU Chief	- Responsible for regular collection of EIAF information as a part of MIS format at RMU level - Providing hands-on assistance to EDCs, working groups, SHG and other groups, regarding EIAF. - Closely communicating with the Environmental and Social Safeguard Focal Person for timely action if necessary.
EDC/workinggroup/SHG	EDC/(SHG)	Environmental and Social Safeguard Focal Person	- Support the Project for compliance of EIAF. - Encourage beneficiaries to participate in activities relating EIAF.

The project's Management Information System (MIS) will include collection of safeguards-related data and the Project will also be subject to periodical evaluation and review, which will include examination of safeguards compliance. Through the Environmental and Social Safeguard Chiefs at DMU level, information will be regularly collected as a part of MIS format by the Environmental and Social Safeguard Manager who will be responsible for management of EIAF monitoring and EIAF related information of the Project.

8.3. Detail Procedures of EIAF

(1) Free, Prior and Informed Consultation (FPIC)

Beneficiary groups will be preliminarily selected based on the defined criteria, thereafter their participation in the Project must be confirmed through a process of free, prior and informed consultation with the EDC. If broad community support does not exist and/or the village actively does not wish to participate in the Project, then another village may be selected.

Consultation for Broad Community Support

Purpose/Objective:	Establishing broad community support for the project implementation
Consultation Topic:	– Basic information about the Project including area, location, purpose/objectives, key activities, stakeholders involved, target beneficiaries. – Expected role and involvement of communities. – An overview of possible environmental and social risks. – Necessity of Scheduled Tribe and Forest Dependent Plan
Participants:	– Members of EDCs/working groups, SHGs – Gram Panchayat members – Other important individuals
Process:	– Following beneficiary group formation, community meeting will be held using simple language. – Opportunities for open discussion of the Project should be provided. – Opportunities and facilities to facilitate participation of women, elders and other vulnerable. – Adequate time should be provided following the meeting for the participants to digest the information. – Field level officers will visit individuals who have expressed their criticism on any aspect of project implementation. – Decide if they do not wish to participate. – Presentation and discussion with EDC – Field level officers will participate in general community meeting to discuss concerns.
Material Required:	– Provision of simple/easy to read project brochures in Tamil and/or other languages which are usually used among the regions. – Consultation and Participation Monitoring Sheets
Individual Responsibility: Project Director (PD) Environmental and Social Safeguard Manager DFO at DMU RFO at RMU Environmental and Social Safeguard Focal Person	– To call a meeting – To propose and organize meetings. – To present the Project – To record participants and meeting minutes – To encourage participation of local communities

(2) Social Assessment

1) Purpose of Social Assessment

Social Assessment is a tool to help understanding key social issues and risks, and to determine social impacts on the target population of the proposed sub-project. There are many social variables that potentially affect the impacts and success of projects and policies—such as gender, age, language,

displacement, and socioeconomic status. Through data collection and analysis, the social assessment enables the Project in consultation with other stakeholders to prioritize critical issues and determine how to address them. The social assessment will serve a number of purposes:

a) Establish the baseline socio-economic situation of "the Scheduled Tribes and Forest Dependents " in the project area to act as a reference for measuring project impact;
b) Assess and opportunities to avail of basic social and economic services,
c) Provide a basis for identifying appropriate community development and livelihoods interventions under the project
d) Determine the short and long-term, direct and indirect, and positive and negative impacts of the project on the socio-cultural and economic status of particular vulnerable groups, including women, poor households, female-headed households, landless, SCs/STs and others as may be considered relevant
e) Highlight key social issues present, particularly those that are underscored in the JICA guidelines (e.g. relating to human rights, involuntary resettlement, loss of livelihoods, indigenous peoples, gender etc)
f) Provide a basis for developing recommendations for addressing the various concerns and issues of projects that affect them

The social assessment itself will be implemented, basically when, STs, SCs, or OBCs which may have negative impact and require preparation of STFDP are identified. In case there are no such targets, but certain adverse social impacts are anticipated, the implementation of the social assessment shall be conducted.

During the microplanning process, gathering of socio-economic related information will be conducted using similar methodologies as the social assessment described in this document. Information of the social assessment can be used for the microplanning process and additional information will be taken if it is required.

If the socio-economic baseline survey is carried out in the any activities of the Project at the target area, the social assessment for the EIAF/STFDPF can be omitted.

2) Social Assessment Approach and Task

The social assessment involves the participation of the members of the community to determine their needs and priorities, to obtain their views on the design and proposed implementation mechanisms of a particular project, and also to build capacity and involvement. It assists the executing agency in reaching the vulnerable and the poor and ensures that the project objectives are acceptable to the intended beneficiaries. The social assessment can be included in the micro planning process.

The social assessment plan will be prepared by EA to provide a reasonably detailed outline of the objectives, contents, methods and implementation schedule. ST, SC, OBC, forest dwellers and other forest dependents shall be identified as target group and consulted independently in the social assessment and micro planning process. The table below specify key tasks for the social assessment.

Tasks for Social Assessment

	Tasks	Descriptions
1	Description of the socio-cultural, institutional, historical, and political context	It explains the extent of socio-cultural fragmentation or homogeneity. It will also address the macro-policy context of the Project. Broader questions such as the traditional and cultural norms regarding the use of the resources and how these relate to relations between and among stakeholder groups can be determined.
2	Consideration of the legal and regulatory environment	It looks at the legal and regulatory environment of the Project, especially in relation to standing ownership and access arrangements and what their

		implications are for different stakeholder groups, especially the poor and vulnerable.
3	Relevance of core aspects of social development to the Project	It describes the potential outcomes of the proposed project in terms of social opportunities, constraints, impacts, and risks, such as socio-cultural diversity, gender, institutions, rules, stakeholder's interests, social risk and vulnerability.
4	Development of a strategy to achieve social development outcomes	It analyses the opportunities for community involvement in project preparation and implementation, the existing and proposed framework for property rights/access to resources, and sustainable management alternatives to achieve the desired social development outcomes.
5	Recommendations for project design and implementation arrangements	It reviews proposals for project design and provide guidance to the implementing agency on participatory alternatives and institutional strengthening measures appropriate to the socio-cultural characteristics of the project area(s). This will provide a basis for integrating the social analysis of the core elements into a proposal for implementation arrangements.
6	Development of a monitoring plan	The monitoring system needs to have local participation in the generation and refinement of indicators over the project cycle in order for the affected communities to be involved in balancing their own interests in the management of resources for conservation and productive purposes.

Source: Social Analysis Guidelines in Natural Resource Management (2005), World Bank

3)   **Reporting of Social Assessment Results**

A social assessment report shall include at least following contents.

Indicative Contents of Social Assessment Report

Chapter	Descriptions
Introduction	To define the basic purpose of the Social Assessment, its scope and a brief outline of how the report is organised.
Sub-Project Description	To provide brief details of the sub-project – rationale, objectives, area, key activities, the proposed implementation schedule etc.
Approach and Methodology	To describe the methods used in conducting the assessment, both quantitative and qualitative.
Socio-economic Baselines	To provide brief profiles of the target area.
Description of Sub-Project Impacts	Based on consideration of the sub-project's objectives and activities as well as the socio-economic/livelihoods assessment, to describe potential positive and negative impacts of the sub-project.
Vulnerable Groups:	To identify and describe particularly vulnerable groups within the community and how they may be affected by the Project.
Public Consultation and Information Disclosure	To document and present results of public consultation events with the communities.
Conclusion and Recommendations	To provide overall conclusions and recommendations.
Mitigation Measures	To identify specific measures to avoid, minimize and/or compensate for sub-project activities with adverse impacts on communities and particularly vulnerable groups.
Monitoring	To provide the developed monitoring plan including monitoring mechanism and monitoring implementation arrangements

(3)   **Biodiversity Assessment**

If the Subproject includes the construction of infrastructures such rain water harvesting structures, roads and buildings, and ecological impact is anticipated by the construction, biodiversity assessment shall be carried out in and around the construction sites and affected areas (e.g. submerged area by a check dam).

Biodiversity assessment includes but not limited to, following items.

- Identification of endangered species under IUCN Red List (especially Vulnerable, Endangered, Critically Endangered), India's Red List of threatened species of fauna and flora or scheduled under the Wildlife Act (1972)
- Identification of important habitat area for the endangered species

(4)　Micro Planning and Subproject Planning

1)　Micro Planning

Micro plans for ecotourism and ecodevelopment will be developed through participatory method. Micro plans for ecodevelopment shall concentrate on proposals concerning skills development. However, the micro plans shall also stipulate community development and livelihood needs/priorities expressed by villagers. The micro planning process shall involve specific procedures ensuring that the needs and priorities of vulnerable groups are reflected in the plans.

2)　Sub-project Planning (Beat Action Plan and Others)

Sub projects which are not included in a micro plan such as construction of RCC rain water harvesting structures and field office buildings etc., Sub projects will be planned by related organizations such as RMU, DMU, or PMU. During such sub-project planning, related organizations shall careful review of the social assessment and biodiversity assessment results.

3)　Selection and Screening

Sub-projects are selected based on the priority needs identified in the micro plans, beat action plans or other plans. Specific sub-projects will be selected on the basis of community preferences. However, certain exclusion criteria are required to ensure that the Project does not include sub-projects with potentially significant adverse environmental impacts such as EIA required projects (i.e., No Category 'A' or 'B' projects as per Indian EPA (1986) and the EIA Notification (2006)).

Sub-project selection and screening will be firstly carried out by EDC for the micro plan and Forest Range Officers for the action plan. Each activity in the sub-project shall be screened and then the highest category among the activities will be the category of the sub-project. For example, if the infrastructure development activity falls into category B while other activities fall into category C, the sub-project shall be categorized as B. Then, the screening results are submitted to DMU with the screening result format attached in Annexure 2 of this document.

The sub-project categorisation as per the JICA Guideline and finalisation of the exclusion criteria will be conducted by PMU prior to the commencement of the Project or at the early stage (before the EDC selection and consultation) of the preparatory work. In accordance with the JICA guidelines, various other exclusion criteria have also been developed and are shown in the table below.

Subproject Exclusion Criteria

Component	Exclusion Criteria
1. Overall	− Sub-projects which involve diversion of forest land − Sub-projects that involve acquisition of private land − Sub-projects that cannot demonstrate the broad community support − Sub-projects likely to have major adverse impacts on the environment − Sub-projects which will fall into "Category A" as per the JICA Guideline − Sub-projects which will fall into "Category A" as per the EIA Notification, 2006
2. Forest and Natural Environment	− Sub-projects to be conducted inside protected areas and will not contribute to environmental protection/ conservation of the selected protected areas. − Sub-projects which are not in accordance with principle of sustainable forest management including biodiversity conservation − Sub-projects that substantially alter basic composition of forest, especially natural forest. − Sub-projects likely to cause damage to wildlife and their habitats

Component	Exclusion Criteria
	– Sub-projects which involve felling of trees on Reserved Forest or PA unless ancillary to conservation and management of forests and wildlife defined in the working plan (e.g. fire breaks, thinning etc)
	– Sub-projects involving the collection, processing and sale of NTFP species listed under CITES, India's Red List of threatened species of fauna and flora or scheduled under the Wildlife Act (1972)
	– Sub-projects involving the use of fertilizers and pesticides banned by WHO (Classes IA, IB and II)
3.Social Environment	– Sub-projects that involve child labour
	– Sub-projects or activities which could lead to the exploitation of women
	– Sub-projects which involve acquisition of private land and/or resettlement
	– Sub-projects which affects adversely to forest dependents (Scheduled Tribes (ST), Scheduled Castes (SC) and other forest dependents).
	– Activities that could cause damage to places of religious importance, historical monuments or cultural properties

Though sub-projects which fall into the "Category A" as per the JICA Guideline are not anticipated in the Project, following scale of sub-projects are basically regarded as the "Category A" and "Category B". However, screening criteria might be changed based on its location and social situation.

Category A

JICA Guidelines stipulates that "Proposed projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. Projects with complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible impacts, are also classified as Category A. These impacts may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors, projects that have characteristics that are liable to cause adverse environmental impacts, and projects located in or near sensitive areas". Example of the screening criteria is as shown below.

- Conversion or felling   more than 100 ha of forest
- Construction of embankments/dams with water reservoir area more than 100 ha
- Development of more than 100 ha agricultural area
- Large-scale involuntary resettlement and land acquisition (more than 100 persons)

Category B

JICA Guidelines stipulates that "Proposed projects are classified as Category B if their potential adverse impacts on the environment and society are less adverse than those of Category A projects. Generally, they are site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily." and no specific criteria is set out. Example of the screening criteria for the project is as shown below.

- Construction of embankments/dams with water reservoir area more than 10 ha
- Development of more than 50 ha agricultural area
- Development of infrastructure or building where endangered species listed in Wildlife Act (1972) or their habitat are existed
- Building more than 20,000 square meters.
- Small-scale involuntary resettlement and land acquisition (more than 1 person)
- Other activities which fall into Category B in EIA Notification (2006)

Example of the endangered species listed Schedule IV (Plant) of Wildlife Act (1972) is shown below.

1 Beddomes cycad (Cycas beddomei)	4 Ladies slipper orchids (Paphiopedilum spp.)
2 Blue vanda (Vanda soerulec)	5 Pitcher plant (Nepenthes khasiana)
3 Kuth (Saussurea lappa)	6 Red vanda (Rananthera inschootiana)

Category C

JICA Guidelines stipulates that "Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society."

(5) Approval of Micro Plan and Sub-projects

Screening results from RMU shall be reviewed by DMU or PMU from the viewpoints of environmental and social safeguard and then submitted to DMU for approval. DMU officers shall final review the screening results and make a decision for approval.

During the review and approval processes, related organizations shall also take carefully considerations for above mentioned environmental and social safeguarded policy.

In case subprojects which fall into the "Category B" as per the JICA Guideline are identified during the above "Selection and Screening" process and adverse environmental/ social impacts are anticipated from such sub-projects, DMU shall report to JICA through PMU at the timely manner and preparation of the EMP and EMoP and their implementation will be required as shown below.

If the sub-project falls into category C, DMU shall submit the screening result with the screening result format attached in Annexure 2 of this document to JICA through PMU quarterly together with Project Status Report (PSR) to be prepared for the overall Project

(6) Environmental Management Plan and Monitoring Plan

Sub-projects which require the Environmental Management Plan (EMP) and the Environmental Monitoring Plan (EMoP) are not determined at the time of preparation of this document. In case subprojects which fall into the "Category B" as per the JICA Guideline are identified, preparation of the EMP and EMoP will be required and the process indicated below should be followed.

1) Screening of subprojects
2) Scoping of subprojects
3) Environmental and social survey/assessments
4) Preparation of EMP and EMoP
5) Implementation and monitoring of subprojects based on EMP and EMoP

The sub-project owner (SPMU) and contractors/implementers are the key entities for the implementation of environmental clearance.

The EMP and EMoP shall consist and cover following aspects:

1) EMP: Environmental mitigation and consideration measures which shall be taken in the course of the Project implementation in construction and operation phases. The measures shall be examined based on the subproject description and assessment results of environmental, social, health and safety impacts.

2) EMoP: Environmental monitoring plan to supervise/examine the implementation of proposed environmental mitigation and consideration measures and to measure the quality of surrounding environments under the influence of the project activities during construction, and operation phases.

In case of community related sub-project activities, contents of the EMP and EMoP shall be included in the Micro Plan to be prepared by the concerned community.

(7)   Monitoring and Reporting

The safeguards frameworks require certain outputs relevant to ensuring that environmental and social safeguards have been observed. Therefore, indicators are required to measure the utilization and quality of the safeguard processes. The table below presents monitoring items, their indicators, means of verification, frequency and responsible parties for demonstrating and measuring that safeguards measures have been implemented. Monitoring shall be carried out for each sub-project.

Such monitoring results shall be compiled as monitoring report and submitted to JICA by PMU. Monitoring form shall be developed also by PMU so that every sub-project can use same format. Monitoring report shall be submitted to JICA through PMU quarterly together with Project Status Report (PSR) to be prepared for the overall Project.

Draft Monitoring Items, Indicators, Means of Verification, Frequency and Responsible Parties

	Item	Indicator	Means of Verification	Frequency	Responsible Party
1.	Information disclosure and establishment of broad community support	- Method, location, and timing of free, prior and informed consultation (FPIC) - No. of men, women, SCs/STs attended at the community meeting - % of interviewees satisfied with information disclosure process	- Minutes of the Meetings - Community resolution - Voting records	For every sub-project. Additional measurement should be carried out whenever need arises during the Project implementation.	PMU/ DMU
2.	Baseline Surveys	Social Assessment - No. of men, women, SCs/STs Biodiversity Assessment - No. of endangered species and locations	- Social Assessment Reports - Biodiversity Assessment Reports	For every assessment	DMU/ RMU
3.	Sub-project Planning	- No. of men, women, SCs/STs consulted in micro planning - % of interviewees satisfied with micro plans - Linkage/ convergence with other schemes	- Micro plans - Beat action plans - Other plans	For every sub-project planning	PMU/ DMU/ RMU
4.	Approval of Sub-project	- No. of excluded sub-projects	- Lists of sub-projects - Reports on the selection and screening	At the time of sub-project selection	PMU/ DMU
5.	Sub-project implementation	- No. of women, SC/ST beneficiaries - % of interviewees satisfied with beneficiaries selected	- JFMC, SHGs, established - Sub-project Plans	At the time of beneficiary selection At the time of sub-project planning	PMU/ DMU/ RMU
6.	Monitoring and Evaluation	- No. of men, women, SCs/STs attended community meeting	- Monthly, quarterly, annual monitoring forms - Social audit reports	At least once a year. Additional measurement should be carried out whenever need arises during the project implementation.	PMU/DMU/ RMU

	Item	Indicator	Means of Verification	Frequency	Responsible Party
		Rain water harvesting structure construction - Ground water level - River flow - Water quality	- Monitoring forms	Pre-construction: once After-construction: at least quarterly	SPMU/ DPMU/ BPMU
		Operation of lodges and canteens - Water quality - Waste management	- Monitoring forms	During operation: twice a year monthly	
7.	Grievance procedures	- No of grievances submitted - No of grievances resolved - % of interviewees aware of and satisfied with grievance mechanism	- Grievance forms	At least once a year. Additional measurement should be carried out whenever need arises during the Project implementation.	PMU/ DMU/ RMU

(8) Information Disclosure and Grievance Procedures

The executing agency will disclose all information relating environmental and social safeguard of the Project. This will include all the ESMS related documents including social assessment documents, monitoring report and their plans. All information will be made available in a timely manner, in an accessible place, and in a form and language(s) understandable to all stakeholders, including the general public, and affected people, if any, so that they can provide meaningful inputs for further development of the ESMS. JICA will also make the monitoring result open for the public via their website.

Formal grievance mechanism will be in line with existing policies, strategies, and regulations on grievances as defined by GoI (i.e., Guidelines for Redress of Public Grievances (2010)). However, it is expected that project related grievances can be dealt with through the proposed institutional structure of the Project. Thus, the grievance mechanism will be institutionalized in each level of project implementation, from the community to the executing agency.

Key principles for grievance redress in TNFD are described hereunder:

1. The rights of all project participants are respected and their interests protected

2. Concerns of project participants arising from the project implementation process are adequately addressed and in a prompt and timely manner

3. Entitlements or livelihood support for project participants are provided on time and in accordance with the relevant GoI and JICA safeguard policies and applicable legal framework

4. Project participants are aware of their rights to access and to realize access to grievance procedures free of charge

5. The grievance mechanism will be institutionalized in each village by the Village Council

Chapter 9.   Framework and Procedures of STFDPF

9.1.   Preparation of Scheduled Tribe and Forest Dependents Plan

(1)   Process

The Scheduled Tribe and Forest Dependents Plan shall be prepared at the Gram Panchayats/

JFMC/EDC level when adverse impacts of the Project to the ST and Forest Dependents are anticipated. The content of the Scheduled Tribe and Forest Dependents Plan should be a part of the micro plan or other sub-project plan to be prepared. The Scheduled Tribe and Forest Dependents Plan should be prepared by the lead of field officers/ animators and with active participation of ST and Forest Dependents of the village/ habitation. The indicative steps for preparation of the Scheduled Tribe and Forest Dependents Plan have been described at the table below.

Processes for Preparation of Scheduled Tribe and Forest Dependents Plan

Step	Safeguard Activity, Methods, Processes
Screening and Basic Information Collection	- Consultation and confirmation of whether the plan is necessary to prepare or not. - Collection of basic information on the village/habitation such as status of ST and forest dependents; possibility of forest dwellers' participation of ST and forest dependents in the project; potential impact of the project on ST and forest dependents.
Social Assessment	- Assessments of needs and priorities of ST and forest dependents by participatory rural appraisal tools
Consultation with ST and Forest Dependents	- Workshops and discussion for identification of mitigation measures and other support activities
Drafting and Approval of the Plan	- Preparation based on workshop/discussion activities - Meeting of EDCs

(2) Contents of Scheduled Tribe and Forest Dependents Plan

The Scheduled Tribe and Forest Dependents Plan shall include at least following contents.

Indicative Contents of Scheduled Tribe and Forest Dependents Plan

Chapter	Descriptions
Introduction	- To define the basic purpose of the plan, its scope and a brief outline of how the report is organised. - To define Scheduled Tribe and Forest Dependents
Sub-Project Description	- To provide brief details of the sub-project – rationale, objectives, area, key activities, the proposed implementation schedule etc.
Socio-economic Baselines	- To provide brief profiles of the target area. - To provide baseline information on the demographic, social, economic and cultural characteristics of ST and Forest Dependents - Baseline information on the natural resources (land, water and forest) managed and used by the ST and Forest Dependents.
Summary of the Social Assessment and Free, Prior and Informed Consultation	- To identify key project stakeholders - To describe consultation with the ST and forest dependents - To assess the potential adverse and positive effects of the project
Action Plan	- To identify measures to be taken up for avoiding and/ or mitigating the potential adverse effects of the Project - To identify activities to be carried out for supporting the ST and forest dependents to participate in the Project
Public Consultation and Information Disclosure	- To document and present results of public consultation events with the communities.
Cost estimates and financing plan	- To provide activities wise budget and possible sources of finance
Monitoring Plan	- To provide details of monitoring mechanism upon implementation of Scheduled Tribe and Forest Dependents Plan

(3) Institutional Framework for STFDPF

In principle, the institutional framework for EIAF will be applied for implementation of STFDPF

9.2. Detail Procedures of STFDPF

(1) Free, Prior and Informed Consultation

It is important that the target population (ST and Forest Dependents) of the Project are consulted in the process of establishing broad community support for the Project at local levels. At the preparatory stage, the locations where each of these communities live and derive a livelihood will be mapped. It should be ensured that these communities are adequately represented in consultation meetings and during the preliminary information disclosure. In consultation meetings and disclosing information including written materials, language of communication should be Tamil and/or other languages which are usually used among the regions. Contents of written materials should be simple enough for everyone to follow. Also, opportunities and facilities to facilitate participation of women, elders and other vulnerable should be considered. It should be the responsibility of the animators/ field officers to make sure that visualization and visual presentations are used as much as possible. A well designed program would benefit from well documented consultations with indigenous communities.

(2) Social Assessment and Sub-Project Planning

Social assessment and sub-project planning process shall involve specific procedures ensuring that the needs and priorities of vulnerable groups are reflected in subprojects under the Project.

In principle, the social assessment for STFDP should follow the procedure determined in the EIAF. However, in case, there are targets of STFDP, following issues should be also covered in the Social Assessment.

a. Demography, cultural and political characteristics of affected ST & Forest Dependents.

b. Lands which affected ST & Forest Dependents have been traditionally possessing or customary using/occupying.

c. Natural resources which affected ST & Forest Dependents rely on for their social as well as economic bases.

(3) Selection and Screening of Subprojects

Selection of subprojects will be prioritized keeping in mind the target beneficiaries (ST and Forest Dependents) will face no/minimum negative impacts by the project activities. All subprojects to be supported by the Project need and to be finalized through participatory consultation processes and vulnerable communities will be an integral part of this process. Target beneficiaries will have preferential treatment even during the project implementation stage.

(4) Monitoring and Reporting

Basically the monitoring and reporting related to the STFDP to be monitored through regular Project monitoring and evaluation system together with EIAF. The Project will include participatory monitoring where identified ST and forest dependents should be consulted separately. In this process, they are a part of the beneficiary community, ensuring that they have a fair opportunity to provide feedback on project implementation.

(5) Grievance Procedures

Grievance procedures for ST and forest dependents are the same as that of other vulnerable groups provided in the EIAF. However, if deemed necessary, it is important to establish a grievance redress committee to respond effectively in a timely and responsible manner.

Chapter 10. Capacity Development Requirements for EIAF and STFDP Implementation

The project will not include any sub-projects requiring prior clearances such as environmental clearance nor any activities with major social impacts, however as described in the previous sections, there are certain potential impacts and risks. Management and monitoring of environmental and social risks require a certain level of awareness and technical capacity.

Particularly for environment and social management, certain specialized knowledge and skills will be required at different management levels for operationalising the procedures for assessing and screening environmental and social impacts as well as implementing and monitoring safeguards measures.

The table below describes indicative key capacity development requirements for implementing the EIAF and STFDP measures, steps and procedures. Detailed capacity development plan for environmental and social safeguard will be developed by the executing agency in line with the capacity development component of the Project during at the preparation stage.

Capacity Development Plan for Environmental and Social Safeguards

Module Name	Theme/Topic	Key Participant	Schedule
Management/ Administrative Level	− JICA's safeguard policy − Basic introductory concept of safeguard − EIAF/STFDPF steps and procedures to be applied in the Project − Free and prior informed consent (FPIC) − Monitoring and Evaluation	− PMU officers / DFO at DMU/FRO at RMU	− One time at the preparatory phase (total one batch)
Field/ Operational Level	− Basic introductory concept of safeguard − EIAF/STFDPF steps and procedures to be applied in the Project − Community consultation processes − Free and prior informed consent (FPIC) − Monitoring and evaluation	− Representatives from EDCs − Other representative from Village Council and Gram Panchayat (if necessary)	− One time for each district at the preparatory phase (total 4 batches)

Annexure 1: Implementation Structure for the Project for TBGCP
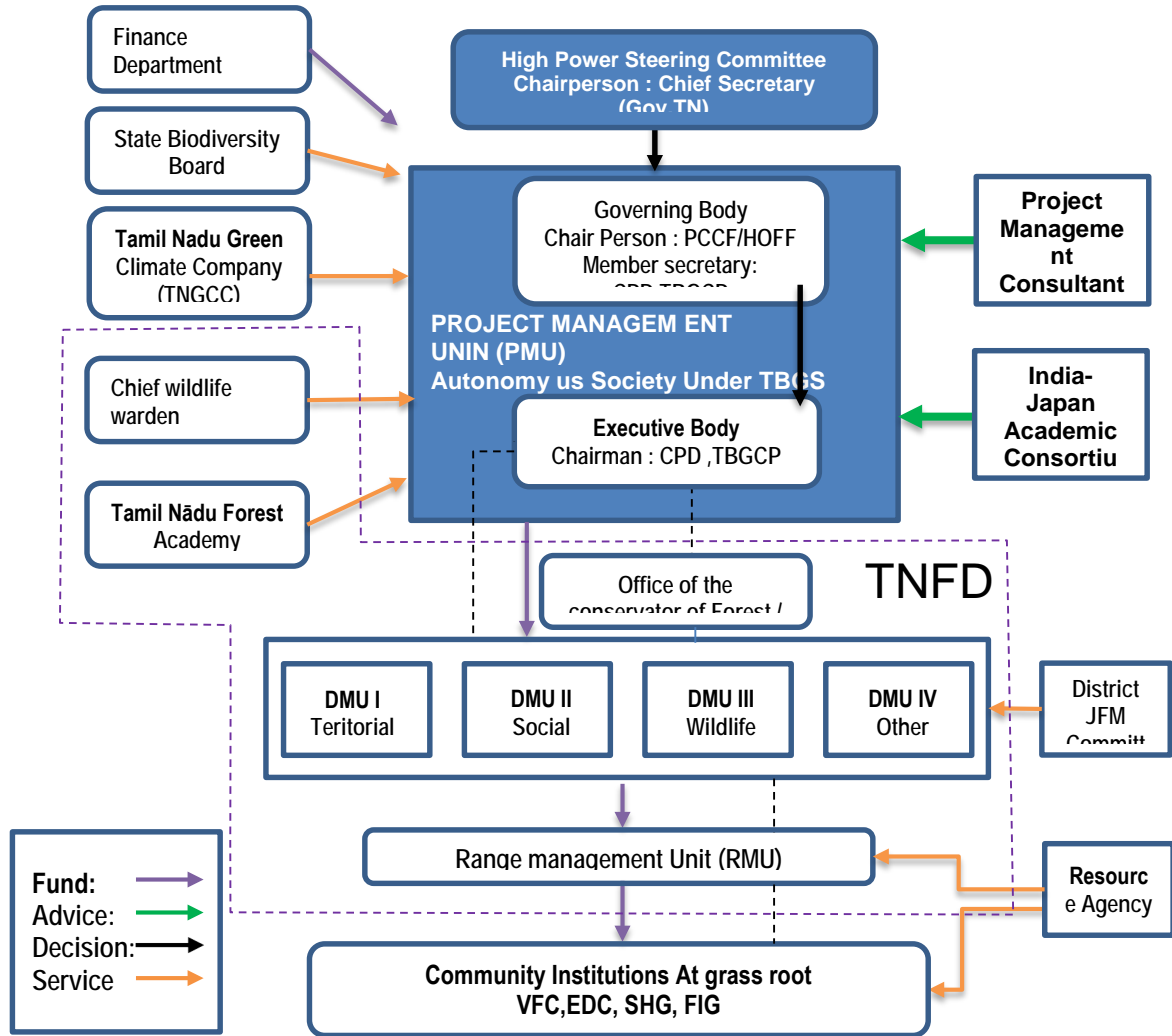
Annexure 2: Sample of Screening Results for Sub-Project

1. General Information of the Sub-Project

Items	Descriptions
Name of Sub-Project	(e.g.Micro Plan of XXX EDC)
Location	(e.g. XXX Village/Hamlet)
Implementation Organization	(e.g. XXX EDC)

2. Screening Results of the Sub-Project

Screening Results	Reason for the Screening	Person in Charge for Screening(Name, Position, Organization)
(A, B, C)	(e.g. this sub-project include Category B activity such as check dam construction)	(e.g. Mr.XXX, DFO of ZZZ DMU)

Note: The highest screening result of the activities should be applied for the sub-project

3. Screening Results of Each Activity in the Sub-Project

Component	Name of Activity	Location of the Activity	Description of the Activity	Screening Result	Reason for the Screening
Ecotourism	(e.g. construction and operation of accommodations)	(e.g. from Lat. XXX Long.XXX to Lat.YYY to Long YYY, Distance ZZZ km)	(e.g. tourist facilities with accommodations and canteens)	(e.g. C)	(e.g. effluent and waste will be generated during the operation in forest areas. Waste management plan will be prepared and septic tanks will be installed to mitigate the impacts)
Ecodevelopment	(e.g. Construction of rain water harvesting structures)	(e.g. Lat. XXX, Long XXX,)	(e.g. one rain water harvesting structures with catchment area of 15 ha and submerged area of 5ha will be constructed)	(e.g. B)	(e.g. some endangered species listed on Wildlife Act(1972) such as *cycas beddomei* were found at the construction sites based on the biodiversity assessment results. Endangered species will be transplanted outside of the submerged area)
Livelihood Improvement Activities					
Management Capacity Development					

Annexure 10.5: Environment Checklist

Information as of 15 Nov, 2021

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process?	N	The Project doesn't include any activities which require prior clearances, such as Environmental clearance, CRZ clearance, Forest clearance, and Wildlife clearance. Environmental and Environment Impact Assessment Framework (EIAF) and Scheduled Tribe and Forest Dependents Plan Framework (STFDPF) are prepared to avoid adverse environmental and social impact. The activities which may have significant environmental and social impact will be eliminated based on the EIAF/STFDPF.
		(b) Have EIA reports been approved by authorities of the host country's government?	N	ditto
		(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	N	ditto
		(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	N	Other environmental permits are also not required for the proposed project
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?	Y	Specific stakeholder consultation meetings/workshops are not planned yet. However, series of meetings/ workshops are to be held with various stakeholders in relation to project formulation. Comments of local stakeholders will be integrated into design of subprojects and activities prior to their implementation following social assessment and consultation processes.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	Y	Since majority of the project activities to be implemented through communities, comments of local stakeholders will be integrated into design of subprojects and activities prior to their implementation following social assessment and consultation processes.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	Y	The project location and components have not been fully determined yet. However social and environmental considerations to be factored into project design (through exclusion/selection criteria for project activities). If the activities which may have some environmental and social impact, mitigation measures including alternatives will be studied based on the EIAF/STFDPF.
2 Pollution Control	(1) Air Quality	(a) Do air pollutants, such as dust, soot and dust, sulfur oxides (SOx), nitrogen oxides (NOx), and organic chemical substances emitted from various sources, such as logging operations, forest products manufacturing processes, and incinerators comply with the country's emission standards and ambient air quality standards? Are any mitigating measures taken?	NC	No significant serious impacts by the Project are predicted. However, if any impact may be predicted by further studies, as required, necessary measures will be carried out based on EIAF.
	(2) Water Quality	(a) Is there a possibility that the use of chemicals, such as fertilizers, and agrochemicals will cause water pollution?	NC	Construction of loose boulder check wall vegetative barrier and rain harvest structures may temporarily cause siltation and aquaculture in conservation ponds may deteriorate the water quality. However, no significant serious impacts to water quality by the Project are predicted. If some negative impacts are anticipated, mitigation measures and monitoring will be carried out based on EIAF.
		(b) Where facilities, such as forest products manufacturing facilities are installed, do effluents from the facilities comply with the country's effluent standards and ambient water quality standards?	Y/NC	There will be no large-scale manufacturing facilities of forest products such as bamboo or timber operations planned under the Project. There may be some small-scale manufacturing facilities. The effluents from ecotourism facilities such as a lodge and canteens may cause water pollution but the installment of septic tanks can mitigate problems. Therefore associated effluent and effect on water sources/supply will be nil or negligible.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				If some impacts are anticipated, mitigation measures and monitoring will be carried out based on EIAF.
	(3) Wastes	(a) Are wastes properly treated and disposed of in accordance with the country's regulations?	Y	There will not be any significant waste associated with the Project activities since there will be virtually no manufacturing. Ecotourism/ ecodevelopment activities will generate garbage wastes, but waste management system will be planned as a part of microplan for the implementation of proper waste management. However, if any impact may be predicted by further studies, as required, necessary measures and monitoring will be carried out according to national regulations and EIAF.
	(4) Soil Contamination	(a) Are adequate measures taken to prevent contamination of soil and groundwater by use of chemicals, such as agrochemicals?	Y	Any chemicals will not be used under The Project. Thus, no significant serious impacts by the Project are predicted. However, if any negative impact may be predicted by further studies, as required, necessary measures and monitoring will be carried out according to national regulations and EIAF.
		(b) Are any agrochemicals management plans prepared? Are any usages or any implementation structures organized for proper use of the plans?	N	The Project will not use any chemicals. However, existing guidelines will be adopted or guidelines will be prepared if necessary.
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	Y	Certain parts of the Project area include protected areas such as national parks and wildlife sanctuaries. Even though, all the proposed project interventions are aimed at promoting sustainable/ scientific management of selected protected areas that would contribute to environmental conservation of the area. If any adverse impact may be predicted by further studies, required countermeasures/monitoring will be examined to avoid/mitigate the predicted impacts based on the related laws/regulations and EIAF.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	Y	Primeval forests and ecologically valuable habitats such as coral reefs, mangroves and tidal flats are to be included in the Project. If any adverse impact may be predicted by further studies, required countermeasures/monitoring will be examined to avoid/mitigate the predicted impacts based on the related laws/regulations and EIAF.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	N	This project intends to conserve the protected habitats and will not involve any activities which affect them negatively. However, there are the possibilities that endangered plants or habitat for endangered species occur at or around the construction sites of rain water harvesting structures or buildings. Biodiversity assessment will be carried out at or around the construction sites as occasion arises. If any adverse impact may be predicted by further studies, required countermeasures/monitoring will be examined to avoid/mitigate the predicted impacts based on the related laws/regulations and EIAF
		(c) Is there a possibility that changes in localized micro-meteorological conditions, such as solar radiation, temperature, and humidity due to a large-scale timber harvesting will affect the surrounding vegetation?	N	There will be no large-scale timber harvesting in the Project
		(d) Is there a possibility that a large-scale timber harvesting will result in loss of breeding and feeding grounds for wildlife?	N	There will be no large-scale timber harvesting in the Project
		(e) In the case of reforestation projects, is there a possibility that mono-species plantations will adversely affect wildlife habitats? Is there a possibility that mono-species plantations will cause outbreaks of pests?	N	Mono-species plantations will not be expected in the Project
		(f) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	N	Significant negative ecological impacts are not anticipated. Ecological restoration is a key Project goal.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(g) Isn't an illegal deforestation associated with the project being carried out, or is an acquisition of the forest certification by the project proponent being carried out?	N	The Project will not involve any deforestation. Small-scale removal of trees associated with small-scale infrastructure development may occur and subject to relevant legislation requiring clearance.
	(3) Hydrology	(a) Is there a possibility that alteration of rainwater runoff and runoff characteristics due to a large-scale timber harvesting and access road construction will cause impacts on the hydrology of the surrounding areas?	NC	There will be no large-scale timber harvesting. The Project should have generally positive impacts on surrounding hydrology due to the construction of rain water harvesting structures. Basically, no significant adverse impact is predicted. However, rain water harvesting structure construction may cause small changes of river flow and ground water level, so monitoring of relevant items will be carried out based on EIAF.
		(b) Is there a possibility that decreased water retention capacity due to deforestation will affect the existing drainage patterns of the forest?	N	Soil and Moisture Conservation measures such as small and medium scale rain water harvesting structures are designed and implemented to maintain and improve drainage patterns of the forest.
	(4) Topography and Geology	(a) Is there a possibility that loss of forest stability due to timber harvesting will cause slope failures or landslides?	N	There will be no timber harvesting in the forest areas.
	(5) Management of Abandoned Sites	(a) Are adequate restoration and revegetation plans considered for the harvested areas? In particular, are adequate measures taken to prevent soil runoff from the harvested areas?	N	As no timber harvesting is proposed in the forest areas hence, there is no question of soil erosion etc.
		(b) Is a sustainable management system for the harvested areas established?	N	ditto
		(c) Are adequate financial provisions secured to manage the harvested areas?	N	ditto
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	N	There will be no involuntary resettlement anticipated. Activities which involve involuntary resettlement should be avoided based on the subproject exclusion criteria on EIAF.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	N	There will be no involuntary resettlement in The Project.
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	N	ditto
		(d) Is the compensations going to be paid prior to the resettlement?	N	ditto
		(e) Is the compensation policies prepared in document?	N	ditto
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	N	ditto
		(g) Are agreements with the affected people obtained prior to resettlement?	N	ditto
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	N	ditto
		(i) Are any plans developed to monitor the impacts of resettlement?	N	ditto
		(j) Is the grievance redress mechanism established?	N	ditto
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? Is particular attention paid to the inhabitants whose livelihoods are based on primary industries, such as farming, raising livestock, or hunting and gathering in the forests?	NC	The Project intends to have a positive impact in terms of improving local people's livelihoods/ living conditions. However, it is possible that certain biodiversity conservation activities could have some negative impact on local people's customary access to natural resources. Such impacts will be addressed through participatory planning and required countermeasures will be examined to avoid/mitigate the predicted impacts based on EIAF/STFDPF.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Are adequate measures taken to prevent illegal entry into the forestry resource areas from the outside through newly constructed access roads?	NC	The Project may not construct new access roads in the majority of Project areas. If any adverse impact may be predicted by further studies, required countermeasures/monitoring will be examined to avoid/mitigate the predicted impacts based on the related laws/regulations and EIAF/STFDPF.
		(c) Is there a possibility that the forest right of common is obstructed?	NC	A key Project objective is to strengthen community-based forest institutions and empower local people to realize their forest management, and planned Ecodevelopment activities would be skills development, which are not related to forest right. However, it is possible that certain biodiversity conservation activities could have some negative impact on local people's customary access to natural resources. Such impacts will be addressed through participatory planning and required countermeasures will be examined to avoid/mitigate the predicted impacts based on EIAF/STFDPF.
		(d) Are considerations given to life of residents before implementation of project?	Y	A key objective of the Project is to improve local livelihoods. Local people will be consulted prior to any Project activities and thus Project activities will be defined by the communities themselves based on EIAF/STFDPF.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	NC	There are archeological, historical, cultural, and religious heritage sites within the Project area, and some of them would be targets of conservation for the promotion of ecotourism. In addition, since the Project carried out in participation manner, it will have no significant impact on such sites. If any adverse impact may be predicted by further studies, required countermeasures will be examined to avoid/mitigate the predicted impacts.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	N	Basically, no significant impact is predicted affecting the landscape since infrastructure under the Project will be on a small scale. Promoting urban and peri-urban forestry may improve the landscape of urban and peri-urban areas.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	Y	Scheduled Tribe and Forest Dependents Plan Framework (STFDPF) will be prepared to reduce impacts on the scheduled tribe and other forest dependents.
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	Y	The STFDPF includes measures to ensure that the rights of Scheduled Tribe and Forest Dependents are respected in terms of access to land and resources
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	N	The working conditions will be protected by India's laws and regulations.
		(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	NC	As required, proper instruction and guidance on safety consideration will be given to workers and other individuals involved in the Projects.
		(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	NC	ditto (Such activities are relevant for large scale construction or commercial forestry but not for this type of Project.)
		(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	NC	ditto (Security guard will not be required for most of the proposed project activities)
5. Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	NC	Construction will be of small-scale with limited and temporary environmental impacts. If any adverse impacts may be predicted by further studies, required countermeasures/monitoring will be examined to avoid/mitigate the predicted impacts based on the related laws/regulations and EIAF

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	Y	It is considered that the construction activities will not affect the natural environment adversely in the sites, but adequate measures/monitoring will be adopted to mitigate impacts as required based on the related laws/regulations and EIAF.
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	Y	Adverse social impacts of construction are expected to be eliminated through the exclusion/ selection criteria (e.g. resettlement, damage to cultural buildings etc.). However, if required, adequate measures such as detours, etc. will be taken to mitigate impacts to social environment based on EIAF.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Y	Monitoring should be executed, based on a monitoring system to be developed for the Project which includes the monitoring of environmental and social safeguards measures
		(b) What are the items, methods and frequencies of the monitoring program?	Y	The items, methods, and frequencies of the monitoring system are covered in the EIAF/STFDPF
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	Y	ditto. (Also adequate provisions are made in the Project proposal to cover monitoring requirements)
		(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	N	The monitoring requirements will be entirely for the purposes of the Project and additional reporting to regulatory agencies will not be required because the Project activities will not require environmental clearance.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Agriculture checklist should also be checked.	NC	It is possible that The Project will include some agricultural activities as a part of ecodevelopment activities/livelihood improvement, but these will be small-scale and no significant impacts are predicted for the Project, However, details needed to be confirmed at further studies for the Project.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not Clear: NC	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	N	The Project will not have any significant global or transboundary impact. It will have a slight positive global impact due to forest restoration and carbon sequestration.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.   In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked.   It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Annexure 10.6: Environmental and Social Management System (ESMS) Checklist

Information as of 18 November, 2021

	Questions	Answer	Improvement Plan
1.	**Policy (environmental and social policy)**		
1	Does the financial intermediary / executing agency have any formal environmental policy or procedures? If yes, please describe them and provide appropriate documentation. If no, does the financial intermediary /executing agency have any plan to set such policy or procedures?	No: The Executing Agency (EA), TNFD, does not itself have formal environmental policies or procedures to avoid negative impact on the natural and social environment, because most of the TNFD engaged projects are not expected to do harm to the environment. However, all activities undertaken by EA must be implemented in accordance with the relevant environmental laws, policies and procedures of Indian Government (defined by MoEF&CC and others) and the state government of Tamil Nadu.	The existing Indian legal/policy framework is sufficient for the elimination of sub-projects with serious adverse environmental impacts. EA may however involve certain sub-projects with minor environmental impacts (e.g. small-scale infrastructure). Although all such activities shall not require environmental clearance as per the legislations, the Environmental Impact Assessment Framework (EIAF) and the Scheduled Tribe and Forest Dependents Plan Framework (STFDPF) to be prepared will be the principal documents which define measures to avoid adverse environmental and social impact.
2	Are there any types of projects in which the financial intermediary / executing agency will not take part due to the environmental risks? (e.g., projects involving handling of hazardous wastes or endangered plants or animals).	No: No types of sub-projects with such environmental risks (e.g., generating hazardous wastes or affecting endangered plants or animals) are foreseen. However, the project will involve community related sub-projects which will be selected in participatory mode and therefore there is some flexibility for appropriate interventions in accordance with the ground situations. The Project objective aims at protecting environment, by promoting biodiversity and increasing forest areas, rather than any risks.	Sub-projects with serious environmental impacts beyond the mitigation capacity of the Project will be eliminated or avoided. EIAF/STFDPF is the principal documents which define measures to avoid environmental and social adverse impact. Projects with serious environmental risks beyond the mitigation capacity of the natural environment will be avoided under EIAF/STFDPF.
2.	**Procedures (screening, category classification and review procedures)**		
3	Does the financial intermediary / executing agency have any environmental procedures such as screening, categorization and environmental review? If yes, please describe.	No: However; clear guidelines and procedures for environmental safeguard exist in Indian legislation system. The EA itself is not responsible for implementation of environmental procedures such as screening, categorization and environmental review as per indicant laws and regulations.	The EIAF/ STFDPF being the principal documents, will clarify the basis for detail procedures for screening, categorization and environmental review of the Project and sub-projects. Additional supplemental documents will be prepared during the preparatory stage of the Project.

	Questions	Answer	Improvement Plan
4	Please describe how you ensure that your subproject companies and their subprojects are operated in compliance with the national laws and regulations and applicable JICA's requirements.	Basically, EA does not hire companies to execute sub-projects. Activities of the sub-projects are divided into four components: Ecosystem Based Climate Change Measures, Human Wildlife Conflict Measures, Promoting Supply Chain Development, Livelihood Improvement Activities, and Management Capacity Development, and will be managed by EA with a multifaced approach to integrate the other agencies in the state and the division level. At the state PMU level, State Biodiversity Board , Chief Wild life Warden and Tamil Nadu Forest Academy will be roped in for their valuable advice to the project . At the DMU level, District JFM committee will act as a hub for supporting various Project Interventions and assist in intersectoral linkage. At the community level, in cooperation with Ecodevelopment committee, the community, and NGOs, the sub-projects will be implemented by the EA itself. However, EA shall hire companies to implement specific infrastructure construction (e.g. rain water harvesting structures, water storage tanks, etc.) as needed.	EIAF will be prepared for addressing issues arising under the Project and sub-projects. STFDPF will be also prepared to cover instances where the Project will directly impact or involve forest dependents including STs/SCs/OBCs. Mitigation measures will be built into project component design and implementation. Overall coordination and support for EIAF/STFDPF will be provided through the PMU as the executing agency. Within the executing agency, the Chief Project Director, PD, at PMU will hold central responsibility for ensuring EIAF in the Project, and information related EIAF will be centrally managed by the PD. Under the supervision of PD, Project Director (Admin and Finance) will hold position as Environmental and Social Safeguard Managers for their activities in each designated work field. Further, DFO at DMU and RFO at RMU will be responsible for environmental and social safeguard issues to provide hands-on assistance to members of EDCs/SHGs who will be the Environmental and Social Safeguard Focal Person.
5	How are environmental considerations taken into account in the credit review and approval process for project loans or equity investments?	N/A	In the proposed EIAF, subproject exclusion and screening criteria are prepared. The subproject review, selection and approval will be conducted by DFO at DMU and FRO at RMU in accordance with the set subproject exclusion and screening criteria.
6	How are environmental issues taken into account in deciding whether to offer or extend commercial credit, working capital finance, trade finance, payment services and other financial services to a company?	N/A	In the proposed EIAF, subproject exclusion and screening criteria are prepared. The subproject review, selection and approval will be conducted by DFO at DMU and FRO at RMU in accordance with the set subproject exclusion and screening criteria.
3.	**Organization and Staff (institutional framework and staff allocation)**		

	Questions	Answer	Improvement Plan
7	Please provide us with the organization chart of the financial intermediary / executing agency's Environmental and Social Management System (ESMS).	EA does not have ESMS as not required for their present role and responsibility; therefore the organizational chart is not available at the moment.	Organization structure of EA for EIAF/STFDPF implementation will be clarified at the initial stage of the Project. The organizational chart will be prepared accordingly. Proposed institutional arrangement for ESMSF/STFDPF is described in "Item 9" hereunder.
8	Who is responsible for environmental and social management within the financial intermediary / executing agency? (name/role and title)	N/A	CEO & Project Director, TNFD
9	Are there any staffs with training for environmental and social considerations in the financial intermediary / executing agency? If so, describe.	Key officers are well-trained in the application of the Forest Conservation Act and Wildlife (Protection) Act, relating to forest and wildlife clearance procedures. However, in most of cases not trained in environmental and social impact assessment procedures and risk management.	In the PMU, deputies of the PD (Chief Project Director) will serve as Environmental and Social Safeguard Director for activities in each designated work field. Project Director (Admin and Finance) serves as Environmental and Social Safeguard Manager to conduct overall EIAF/STFDPF monitoring and management of EIAF/STFDPF related information for the Project at the PMU level. At the level of DMU/RMU, DFO and FRO will serve as Environmental and Social Safeguard Chiefs for the project implementation respectively. Training will be provided by EA to improve understanding of environmental and social safeguards/ assessments, screening, monitoring procedures.
10	Are there any technical staffs with an engineering/industry background responsible for technical analysis of credit proposals?	No However, all India Service Officers (IFS), State Service Officers, Frontline Uniformed Staff (FRO) are trained on basic engineering for small scale infrastructure etc during their service training.	For small scale community infrastructures development technical training will be provided to EA staffs and other key stakeholders accordingly.
11	What experience, if any, do the financial intermediary / executing agency have of hiring or dealing with environmental consultants?	N/A Activities which EA has been involved had minimal environmental impact, therefore; environmental consultant(s) have not been hired so far.	Environmental and Social Safeguard Director and Manager will be assigned in the PMU to support PMU for preparation and updating of EIAF/STFDPF. In addition, project management consultants will be contracted for providing the PMU with overall assistance on technical and managerial aspects and policy initiatives relating to programme implementation including environmental and social consideration issues.

	Questions	Answer	Improvement Plan
12	What was the budget allocated to the ESMS and its implementation during a year? Please provide budget details including staff costs and training as well as any actual costs. What was the budget allocated to the ESMS and its implementation during a year?	N/A. EA does not have ESMS as such and therefore no budget has been specifically allocated to it.	During the Project, most of the cost associated with environmental and social safeguard will be covered by addressing relevant issues in the Project's approach or technical methodologies. As such they normally do not incur as separate budget lines. However, there will be some allocation of budget towards environmental and social considerations under the Project, mainly in the form of capacity building costs. Based on necessity, cost for hiring agency/experts in the field of environment and social consideration may be additionally required.
4.	**Monitoring and Reporting (Reporting procedures and monitoring)**		
13	Do you receive environmental and social monitoring reports from subproject companies that you finance?	N/A	There will be limited usage of subproject companies for the project implementation However, environmental and social monitoring of subproject activities will be conducted as part of the regular project monitoring.
14	Please describe how you monitor the subproject company and their subprojects' social and environmental performance.	N/A	Environmental and social monitoring/ evaluation of subproject activities will be conducted within the framework of project M&E system.
15	Is there an internal process to report on social and environmental issues to senior management?	Yes: Although there is no systematic monitoring and reporting process for environmental and social issues, there is an internal reporting system from Range forest office to the Headquarter through Divisional forest office and Circle office.	The Project will develop M&E system including MIS for monitoring and reporting on project progress, processes and impacts. Safeguards monitoring and reporting will be built into this system.
16	Do you prepare any social and environmental reports: - For other multilateral agencies or other stakeholders - E&S reporting in the Annual Report	No: Environmental and social reports have not been prepared systematically by EA.	EA will prepare and submit monitoring reports to JICA at regular basis. These reports shall contain designated sections on environmental and social aspects. The Project will include independent evaluations which will also assess the Project's implementation of the ESMSF/STFDPF and environmental and social issues related to the Project.
5.	**Experience(results of the environmental and social management)**		

	Questions	Answer	Improvement Plan
17	Has the financial intermediary / executing agency signed any national or international agreements or declarations concerning environmental issues?	No:	N/A
18	Has the financial intermediary / executing agency ever received any criticism of its environmental record? If so, what was the criticism?	No:	The project as a whole is intended to strengthen community-based forestry institutions and implementation by these institutions. The project will also build the EA's capacity for more collaborative and participatory approaches to community development management. Therefore, the project aims to build better and stronger relationships with communities. The project will include social safeguards for protecting communities and especially the vulnerable segments of society including women, and poor, ensuring that they are properly consulted and are able to participate and benefit from the Project in appropriate ways.
19	Does the financial intermediary / executing agency carry out environmental audits of its properties to analyze health and safety issues, waste disposal, etc.?	No:	N/A
20	Please state any difficulties and/or constraints related to the implementation of the ESMS.	The EA, as an organization, still lacks experience in managing and monitoring environmental and social risks in a systematic way will be the principal challenge.	Through implementing the Project, establishing the proposed safeguards frameworks and measures, and through specific trainings EA will build their capacity and experience for managing and monitoring environmental and social risks.

6. Need of Capacity Development and Improvement Plan(Improvement and the need for capacity building measures)

ESMS requires different knowledge and skills sets at different management levels (i.e. field skills versus administrative/management skills) – these will be drawn out in the environmental and social safeguards capacity development and training programs.

Module Name	Theme/Topic	Key Participant	Schedule
Management/ Administrative Level	- JICA's safeguard policy - Basic introductory concept of safeguard - EIAF/STFDPF steps and procedures to be applied in the Project - Free and prior informed consent (FPIC) - Monitoring and Evaluation	- PMU officers / - DFO of DMU/RFO of RMU	- One time at the preparatory phase (total one batch)

	Questions		Answer	Improvement Plan	
	Field/ Operational Level	- Basic introductory concept of safeguard - ESMSF/STFDPF steps and procedures to be applied in the Project - Community consultation processes - Free and prior informed consent (FPIC) - Monitoring and evaluation	- Representatives from JFMCs and EDCs - Other representative from Village Council and Gram Panchayat (if necessary)	- One time for each district at the preparatory phase (total 4 batches)	

Annexure 10.7: Indicative Terms of Reference for Gender Specialist

Table 1: Indicative Qualifications

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Table 2: Indicative Major Tasks and Duties

Close to the Public

Annexure 10.8: Indicative Gender Action Plan (GAP)

1. Overview

Gender mainstreaming is a process to identify development issues, needs, and impacts from a gender perspective, in all stages of planning, implementation, monitoring, and evaluation of development policies, programs, and projects.

The Project shall develop gender mainstreaming strategy and action plan during the preparatory stage. Appropriate gender training shall also be proposed for all levels of project implementation units and stakeholders. The gender monitoring system shall also be institutionalized in the Project.

2. Project Components and Gender Action Plan

Necessary actions for the implementation of gender mainstreaming for each component are summarized below.

Project Components/Sub-Components	Gender Action	Data Required	Means of Verification
Organizational structure	More number of women managers/ officers/ experts/ field level staffs/ are to be engaged in the project.	Gender segregated number of managers, officers, field staff, experts	Project MIS
	Gender Committee is formed and a gender focal point from each relevant unit at the village, block, district, and state levels is appointed.		
	Gender analysis of the target tribal areas is conducted.	Result of analysis	Report by survey contractor
	All officers/ staff/ community level groups are to be trained in gender.	Gender segregated number of trainees	Project MIS
	Monitoring indicators by gender are to be adopted and the data to be collected accordingly.		Project MIS
	A member of PMC in charge of Capacity Development will be responsible for gender mainstreaming.	TOR of PMC, PMC proposal	Contract
Ecotourism and ecodevelopment activities	Information on the project is disseminated among all villagers	activity records	Reports by RMU
	Involvement of women and men in all activities of the Project is promoted: • micro-planning • mapping/GIS activities • community development • Ecotourism • Ecodevelopment activities, etc.	Gender segregated number of meeting participants , Meeting minutes Household participation rate	Project MIS Report by RMU
	Women working groups shall be constituted under EDC.	Number of groups established	Project MIS Report by RMU
	To promote women to participate in decision-making process: Target: more than 50% of executive committee member are women	Women participation rate in executive committees of EDC Minutes of meetings	Project MIS Report by RMU
	Training on communication skills and leadership for women would be provided.	Gender segregated number of trainees	Project MIS
	More women would take leadership positions	Gender segregated number of chair/vice chair of the committees/ community level groups	Project MIS
	All officers/ staff/ community level groups are to be trained in gender.	Gender segregated number of trainees	Project MIS

	All the community based training programmes/exposure visits should have at least 40% of women participation.	Gender segregated number of trainees	Project MIS
	Training venues and timings need to be set to accommodate women's daily schedule and requirement.	Assessment by the participants	Report by RMU
	Training facilities shall have gender segregated toilet facilities.	Assessment by the participants	Report by RMU
	Community level training programmes are conducted in the local languages. Training/workshop materials are prepared in the local languages.	Assessment by the participants	Report by RMU
	No gender segregation in wages of community infrastructure construction work	Financial report	Project MIS

3. Implementation Framework

The gender action plan is to be embedded in the project implementation process through project guidelines/ manuals/ training programmes and also through the gender mainstreamed recruitment process. The project design has taken gender into consideration as much as possible.

4. M&E System

At the PMU level, executive body shall assume the function of gender M&E committee which would monitor and take decisions on necessary corrective actions to be taken in the project implementation process. Review meeting shall be held after receiving the quarterly report from Circle offices. The nodal person, Project Director, Administration and Finance, at PMU will prepare the quarterly report and annual report on the status of gender action plan.

At DMU/FMU level, a relevant Range officer shall be the focal person to monitor and assess the gender situation at range level and compiles the quarterly report based on the project MIS and field observation.

5．Gender Training

Project Implementation Unit	Topics to be covered	Duration	Category of the Participants
PMU	Human Rights and legal provisions in India Gender based violence Gender awareness Gender and leadership and governance Gender Action Plan for TBGCP and M&E Gender Budgeting Gender Analysis (Role play)	1 day	PMU officials/staff
DMU/RMU	Human Rights and legal provisions in India Gender based violence Gender awareness Gender and leadership and governance Gender roles and relations in the project areas Gender Action Plan for TBGCP Gender Budgeting Gender Analysis (including field exercise) Gender Monitoring	4 days	DFO at DMU, RFO at , RMU
EDC	Understanding gender Gender situation in the villages through gender analysis Gender action plans for TBGCP Gender budgeting	4 days	Executive members of EDC

	Gender dimensions in Ecotourism management plan and Ecodevelopment plan preparation Gender dimensions in EDC – leadership & Governance		
SHG/working groups	Understanding Gender Gender situation in the villages through gender analysis Gender awareness Gender relations in the project areas Gender action plans for TBGCP	2 days	Representatives of SHGs

Annexure 10.9: Indicative Project Cost Breakdown

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Annexure 10.9: Indicative Project Cost Breakdown

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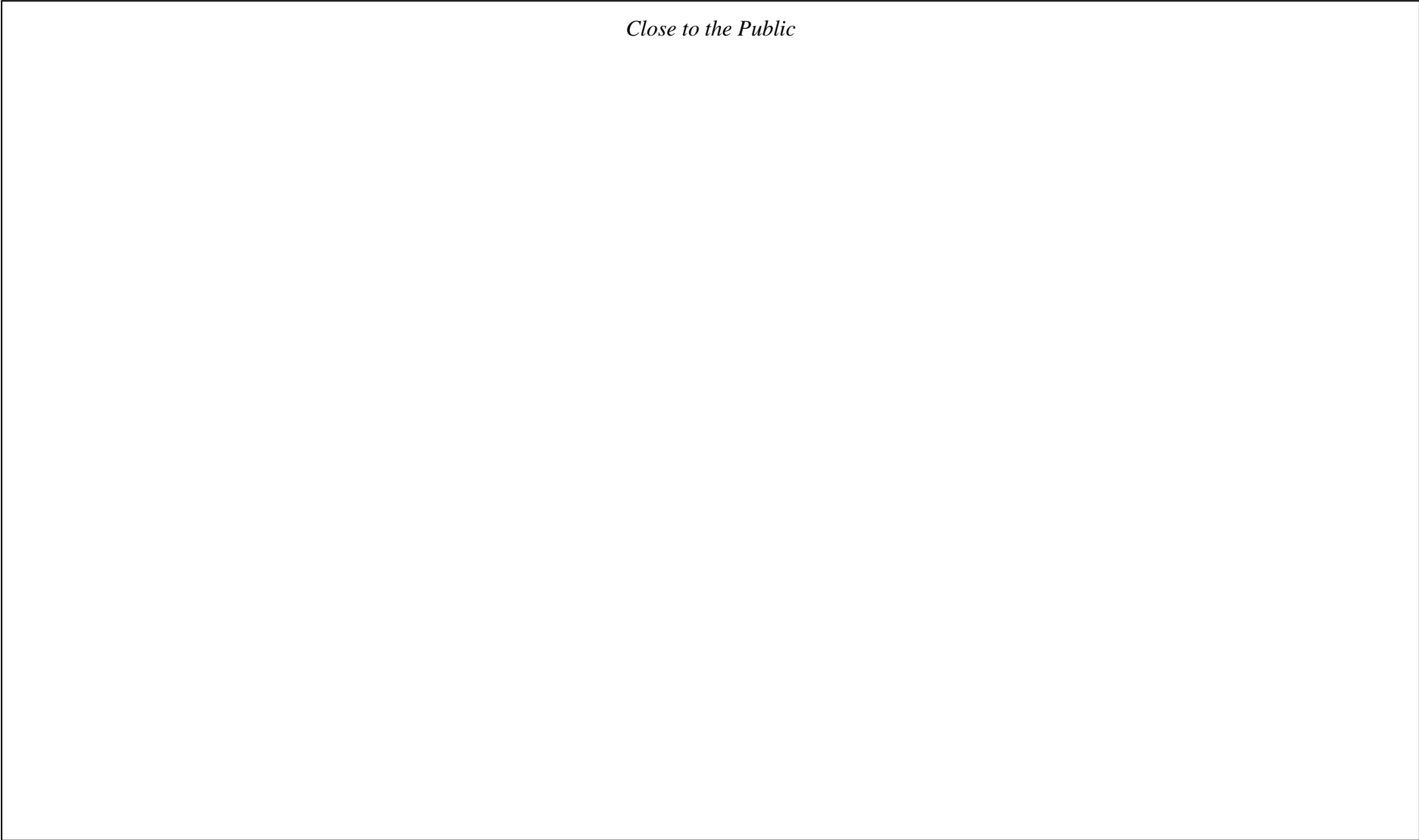
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Annexure 10.10: Indicative Breakdown of Annual Fund Requirement

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Annexure 10.11: Risk Management Framework

Risk Management Framework

Project Name: Tamil Nadu Biodiversity Conservation and Greening for Climate Change Project
Country: India
Sector: Forestry

Officers in charge:
  - Operational staff
  - Engineering staff:
  - Country office staff:

Potential project risks	Assessment
1. Stakeholder Risk	Probability: L
(Description of risk)	Impact: L
- In Tamil Nadu, the two major parties, All India Anna Dravida Munnetra Kazhagam (AIADMK) and Dravida Munnetra Kazhagam (DMK) have taken the reins of the government in turn since 1967, except in 2016. Since there are not significant differences between the basic policies of the two parties, the changes in political administrations have not affected the management of previous three JICA funded projects by the TNFD. - In Tamil Nadu, the score of SDG15 (Life on Land) is not good, and it is important for the State Government to increase the forest coverage and enhance biodiversity in order to ensure the sustainable development of the state. - TNFD has already implemented three JICA ODA loan projects since 1997. The operation and management systems of the TNFD was evaluated high by the ex-post evaluations. It can be said that TNFD will be able to make a commitment to TBGCP well. However, with time the TNFD officials responsible for project implementation may either get elevated and transferred to new positions or may be retired. Thus, continued capacity development initiatives need to be in place to support the project implementation. - According to the Impact Assessment Survey on TAP1 and TAP2, the People Organizations (POs) such as VFCs and JFMCs continued to function after the completion of the project. However, the roles of TNFD officers at the range level is large, and local communities tend to depend on them and lack self-initiative.	Analysis of probability and impact:
	- TNFD has implemented three JICA ODA loan projects since 1997. The operation and management systems of the TNFD was evaluated high and thus TNFD will be able to make a commitment to TBGCP well, but there might be personnel change. - The roles of TNFD officers in the range level is large and local communities tends to depend on them. - Initial challenge with the project will generate interest amongst community for participation in the project.
	Mitigation measures:
	- Strengthen the communications to stakeholders to help enhance the understanding of the benefits of the project - Enhance information disclosure and deal with grievance when it happens immediately. - Provide continue guidance and supervision, including capacity building initiatives both for TNFD officials and local communities - Support and engage with NGOs/Resource organizations - Ensure support sectoral convergence in project by intersectoral coordination with the line departments and planning with the local/ district/ block administration.
	Action during the implementation:
	- Hold regular meeting with PMUs and stakeholders at all levels. - Make and use Operation Manuals including grievance procedure.
	Contingency plan (if applicable):
	Not applicable.
2. Executing Agency Risk	
2.1. Capacity Risk	Probability: M
(Description of risk)	Impact: M
	Analysis of probability and impact:

	- Still many things are not known about coral reef, seaweed, dugong, sea turtles. It is highly possible for TNFD to encounter technical problems during survey and implementation.
- Coral reef construction, dugong surveys, seaweed growth are not fully established in terms of technique or method. Therefore there are still some room to elaborate through Trial & Error. Blue carbon is also a new activity for TNFD, so that it is necessary to get technical advice from national research institutes such as ICFRE. Carbon measurement for quantification of blue carbon is still in development stage even at national research institutes. International/national expert is needed to raise up a skill. -It is difficult for TNFD to implement activities related to wildlife animal research alone. It is planned that WII and AIWC will collaborate with TNFD, and their knowledge and skills will be essential for the successful project implementation. - 155 villages/hamlets are set for the target of Ecodevelopment Activities. This number of villages/hamlets is much more than the one of TBGP-1, which was 63 (30 villages for Ecodevelopment (ED) Activities and 33 villages for Ecologically Sustainable Development (ESD) for tribal villages). Therefore, it is anticipated the PMU/DMU will not be able to manage all the relevant activities in all the villages/hamlets in effective and efficient manner.	- It is expected the TNFD will be able to fully utilise the accumulated experience and know-hows during the course of the implementation of the ED Activities and ESD under the TBGP-1 in case that the key staffers of the TBGP-1 can appropriately be assigned as the resource persons. - An initial and key challenge for the project will be how to conduct a process for capacity building of field staff who facilitate the target communities.
	Mitigation measures:
	- Ask technical advice from national research institutes such as ICFRE. - Assign the key staff of the TBGP-1 to the positions that involve in management of the overall ED Activities. - Allocate sufficient time and resources for the planning of capacity building of field staff who facilitate the target communities. - Establish a backup system of the field staff even after the period of capacity building processes.
	Action during the implementation:
	- Find technical solution from not only national experts but also foreign experts. - Conduct careful and detailed monitoring on the process of participatory planning for ED plans.
	Contingency plan (if applicable):
2.2. Governance Risk	Probability: H/M/L
(Description of risk)	Impact: H/M/L
- From the preparatory study, considering the wide range of avtivities as we as their large workload, the number of concerned officers seems to be limited. For example, in the field of biodiversity alone, the target area ranges from land to sea, and the target livings range from animals to plants. Currently one officer is in charge of multiple fields. Because of the various needs and large volume, it is difficult to supervise all the things by single person, and it may be rquired to arrange sufficient number of concerned officers for the project implementation.	Analysis of probability and impact:
	-As long as few persons are in charge, it is possible that the governance will get a problem.
	Mitigation measures:
	-Increase the number of persons in charge.
	Action during the implementation:
	-Conduct regular check on governance status of TNFD.
	Contingency plan (if applicable):
2.3. Fraud & Corruption Risk	Probability: H/M/L
(Description of risk)	Impact: H/M/L
	Analysis of probability and impact:
	Mitigation measures:

	Action during the implementation:
	Contingency plan (if applicable):
3. Project Risk	
3.1. Design Risk	Probability: H/M/L
(Description of risk)	Impact: H/M/L
- In case of the event of natural disasters, some project activities will be largely implacted. For example, in the surveys of coral and seaweed, divers cannot work due to bad weather. In the case of cyclones, the target mangrove plantation areas will be geavily damaged. Due to the increase of seawater temperature, coral reef building will be deavialy damaged.	Analysis of probability and impact:
	-Probabilities of ocurring both cases are low.
	Mitigation measures:
	-Make working schedule flexible to cope with bad weather. -Ask coral experts who have international network.
- Some activities are new for TNFD as well as the forestry sector of India, and the previous examples that can be used as reference are quite limited. For example, it is difficult to find an appropriate model for the establishment of corallarium. In this regard, the detailed desinging of those activities may take a longer time than initially expected or need to change the plan in the course of poject implementation.	Action during the implementation: -Adjust working days for survey. -Get a consultancy from other country in coral exhibition.
	Contingency plan (if applicable):
3.2. Program & Donor Risk	Probability: H/M/L
(Description of risk)	Impact: H/M/L
	Analysis of probability and impact:
	Mitigation measures:
	Action during the implementation:
	Contingency plan (if applicable):
3.3. Delivery Quality Risk	Probability: H/M/L
(Description of risk)	Impact: H/M/L
	Analysis of probability and impact:
	Mitigation measures:
	Action during the implementation:
	Contingency plan (if applicable):

4. Other Risk	Probability: H/M/L
(Description of risk)	Impact: H/M/L
	Analysis of probability and impact:
	Mitigation measures:
	Action during the implementation:
	Contingency plan (if applicable):
5. Overall Risk Rating	Probability: H/M/L
(Overall comments)	Impact: H/M/L

1/ Descriptions in the risk management matrix can be brief and concise. In order to record the description of each risk as well as the evidence for the team's assessment, a separate sheet should be prepared to describe the details.