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Abbreviations

AD	Adaptation
ADB	Asian Development Bank
AED	Agricultural Engineering Department, Tamil Nadu
AG	Agriculture
AHP	Affordable Housing in Partnership
AIBP	Accelerated Irrigation Benefits Program
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AR	Artificial Recharge of groundwater
AR	Assessment Report
ARC	Arasu Rubber Corporation
ASB	Annual Severe Bleaching
ASCAD	Assistance to States for Control of Animal Diseases
ASHA	Accredited Social Health Activist
AT&C Losses	Aggregate Technical & Commercial losses
BAU	Business as usual
BCM	Billion Cubic Metre
BEE	Bureau of Energy Efficiency
BL	Base line
BLC	Beneficiary Led Construction
BR	Biosphere Reserve
CAAQMS	Continuous Ambient Air quality Monitoring Stations
CAD	Command Area Development
CAGR	Compound Annual Growth Rate
CAM	Coastal Area Management
CAMPA	Compensatory Afforestation Management and Planning Authority
CanESM2	Canadian Earth System Model
CASMB	Centre of Advanced Study in Marine Biology, Annamalai University
CB	Capacity Building
CBRN	Chemical, Biological, Radiological and Nuclear
CCA	Climate Change Adaptation
CCAM	Conformal Cubic Atmospheric Model
CCA-RAI	Climate Change Adaptation in Rural Areas of India
CCC&DM	Centre for Climate Change and Disaster Management
CCKN-IA	Climate Change Knowledge Network in India Agriculture
CCRCP	Chennai City River Conservation Project
CDRRP	Coastal Disaster Risk Reduction Project
CEA	Central Electricity Authority
CEIG	Chief Electrical Inspectorate to Government
CFA	Central Financial Assistance
CFA	Central Financial Assistance
CGWB	Central Ground Water Board
CHC	Community Health Centre
CLSS	Credit Linked Subsidy Scheme
CMA	Commissionerate of Municipal Administration
CMDA	Chennai Metropolitan Development Authority

CMDA	Chennai Metropolitan Development Authority
CMFRI	Central Marine Fisheries Research Institute
CMWSSB	Chennai Metropolitan Water Supply and Sewerage Board
CO	Carbon Monoxide
CO₂	Carbon dioxide
CORDEX	Coordinated Regional Downscaling Experiment
CPHEEO	Central Public Health and environmental Engineering Organization
CPREEC	C.P.R. Environmental Education Centre
CR	Conservation Reserve
CRRT	Chennai River Restoration Trust
CRZ	Coastal Regulation Zones
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSIS	Climate Services Information System
CSMCRI	Central Salt and Marine Chemicals Research Institute
CSR	Corporate Social Responsibilities
CSTEP	Centre for Study of Science, Technology and Policy
CUF	Capacity Utilization Factor
CUMTA	Chennai unified Metropolitan transport System
CWC	Central Water Commission
CZMP	Coastal Zone Management Plan
DDUGJY	Deen Dayal Upadhyaya Gram Jyoti Yojana
DFFDA	District Fish Farmers Development Agency
DFR	Detailed Feasibility Report
DHAN	Development of Humane Action
DISCOM	Distribution Companies
DoA	Department of Agriculture
DoAH	Department of Animal Husbandry
DoE	Department of Environment
DoF	Department of Fisheries
DoH	Department of Horticulture
DP	Demonstration Project
DPR	Detailed Project Report
DSM	Demand Side Management
DSS	Disaster Support System
DSSAT	Decision Support System for Agro technology Transfer
DST	Department of Science and Technology
DTCP	Directorate of Town and Country Planning
DTP	Directorate of Town Panchayat
DWDA	Tamil Nadu Water Development Agency
EC	End-Century
ECBC	Energy Conservation Building Code
ECV	Essential Climate Variable
EDC	Eco-Development Committees
EDL	Essential Drug List
EE	Energy Efficiency
EESL	Energy Efficiency Services Limited
EEZ	Exclusive Economic Zone

EF&CC	Environment Forest and Climate Change
EI	Emission Intensity
EIDC	Environment Information Dissemination Centres
EM	Efficient Microorganism
ENVIS	Environmental Information System, Tamil Nadu
EPRED	Environment Protection and Renewable Energy Development Fund
ES	Energy Efficiency
ETCCDI	Expert Team on Climate Change Detection Indices
ETI	Environmental Training Institute
ETRP	Emergency Tsunami Reconstruction Project
EWS	Economically Weaker Sections
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FFDA	Fish Farmer's Development Agency
FIDF	Fisheries and Aquaculture Infrastructure Development
FR	Forest Resource
FRP	Fiber Reinforced Plastic
GCAM	Global Change Assessment Model
GCC	Greater Chennai Corporation
GCF	Green Climate Fund
GCM	General Circulation Model
GDP	Gross Domestic Product
GEF	Global Environment Facility Trust Fund
GEMS	Global Environmental Monitoring System
GHG	Green House Gas
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GKMS	Gramin Krishi Mausam Seva
GoI	Government of India
GoM	Gulf of Mannar
GoMBR	Gulf of Mannar Biosphere Reserve
GoMBRT	Gulf of Mannar Biosphere Reserve Trust
GoTN	Government of Tamil Nadu
GSDP	Gross State Domestic Product
GW	Giga watt
GWB	Ground Water Board
H	High
HADP	Hill Area Development Program
HC	Hydrocarbons
HDI	Human Development Index
HH	House Hold
HIV	human immunodeficiency virus
HTL	High Tide Line
HUD	Health Unit Districts
IAMWARM	Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration and Management
IAY	Indira Awaas Yojana
ICAR	Indian Council for Agriculture

ICZMP	Integrated Coastal Zone Management Project
IDSP	Integrated Disease Surveillance Project
IDWH	Integrated Development of Wildlife Habitats
IEC	Information, Education and Communication
IFGTB	Institute of Forest Genetics and Tree Breeding
IFPS	Intensification of Forest Management Scheme
IFS	Integrated Farming System
IHHL	Individual Household Latrines
IMAGE	Integrated Model to Assess the Global Environment
IMD	Indian Metrological Department
IMR	Infant Mortality Rate
IMSWM	Integrated Municipal Solid Waste Management
IMTI	Irrigation Management Training Institute, Thuvakudy
INGO	International Non Governmental Organizations
INR	Indian Rupee
INRM	Integrated Natural Resource Management
IOM	Institute for Ocean Management
IP	Investment Project
IPCC	Intergovernmental Panel on Climate Change
IRS	Institute of Remote Sensing, Anna University
ISBIG	Incentivization Scheme for Bridging Irrigation Gap
ISSET	Institute for Social and Environmental Transition
ISFR	India State of Forest Report
ISSR	In Situ Slum Redevelopment
IUCN	International Union for Conservation of Nature
IUDM	Integrated Urban Development Mission
IWMP	Integrated Watershed Management Programme
JF	January, February
JFM	Joint Forest Management
JICA	Japan International Cooperation Agency
JJAS	June, July, August, September
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
JSA	Jal Shakti Abhiyan
KfW	KfW Bankengruppe
KM	knowledge management
KVK	Krishi Vigyan Kendra
KWh	Kilo Watt hour
L	Low
LED	Light Emitting Diode
LGBR	Load Generation Balance Report
LPA	Long Period Average
LPCD	Litres Per Capita per Day
LPG	Liquefied petroleum gas
LTL	Low Tide Line
M	Medium
MAB	Man and Biosphere
MAM	March, April, May

MANAGE	Ministry of Agriculture and Farmers Welfare
MaxEnt	Maximum Entropy
MC	Mid-Century
MCM	Million cubic metre
MEEP	Municipal Energy Efficiency Programme
MESSAGE	Model for Energy Supply Strategy Alternatives and their General Environmental Impact
MFP	Minor Forest Produce
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MI	Mitigation
MIDH	Mission for Integrated Development of Horticulture
MIE	Multilateral Implementing Entities
MINARS	Monitoring of Indian National Aquatic Resources
MIS	Management Information System
MLCP	Multi-Level Car Parking
MLD	Millions of Litres Per Day
MMM	Multi-Model Mean
mm	Milli metre
MMR	Maternal Mortality Ratio
MoEF&CC	Ministry of Environment, Forest and Climate Change
MoP	Ministry of Power
MPES	Multi-Purpose Evacuation Shelters
MSP	Minimum Support Price
MSSRF	M.S. Swaminathan Research Foundation
MSW	Municipal Solid Waste
MTPA	Million Tons Per Annum
MU	Million Units
MW	Mega Watt
NAAQM	National Ambient Air Quality Monitoring
NABARD	National Bank for Agriculture and Rural Development
NADP	National Agricultural Development Project
NAIS	National Agricultural Insurance Scheme
NAMP	National Air Quality Monitoring Programme
NAP	National Afforestation Programme
NAPCC	National Plan Action on Climate Change
NATCOM	India's Initial National communication
NBA	National Biodiversity Authority
NCA	National Commission of Agriculture
NCCR	National Centre for Coastal Research
NCSCM	National Centre for Sustainable Coastal Management
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NE	North-East
NFDB	National Fisheries Development Board
NFDB	National Fisheries Development Board
NFHS	National Family Health Survey
NFSM	National Food Security Mission

NHM	National Horticultural Mission
NHM	National Health Mission
NICE platform	Network for Information on Climate (Ex)Change
NICRA	National Initiative on Climate Resilient Agriculture
NIE	National Implementing Entities
NIF	National Indicator Framework
NISE	National Institute for Solar Energy
NITI Aayog	National Institution for Transforming India
NMPB	National Medicinal Plants Board
NMSA	National Mission For Sustainable Agriculture
NMSDA	National Mission For Sustainable Agriculture Rainfed Area Development
NMSKCC	National Mission of Strategic Knowledge for Climate Change
NP	National Park
NRCP	National River Conservation Plan
NRDWP	National Rural Drinking Water Programme
NREGA	National Rural Employment Guarantee Act
NRHM	National Rural Health Mission
NRSE	New and Renewable Sources of Energy
NRY	Nehru Rozgar Yojana
NTFP	Non-Timber Forest Products
NUHM	National Urban Health Mission
NULM	National Urban Livelihood Mission
NWM	National Water Mission
ODF	Open Defecation Free
OND	October, November, December
OSR	Open Space Reservation
PA	Policy Action
PAT	Perform, Achieve and Trade
PEACE	Promotion of Energy Audit and Conservation of Energy
PHC	Primary Health Centre
PKVY	Paramparagat Krishi Vikas Yojana
PMAY	Pradhan Mantri Awas Yojana
PMFBY	Pradhan Mantri Fasal Bima Yojana
PMGSY	Pradhan Mantri Gram Sadak Yojana
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PRECIS	Providing Regional Climates for Impacts Studies
PWD	Public Works Department
RADP	Rain-fed Area Development Program
RCA 4	Rossby centre regional climate model
RCM	Regional Climate Model
RCP	Representative Concentration Pathway
RD	Research and Development
RD&PR	Rural Development & Panchayati Raj Department
REC	Rural Electrification Corporation
REDD+	Reducing Emissions from Deforestation in Developing Countries
REMO	Regional Climate Model
RKVY	Rashtriya Krishi Vikas Yojana

RPO	Renewable purchase Obligation
RRT	Rapid Response Teams
RSPM	Respirable Suspended Particulate Matter
RWH	Rainwater Harvesting
SAMP	Special Area Management Plan
SBM	Swachh Bharat Mission
SC	Scheduled caste
SCADA	Supervisory Control and Data Acquisition
SDA	State Designated Agency
SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goals
SDMA	State Disaster Management Authority
SDMRI	Suganthi Devadason Marine Research Institute
SDRF	State Disaster Response Fund
SECF	State Energy Conservation Fund
SG&SWRDC	State Ground and Surface Water Resources Data Centre
SH	Sustainable Habitat
SHCs	Soil Health Cards
SHGs	Self Help Groups
SICOM	Society for Integrated Coastal Management
SKO	Superior Kerosene Oil
SLNP	Street Lighting National Programme
SLR	Sea Level Rise
SME	Small and medium Industries
SMHI	Swedish Metrological and Hydrological Institute
SPM	Suspended Particulate Matter
Sq.km	Square Kilo Metre
SRS	Sample Registration System
SST	Sea Surface Temperature
ST	Scheduled Tribe
SW	South-West
SWM	Solid Waste Management
TAFCORN	Tamil Nadu Forest Plantation Corporation Limited
TANGEDCO	Tamil Nadu Generation and Distribution Corporation Limited
TANII	Tamil Nadu Innovation Initiatives
TANTEA	Tamil Nadu Tea Plantation Corporation Limited
TANTRANSCO	Tamil Nadu Transmission Corporation Limited
TANUVAS	Tamil Nadu Veterinary and Animal Sciences University
TBGP	Tamil Nadu Biodiversity conservation and Greening Project
TCMPF	Tamil Nadu Co-operative Milk Producers' Federation Limited
TDEF	Tropical Dry Evergreen Forest
TEDA	Tamil Nadu Energy Development Agency
TERC	Tamil Nadu Electricity Regulatory Commission
TFR	Total Fertility Rate
TMC	Thousand Million Cubic
TN	Tamil Nadu
TNAMB	Tamil Nadu Agricultural Marketing Board

TNAU	Tamil Nadu Agricultural University
TNCDBR	Tamil Nadu Combined Development and Building Rules, 2019
TNEB	Tamil Nadu Electricity Board
TNERC	Tamil Nadu Electricity Regulatory Commission
TNFA	Tamil Nadu Forestry Academy
TNFCRI	Tamil Nadu Fisheries College and Research Institute
TNFD	Tamil Nadu Forest Department
TNHB	Tamil Nadu Housing Board
TN-ICPP	Tamil Nadu- Integrated Coastal Protection Plan
TNJFU	Tamil Nadu Dr. J. Jayalalithaa Fisheries University
TNLDA	Tamil Nadu Livestock Development Agency
TNMSC	Tamil Nadu Medical Services Corporation
TNPCB	Tamil Nadu Pollution Control Board
TNSACS	Tamil Nadu State AIDS Control Society
TNSAMB	Tamil Nadu State Agricultural Marketing Board
TNSAPCC	Tamil Nadu State Action Plan on Climate Change
TNSCB	Tamil Nadu Slum Clearance Board
TNSGDC	Tamil Nadu Surface and Groundwater Data Centre
TNSLURB	Tamil Nadu State Land Use Research Board
TNSPCB	Tamil Nadu State Pollution Control Board
TNSUDP	Tamil Nadu Sustainable Urban Development Project
TNUDP III	Third Tamil Nadu Urban Development Project
TNUIFSL	Tamil Nadu Urban Infrastructure Financial Services Limited
TOF	Trees Outside Forests
TPP	Thermal Power Plants
TRANSTAN	Transplant Authority of Tamil Nadu
TSPM	Total Suspended Particulate Matter
TWAD	Tamil Nadu Water Supply and Drainage Board
TWAD	Tamil Nadu Water and Drainage Board
UDAY	Ujjwal DISCOM Assurance Yojana
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
UJALA	Unnat Jyoti by Affordable LEDs for All
ULB	Urban Local Bodies
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United State Dollar
VAMBAY	Vaalmiki Ambedkar Awas Yojana
WALAMTARI	Water and Land Management Research Institute, Hyderabad
WALMI	Water & Land Management Institute, Aurangabad
WB	World Bank
WBCIS	Weather Based Crop Insurance Scheme
WLS	Wildlife Sanctuary
WR	Water Resource
WRD	Water Resources Department
WRO	Water Resource Organization

Executive Summary

In 2019, climate change is an undisputed reality causing severe impacts on the natural environment, human lives, and economic assets and activities, thus posing an urgent need for ambitious mitigation and effective adaptation action. Both of these, in turn, need to be well planned and coordinated for maximum efficiency, in particular in contexts with competing development pressures and needs.

In this aspect, sub-national planning of action on climate change is a necessary extension of national-level planning, in particular in federal countries like India. India's **National Action Plan on Climate Change (NAPCC)** outlines for addressing climate-related challenges through National Missions. **State Action Plans on Climate Change (SAPCC)** are required to effectively ensure that objectives are aligned with national and regional development priorities. Tamil Nadu State Action Plan on Climate Change (TNSAPCC), launched in 2015, which provided the first State-wide and cross-sectoral climate change impact and vulnerability assessment, and formulated adaptation and mitigation strategies to be carried out by the State Government Departments. These strategies, in turn, were organized into seven **State Sectors**, aligned with the eight National NAPCC Missions.

Since the formulation of the TNSAPCC, important changes have impacted the realm of climate change policy planning. Not only have the science, knowledge and understanding of climate change evolved at the global and at the regional level, but so has the policy context, with the ratification of important development and climate goals at the International level, such as the Sustainable Development Goals (SDGs) and the Paris Agreement temperature and adaptation goals. Related all-Indian commitments, such as those in the **Nationally Determined Contribution**, and Tamil Nadu State's goals, such as localised SDG targets in the **SDG Vision 2030**, pose the need for an evolving, appropriate climate change action planning process. Similarly, State also involves (or) launches many important flagship schemes are of utmost importance to climate change action. In the light of these developments, the TNSAPCC2.0 at hand was developed to reflect this changing context and enhance effective mitigation and adaptation planning and action. It takes stock of the degree of TNSAPCC implementation, and uses lessons learnt for future climate change action planning for the period 2020 –2030.

Tamil Nadu is a diverse State in terms of geographic features and natural resource endowments, and among the most progressive States in India in terms of economic and social circumstances. The "Vision Tamil Nadu 2023" moves towards an Accelerated, Innovative and Inclusive Growth. As evidenced by Tamil Nadu's rich history, it's economic and social fabric has evolved under stable environmental conditions over many centuries. Tamil Nadu's climate is shaped by spatial differences between plain, Coastal and mountainous regions and by four distinct seasons – The highest value attained for maximum temperature 34.7degree Centigrade is in the pre- monsoon season (March, April, May) while its lowest maximum value (29.8 degree Centigrade) is attained in Post monsoon season. A rainy season accounting for the bulk of annual rainfall 50 percent during Post Monsoon (October, November and December), and a Monsoon season from June to September which contribute 34 percent. However, the latest scientific assessments evidence changes in climatic conditions, with inter alia 0.6 °C increase in minimum temperatures regionally and spatially distinct changes in rainfall amount and intensity robustly detectable since 1950s.

While the magnitude of future change is surrounded by uncertainty related to different sources, a further intensification of these trends seems likely, with seasonal maximum/ minimum temperature increases of 1.7°C/ 3.4 °C (mitigation scenario) to 2.2°C/ 3.8°C (high emission scenario) projected by the mean of the regional climate models. Rainfall projections, which are surrounded by higher levels of uncertainty, suggest slight increases in total annual rainfall under the different scenarios. Changes are, however, more pronounced for certain seasons and regions, with the monsoon and post-monsoon season becoming wetter and the winter and pre-monsoon season become drier.

Changes in rainfall intensity and extreme precipitation events are moreover likely but uncertain in magnitude.

Observed and projected changes in climatic conditions expose different socio-economic systems or sectors of economic activity to the risk of disruption. Sectoral vulnerabilities arise from observed and projected undesirable climate change impacts, and include threats to ecosystem services and species habitats (forest and biodiversity sector), decreasing crop and animal yields due to unfavorable heat conditions and precipitation events (agricultural sector), increases in the volatility of water availability (water resources), increases in the occurrence of both vector-borne and respiratory diseases (health sector), reduced energy system reliability due to (hydrological) extreme events and demand changes (energy sector), and exponential health and extreme event damages related to urbanization in an extreme climate (urban sector). Sectoral vulnerabilities can further be aggregated, and spatial information on aggregate climate change vulnerability is a useful input to stocktaking and adaptation prioritization – in fact, increases in indicators of aggregate vulnerability found here suggests the need for enhanced adaptation measures.

Given this ever more urgent need for adaptation, and the fact that a comparison of planned **TNSAPCC** strategies and a record of departmental activities during the TNSAPCC period shows an at best partial implementation of the former, this document then identifies forward-looking strategies and actions that will enhance the fulfillment of the five adaptation-related TNSAPCC State sectors, namely the Sustainable Agriculture, Water Resources, Forest & Biodiversity, Coastal Area Management and Strategic Knowledge Management. Similarly, forward-looking mitigation strategies are defined that will contribute to the fulfillment of the Enhanced Energy Efficiency and State Solar Mission, as well as the State Mission on Sustainable Habitat.

The elaboration of these strategies in a participatory process led by nodal and line departments – along with the identification of responsible line departments - ensure ownership of these strategies by the key actors. Their design and selection in a manner that maximizes their contribution towards Tamil Nadu's 2030 SDG targets and the Indian NDC goals, as well as synergies with ongoing initiatives such as the central and State programmes and schemes, facilitates mainstreaming and warrants financing and rapid implementation. Moreover, the design and selection of prioritized adaptation and mitigation measures was based on an analysis of key barriers preventing more substantial progress on TNSAPCC implementation, so that learning from the TNSAPCC period are properly incorporated.

While a longer list of useful strategies and activities is presented, a shortlist of five to six prioritized strategies/ activities is proposed for each of the seven State sectors. At State, the implementation of **TNSAPCC2.0** strategies and activities will be overseen by the TNSAPCC Steering Committee (chaired by the Chief Secretary) and the nodal department (Department of Environment). While each proposed strategy/ activity is clearly assigned to a responsible line department, all strategies/ activities under a particular sector are moreover handled and coordinated by a nodal mission department (Sustainable Agriculture – Department of Agriculture, Water Resources -Institute of Water Studies- Public Works Department, Forest and Biodiversity- Tamil Nadu Forest Department, Coastal Area Management- Department of Environment and Strategic Knowledge Management – Centre for Climate Change and Disaster Management, Enhanced Energy Efficiency and State Solar Mission – Tamil Nadu Energy Development Agency, Sustainable habitat –Chennai Metro Water Supply and Sewage Board).

Key intentions of the State to address Climate Change concerns are enshrined in various policies and these have been summarized below:

Key Policy Elements	State Performance
National Action Plan on Climate Change	The State has all eight sectors aligned to NAPCC
State Action Plan on Climate Change	The State Action Plan on Climate Change (SAPCC) for Tamil Nadu was formulated in 2014 and the final draft of TNSAPCC was endorsed by MoEF&CC in March 2015
Sustainable Agriculture	The main policy of the State is to usher in the Second Green Revolution, and thereby raise farm-based incomes through Rashtriya Krishi Vikas Yojana (RKVY) Agriculture Programmes like Paddy Mission, Millet Mission, Pulses Mission under National Agricultural Development programme (NADP), National Food Security Mission, Rain-fed Area Development Program (RADP), Irrigated Agriculture Modernization and Water-Bodies Restoration and Management (IAMWARM) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) Horticulture Programmes like Integrated Horticulture Development Scheme Animal Husbandry Programmes Revised Breeding Policy for Cattle 2008 Dairy Development Programmes Tamil Nadu Bovine Breeding Act 2019 Fisheries programmes
Water Resource	The Tamil Nadu Additional Assessment and Additional Water Cess Act 1963 The Water (Prevention and Control of Pollution) Act, 1974 Chennai Metropolitan Area Ground Water (Regulation) Act, 1987 State Water Policy, 1994 The Tamil Nadu Panchayat Act, 1994 The Tamil Nadu Farmers Management of Irrigation Systems Act, 2000 National Water Policy, 2002 Tamil Nadu State Groundwater Development and Management Act, 2003 The National Environment Policy, 2006 The Tamil Nadu Protection of Tanks and Eviction of Encroachment Act, 2007 On-going Programmes and Projects- National Action Plan on Climate Change for Cauvery delta, Tamil Nadu Irrigated Agriculture Modernisation and Water Bodies Restoration and Management Project (TN IAMWARM), Coastal Protection Works, Flood Management Programme, Dam Rehabilitation and Improvement Project
Forest & Biodiversity	The forests in Tamil Nadu are managed in line with the provisions of the National Forest Policy (1988) National Forest Policy 2017 National Environment Policy 2016 Tamil Nadu State Environment Policy, 2017 National Afforestation Programme Tamil Nadu Forest Act, 1882 Forest (Conservation) Act, 1980 Tamil Nadu Rosewood Tree (Conservation) Act, 1994

	Environment Protection and Renewable Energy Development Fund (EPRED) Ongoing State Programmes/Schemes- Nature Conservation, Community Waste Land Development Programme, Tamil Nadu Afforestation Project (Phase II), Tamil Nadu Biodiversity Conservation and Greening Project, Sandalwood Plantation, Teakwood Plantation, Minor Forest Produce, Forest Research, Consolidation of Forests, Raising of free supply of seedlings, Erection of Solar Fence to protect the farm land from wild animals, Hill Area Development Programme, Eco-Development (Western Ghat Development Programme), Asian Elephant Depredation and Mitigation Measures, Creation of fodder tree plantation in forest areas to improve the wildlife habitat, Eco-restoration and Conservation of Pallikaranai Marsh Land Centrally sponsored programmes and schemes like Conservation and Management of Biosphere Reserves, Tamil Nadu Biodiversity conservation and Greening Project (TBGP)
Coastal Zone Management	Coastal Aquaculture Act 2005 Coastal Aquaculture Rules 2005 Developing an Integrated Coastal Zone Management Plan for Tamil Nadu which include Shoreline management, Biodiversity conservation, Controlling Coastal Pollution like Solid Waste Management, Livelihood improvement plans, Improvement of fishery resources, Encourage development of ecotourism Disaster Risk Management Programme Gulf of Mannar Biosphere Reserve (GoMBR) Coastal Area Management Project of Tamil Nadu Forest Department Coastal Regulation Zone (CRZ) Notification
Energy Efficiency, Renewable Energy and Solar Mission	New and Renewable Sources of Energy Policy (NRSE) 2012 Policy on net metering for Grid Interactive Roof-Top Solar Photo Voltaic Power Plants Roof Top Solar Energy The Chief Minister's Solar Powered Green House Scheme Perform, Achieve and Trade (PAT) Scheme aimed at industrial efficiency State has reported 100 percent electrification
Sustainable habitat	Several water supply schemes under TNUDP-III, JNNURM, KfW, JICA, IUDM, IGFF and Capital Grant Fund. Housing for All Mission – Tamil Nadu Slum Clearance Board (TNSCB) is the nodal agency and has been implementing various housing schemes under BLC and AHP by In-situ and resettlement and rehabilitation. TNSCB has also proposed to rehabilitate all the slums along the waterways (Adyar, Cooum and Buckingham Canal) within a period of five years. (2019 – 2023). Underground Sewerage Scheme Satellite Town Schemes Integrated Municipal Solid Waste Management (IMSWM) system Special Solid Waste Management (SWM) Fund Tamil Nadu Common Development Promotion Rules, 2018 National Urban Transport Policy (2006) aims to ensure safe, affordable, comfortable, quick, reliable and sustainable access for the growing number of city residents.

Mission for Sustainable Agriculture

This is a comprehensive scheme trying to address issues relating to climate change adaptation in agriculture and allied sector. The allocation under the rainfed area development component of the National Mission for Sustainable Agriculture has shown a rise after 2016-17 while the allocations under Rashtriya Krishi Vikas Yojana (RKVY) are showing a decreasing trend. The State had fund allocation for sub-Mission on agro forestry only during 2016-17.

Poverty and Food Security

According to the report published by the Planning Commission in 2014, during 2011-12, about 22.4 percent of population in the State was living under poverty as compared to the National average of 29.5 percent. As compared to 2009-10, the rural poverty in the State has decreased. The performance of the State in terms of Food Security is improving every year as the food grain production shows an increasing trend. By 2030, the poverty level is expected to be in the range of 3.3 percent as per this criterion.

Water Mission and Water use Efficiency

The main objective of the National Water Mission (NWM) is to conserve water, minimize its wastage and ensuring it equitable distribution. The overall goal of this Mission is to improve water use efficiency by 20 percent. This Mission possesses strong adaptation capacity with mitigation co-benefits through efficient energy use as well as carbon sequestration.

The vision of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) is to extend the coverage of irrigation 'HarKhetKoPani' and improving water use efficiency 'More crop per drop' in a focused manner with end to end solution on source creation, distribution, management, field application and extension activities.

Jal Shakti Abhiyan (JSA)

Jal Shakti Abhiyan (JSA) is a time-bound, mission-mode water conservation campaign. The JSA will run in two Phases: Phase 1 from 1st July to 15th September 2019 for all States and Union Territories; and Phase 2 from 1st October to 30th November 2019 for States and UTs receiving the retreating monsoon (Andhra Pradesh, Karnataka, Puducherry and Tamil Nadu). During the campaign, officers, groundwater experts and scientists from the Government of India will work together with State and district officials in India's most water-stressed districts* for water conservation and water resource management by focusing on accelerated implementation of five target intervention. The JSA aims at making water conservation a Jan Andolan through asset creation and extensive communication.

In Tamil Nadu, Jal Shakti Abhiyan campaign is carried out under the leadership of the Additional Chief Secretary, Rural Development & Panchayat Raj (RDPR), with the full involvement of Gram Panchayats, Women Self- help Group members and the community.

The five intervention areas identified by MoRD, GOI, for the implementation of MGNREGS works under Jal Shakti Abhiyan:

1. Water Conservation and Rain Water Harvesting
2. Renovation of Traditional and other Water harvesting
3. Re-use, Borewell recharge structure
4. Water shed Development
5. Intensive Afforestation

Enhancement of Carbon Sink and Green India Mission

The forest cover in Tamil Nadu is 26,281 sq.km which is 20.21 percent of the State's geographical area. However, only 286 sq.km of forest is very dense forest, 2,435 sq. km is moderately dense

and 5,979 sq km is open forest. The total carbon stock in the forest of Tamil Nadu is 229.338 million tonnes (840.906 million tonnes of CO₂ equivalent) which is 3.24 percent of the total forest carbon stock of the country.

Mission on Enhanced Energy Efficiency

Mission on Enhanced energy efficiency includes the following components:

- Energy Conservation Building Code (ECBC) and UJALA
- Street Lighting National Programme (SLNP), Municipal Energy Efficiency Programme (MEEP), including energy efficient pumps
- Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (EV) - (FAME)
- Demand Side Management (DSM)

Solar Mission and Renewable Energy

Tamil Nadu stands forefront in Renewable Energy sector among all States and has a total installed capacity of 11,113 MW as on 31.03.18. Tamil Nadu Solar Energy Policy, 2012 aims for developing Tamil Nadu as a world leader in solar energy. Tamil Nadu Vision 2023 forecasts a creation of incremental generation of 5000 MW of wind energy and 5000 MW of solar energy by 2023. Tamil Nadu has a total solar installed capacity of 2034 MW as on 31.03.2018.

Mission on Sustainable Urban Habitat

Two important Missions have been launched by the Government of India for several actions that focus on urban habitations, waste handling and emission reduction in the cities. These two Missions are Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Smart City. Beside this, it has also launched National Urban Livelihood Mission (NULM).

Swachh Bharat Mission (SBM)

One of the major public funded sanitation programmes SBM has shown significant result in the State. As per the Swachh Bharat Mission – Gramin dashboard, the State has achieved 100 percent household toilet coverage in 2018.

Mission on Strategic Knowledge for Climate Change

The objective of Tamil Nadu State Mission on Strategic Knowledge is to build a greater understanding of the climate variability, its effect on various sectors and vulnerabilities associated with the sector. It tries to allow for sustainable adaptation to climate change and mitigation the impact of drivers of climate change. The State has also developed a State Action Plan on Climate Change (SAPCC) for assessment, adaptation and mitigation measures with an aim to examine the targets, objectives and achievements of the National Missions specified by the National Action Plan on Climate Change (NAPCC).

Sustainable Agriculture

Agriculture is a predominant sector in Tamil Nadu's economy, engaging more than 70 percent of the population for their livelihood. However, only 22 percent of income comes from agriculture and allied sectors. The total cultivated area in the State is 6.5 million hectares with 8.1 million operational land holders having average farm size of 1.15 hectares. Around 92 per cent of the farmers belong to small and marginal category, operating 61 per cent of the farm area of the State with average land holding of lesser than 0.80 hectare.

As Tamil Nadu gets its major share of rainfall during northeast monsoon, the dryland cultivation is mainly practiced during this season. The principal food crops include paddy, millets and pulses. Commercial crops include sugarcane, cotton, sunflower, coconut, cashew, chillies, gingelly and groundnut.

The growth of the agriculture sector in the State is constrained by many factors including the occurrence of frequent and recurrent hydro-meteorological events such as droughts, extreme rainfall events and cyclones, reduced availability of water, declining cropped area, deterioration in soil health due to depletion of topsoil and decline in organic carbon content, decrease in cropping intensity and shortage of labour force.

The contribution of livestock sector to the gross State Domestic product is 2.58 percent and it constitutes 24.80 percent the total agriculture and allied sector. The dairy sector in Tamil Nadu is mostly in the hands of 2 million marginal and landless farmers.

	No. of Activities (2021-30)	Budget Proposed in crore INR (2021-30)
Adaptation based	45	48,031.94
Mitigation based	3	20,900.00
Both	3	2,800.00
Total	51	71,731.94

Major Achievements

Breeding and testing of varieties tolerant to various climatic stress

Tamil Nadu Agricultural University has introduced eight new crop varieties during 2017-18

Land management for better crop establishment

In order to bring more area under cultivation, the GoTN has created additional irrigation potential by extending an assistance to the District Watershed Development Agencies for adopting water saving technologies (Per drop More crop), enhancing recharge of aquifers and sustainable water conservation practices.

Organic farming including horticultural crops

Under PKVY, Organic farming is promoted through adoption of organic village by cluster approach and Participatory Guarantee System (PGS) certification. From 2015-16 to 2016-17, an area of 1020 Ha has been brought under Organic cultivation.

Increase the use of Micro Irrigation technology

The PMKSY Micro Irrigation Scheme is being implemented with the aim of conserving water and increasing the production and productivity of horticultural

Budget Proposed in TNSAPCC	Rs. 23,093.14crore
Budget Allocated from 2012-17	Rs. 4,641.99crore
Percentage Share	20.1%

and agricultural crops. From the year 2012-2017, an area of 2,69,250 ha has been brought under Drip and Sprinkler Irrigation

Water Resources

Climate change has significant impact on water resources. The overall water stress is continuously increasing and due to climate change a sharp decline in precipitation is expected. Studies also predict reduction in number of rainy days and increase in frequency of extreme rainfall events that will result in frequent droughts and floods. Tamil Nadu constitutes 4 percent of India's land area and is inhabited by 6 percent of India's population, but has only 2.5 percent of India's water resources. More than 95 percent of the surface water and 80 percent of the ground water have already been put into use.

The demand for water in Tamil Nadu is increasing at a fast rate both due to increasing population and due to larger per capita needs triggered by economic growth. The per capita availability of water resources, however, is just 900 cubic meters when compared to the national average of 2,200 cubic meters. Agriculture is the largest consumer of water in the State using 75 per cent of the State's water resources. Demand from other sectors such as domestic and industries have been growing significantly.

The projected demand of water in 2050 has increased from 54395 MCM in 2010 to 57725 MCM in 2015 and ultimately the supply demand gap raised from 16.88 percent in 2010 to 24.05 percent in 2050. In order to meet this demand, augmentation of existing water resources by development of additional sources of water or conservation of the existing resources through impounding of more water in the existing water bodies and its conjunctive use will be needed.

	No. of Activities (2021-30)	Budget Proposed in INR crore (2021-30)
<i>Adaptation based</i>	9	18,441.84
<i>Mitigation based</i>	0	0
<i>Both</i>	1	600
Total	10	19,041.84

Major Achievements

Hilly region interventions

- Rainwater harvesting structures have been constructed along the hill slopes of Western Ghats and eastern Ghats to collect the rainwater

Plain region interventions

- 213 Check dams, 29 Percolation ponds, 266 Recharge shafts, 2 Diaphragm walls, 5 Grade walls, a bed dam and 6 Sub-surface dykes were constructed under Master Plan Artificial Recharge Scheme (MPARS)
- Eco-restoration of Water Bodies

Coastal region interventions

- Periodical desilting has been carried out for the benefit of farming community to improve the status of soil organic matter content

Research and Capacity Building interventions

- Through NADP project, AWS network has been created at block level

Restoration of Water Bodies

Policy interventions

Pricing regulation for use of piped water for domestic use and drinking water

Budget Proposed in TNSAPCC	Rs12,626crore
Budget Allocated from 2012-17	Rs 34,685.95 crore
Percentage Share	275%

Forest & Biodiversity

As per ISFR 2017 by FSI, the forest cover in Tamil Nadu is 26,281 sq.km. which is 20.21 percent of the State's geographical area. In terms of forest canopy density in 2017, very dense forests occupied 12.47 percent (3386 sq.km.) of the total forest area in the State. The moderately dense forests covered 43.77 percent (8544 sq.km.), open forests covered 33.90 percent (5979 sq.km.), and scrubs covered 5.079 percent (1200 sq.km.) of the total forest area respectively. The total carbon stock in the forest of Tamil Nadu is 229.338 million tonnes (840.906 million tonnes of CO₂ equivalent) which is 3.24 percent of the total forest carbon stock of the country.

Ecosystems and associated services are sensitive to changes in climate and anthropogenic changes. Forests as discussed earlier are subject to multiple stresses. Climate change brings an additional stress that can result in serious impacts on the forests. Increasing temperatures usually result in an increase in the frequency of forest fires and pest and disease infestation in forests. Intermittent occurrences of drought and floods also result in an increase in soil erosion and degradation of the watershed, thereby affecting the forest cover. The changes in characteristics of ecosystems coupled with habitat degradation and fragmentation is likely to further weaken the ability of forests to continue to provide ecosystem goods and services.

	No. of Activities(2021-30)	Budget Proposed in crore INR(2021-30)
Adaptation based	24	1,976.48
Mitigation based	6	396.00
Both	7	461.96
Total	37	2834.44

Major Achievements

Participatory Forest Management or Joint Forest Management (JFM)

Planting and maintenance of 3.99 crore seedlings in the 32 districts throughout Tamil Nadu have been achieved through Massive Tree Planting Programme till 2017-18.

Tamil Nadu Biodiversity Conservation & Greening Project with assistance (Japan International Cooperation Agency)

Sandal Wood Plantation

Raising Palmyra plantation

Raising Teak Plantation in Padugai Lands

Promotion of Climate Resilient Agro and Farm Forestry

Under National Innovations in Climate Resilient Agriculture (NICRA) and other climate change adaptation programmes Climate Resilient Agro and Farm Forestry is being promoted in vulnerable regions of Tamil Nadu.

Training and extension activities to develop institutional capacity for biodiversity conservation and ecosystem management

At present, 13 Forest Protection Squads are functioning for the protection of forests, apart from territorial and wildlife staff. Besides the Forest Protection Squads, there are 5 Strike Force squads, 17 Forest Stations, 11 Roving Check Posts and 112 Forest Check Posts to protect the forest and wildlife wealth of the State.

Budget Proposed in TNSAPCC	Rs. 1528 crore
Budget Allocated from 2012-17	Rs. 1440.97 crore
Percentage Share	94.30%

Coastal Area Management

The Coastal State of Tamil Nadu is rich in marine resources with an array of ecosystem services that support the biodiversity as well as livelihood of the local communities. The Coastal stretch is not only zones of heavy population but also constitutes a hub with several flourishing industrial sectors like fishing, agriculture, tourism, shipping industry and other industries, which together help drive the State's economy. The identified ecologically important areas in Tamil Nadu are coral reefs and seagrass beds, mangroves and lagoon.

The coastal areas and resources are under immense stress through human influences like population growth, heavy dependence on the coastal wealth, over-exploitation of resources, developmental activities, and increased levels of pollution on the one hand, and through natural impacts such as cyclones, tsunamis, flooding, saltwater intrusion, siltation and climate change on the other.

The Major issue faced by the State regarding its marine resources is the increasing temperature, degradation of coral reefs, seagrass beds and mangroves, saltwater intrusion, excessive commercial fishing, unsustainable tourism and improper waste management system. In the TNSAPCC 2.0, several new activities on protection, conservation and management of marine resources, livelihood generation, capacity building, institutional arrangements and disaster resilience are proposed for implementation for the time period 2021-2030.

	No. of Activities (2021-30)	Budget Proposed (INR crore) for 2021-30
Adaptation Based	27	4,681.75
Mitigation Based	7	83.34
Both	4	11.01
Total	38	4776.10

Major Achievements

- **Coastal vulnerability Mapping**
- **Preparation of Coastal Zone Management Plan (CZMP) for Tamil Nadu**
- **Native Mangrove Plantation in coastal areas**
- **Conservation of mangrove forests**
- **Ecosystem based Climate proofing of watersheds Rehabilitation of Degraded coral Reef and sea grass in Gulf of Mannar Biosphere Reserve Water quality monitoring under Monitoring of Indian National Aquatic Resources (MINARS) and Global Environmental Monitoring System (GEMS)**
- **Emergency Tsunami Reconstruction Project**
- **Coastal Disaster Risk Reduction Project (CDRRP)**
- **Construction of Coastal defence structures, both hard and soft engineering structures for Coast stabilisation for protection against sea water intrusion**
- **Greenbelt/buffer zone/natural barrier set up through extension of coastal vegetation for protection against sea water intrusion**
- **Integrated Mangrove Fishery Farming System**
- **Fisheries Management for sustainable Livelihoods**

Capacity Building & Awareness programme

- Environment Information Dissemination Centres were formed
- Establishment of Climate change cell
- Special Area Management Plan (SAMP) development Check
- State Disaster Management Perspective Plan for 2018-2030

Budget Proposed in TNSAPCC	Rs 4420 crore
Budget Allocated from 2012-17	Rs 3089.85 crore
Percentage Share	69.9%

Strategic Knowledge for Climate Change

Strategic Knowledge for Climate Change is a major functional body of a State with vast repository of natural resources and, vulnerable to the impacts of climate change. The local communities as well as departments must be made aware of the sectoral vulnerabilities and challenges due to global change and the strategies that can be adopted for better adaptability and increased resilience to the same.

The State of Tamil Nadu extensively works on knowledge dissemination through various scientific working groups, educational organizations and research institutions to people at grass-root levels. In this regard, all the vulnerable sectors are assigned activities to enhance the knowledge base in their respective areas. The climate change vulnerable sectors identified in Tamil Nadu are: Sustainable Agriculture, Water resources, Forest & Biodiversity, Coastal Area Management, Energy Efficiency, Renewable Energy & Solar Mission and Sustainable Habitat.

The State along with the respective sectoral departments is developing a knowledge portal that would support in strategic decision making in order to adapt to the consequences of climate change and ensure security of the residing population through food availability, economic stability and environmental sustainability. The sectoral proposed activities are in line with the NDCs and SDGs.

In TNSAPCC 2.0, several new activities on strengthening of State Climate Change Cell, Campaign on climate awareness and Education, training to farmers on integrated farming system, studies on coral communities, ecosystem based climate proofed watershed have been proposed for implementation for the time period 2021-2030.

	No. of Activities (2021-30)	Budget Proposed (INR crore) for 2021-30
Adaptation Based	9	178.96
Mitigation Based	1	98.46
Both	2	3.45
Total	12	280.87

Major Achievements

Capacity Building & Awareness programme

- Action Research on Adaptation to Climate Change on rainfed farming
- 580 trainings and 279 demonstrations have been conducted under rainfed Area Development
- Study on diversity, abundance and role of reef binding coralline algae in coral reef ecosystem
- Study on Artificial reefs for the enhancement of fishery production and improved livelihood
- Training of 1176 Farmer Producer Groups on installation and commissioning of Micro Irrigation System
- Climate Change Adaptation Demonstration Projects
- SHG skill training
- Capacity building on Climate Resilient Development
- Awareness creation through workshops, seminars and exhibition

Budget Proposed in TNSAPCC	Rs 49 crore
Budget Allocated from 2013-14 to 2017-18	Rs 28.94 crore
Percentage Share	59.06%

Energy Efficiency, Renewable Energy and Solar Mission

The power sector of Tamil Nadu being one of the most diversified sectors in the country is undergoing a significant change that has redefined the industry outlook. Sustained economic growth continues to drive electricity demand in the State.

Tamil Nadu is the third largest consumer of electricity accounting for nearly 9 percent of total energy consumption in India in Financial year (FY) 2016. The primary energy requirement of the State is met through TANGEDCO and it has been able to maintain 24 hours of supply to both urban and rural areas since June 2014. Thus, the energy security of the State is very strong and does not possess any threat to the power supply scenario.

Of the total power allocation, wind accounts for the highest which is 27.3 percent followed by Central Generating Systems (20.6 percent) and then Power Purchases and Captive Power Projects (CPPs) (18.26%). Solar accounts for 6.81 percent, hydro for 7.73 percent, biomass for 0.8% and cogeneration for 2.31 percent.

As compared to National, the State's demand supply is better than the National average (2.1 percent Energy deficit and 3.2 percent Peak deficit in the Financial Year 2016).

The per capita consumption of electricity is higher than national level and even the growth trajectory is higher. The per-capita electricity consumption in the State is 114 percent of National per-capita consumption and owes to higher industrial and commercial sectoral growth.

The sales of petroleum products at national level and State level are in alignment. The per-capita sale of petroleum product in the State is around 130 percent of the national average.

	No. of Activities (2021-30)	Budget Proposed in INR crore(2021-30)
Adaptation based	7	1,365.76
Mitigation based	20	96,690.92
Both	0	0
Total	27	98056.68

Major Achievements

- The draft Amended Tamil Nadu Energy Conservation Building Code has been updated in line with Energy Conservation Building Code (ECBC) 2017 and is submitted to the Empowered Committee for approval and notification.
- Demonstration projects on Energy Efficiency at Nammakkal Kavingar Maaligai and Ezhilagam buildings were completed.
- 81460 nos. of Faster Than Light (FTL) lights converted into 81460 Nos. Light Emitting Diode (LED)(world class cities programme)
- 134965 nos. of FTL lights converted into 123499 Nos. LED (Rest of Urban Tamil Nadu)
- Strengthening of State Designated Agencies on Energy Conservation by Bureau of Energy Efficiency (BEE) and capacity building of Small and Medium Industries (SME) industries on Demand Side Management (DSM)
- Transmission Infrastructure strengthening works
- Distribution Infrastructure Strengthening works

Budget Proposed in TNSAPCC	Rs. 155438 crore
Budget Allocated from 2012-13 to 2016-17	Rs. 32719.22crore
Percentage Share	21.05%

Sustainable Habitat

Sustainable Habitat means achieving a balance between the economic and social development of human habitats together with the protection of the environment, equity in employment, shelters, basic services, social infrastructure and transport. Climate change and its impacts are related with unsustainable, unplanned and rapid development. The climate extreme events affect both rural and urban regions. Rural development needs to accompany urban development in order to create a balanced growth in each sector. Urban regions are most vulnerable to the impacts of climate change because of the rising issues like food insecurity, inequitable water supply, improper sewerage, more accumulation of solid wastes, health issues, vehicular growth, pollution etc. Important factor of urbanisation is the migration of people from rural to urban areas and which impacts, there is increasing pressure on urban infrastructure and services, increase in consumption of energy and associated greenhouse gas emissions.

The sustainable habitat focuses on housing, drinking water, urban development, health and sanitation, waste management, transport, energy, pollution and greening of urban spaces. The increasing rate of urban population is creating humongous stress on housing demand and space thereby making living conditions unsustainable. There is also unplanned settlement and construction. Change in rainfall pattern is a threat to the sustainability of water use in the urban regions as it leads to reduction of water availability and quality from surface and groundwater sources.

	No. of Activities(2021-30)	Budget Proposed in crore INR (2021-30)
Adaptation based	11	107736.93
Mitigation based	12	19752.35
Both	1	0.05
Total	24	127,489.33

Major Achievements

Promote sustainable habitats to adapt to Climate Change (CC)

- The Combined Development Regulation and Building Rules developed by the State focuses on rainwater harvesting, reuse of grey water, ecofriendly construction materials

Providing CC resilient water supply systems

- Providing 24x7 water supply and focusing on sustainable use of water by SCADA application

Urban and Rural development

- Thirumazhisai Satellite Township and Uchappatti – Toppur Satellite Township

Health and sanitation (urban and rural)

- The Rapid Response Teams (RRT) under IDSP (Integrated Disease Surveillance Project) is investigating in all outbreaks of diseases

Waste Management (Urban and Rural)

- Formulation of Solid Waste Management and Plastic Waste Management Rules - 2016

Energy

- Energising one lakh streetlights through Solar Energy by replacing the existing lamps with LED lamps

Developing an efficient integrated transport system

- Improvement to all existing roads and maintenance at regular intervals

bating enhanced air and water pollution in a CC scenario

- Installation of six Continuous Ambient Air Quality Monitoring stations (CAAQMS) in Chennai and Coimbatore, 10 Real Time Ambient Noise Monitoring Stations in Chennai City
- CARE AIR Centre monitors both source emissions and ambient air quality on a real time basis of the industries at TNPCB Corporate Office.
- Chennai City Water ways Monitoring Program

Greening of Urban Spaces

- Development of green parks, parks developed on open space reservation (OSR) land

Capacity Building

- Jal sakthi Abiyan main focus of this campaign being Water conservation and rain water harvesting

Budget Proposed in TNSAPCC	Rs 207104 crore
Budget Allocated from 2012-13 to 2016-17	Rs. 71589.48crore
Percentage Share	34.6%

Summary allocation of climate relevant budget in different Sectors

In the TNSAPCC, 260 climate actions were proposed. The tentative budget to implement these actions was Rs. 404,258.14crore for 5 years (2012-17).

Out of the proposed actions in the TNSAPCC, 59percent were for adaptation, 36percent for mitigation and 5 percent had characteristics of both adaptation and mitigation.

Sector	Proposed Budget (as in SAPCC 2012-17) in crore INR
Sustainable Agriculture	23,093.14
Water Resources	12,626.00
Forest & Biodiversity	1528.00
Coastal Area Management	4420.00
Strategic Knowledge for Climate Change	49.00
Enhanced Energy Efficiency and Solar Mission	155,438.00
Sustainable Habitat	207,104.00
TOTAL	404,258.14

The above table shows, sectoral, the investment focus has been more on the Sustainable Habitat sector that has strong relevance for NDC and is highly affected by climate change.

Prioritized Interventions

For 2021-2030, a total number of 199 planned activities have been identified in seven sectors for prioritisation for which financial allocation have been proposed merging similar activities. The key method of prioritisation is driven by the following:

- Adaptation activities that addresses high vulnerability and fits in to the impact chain (as relevant to sector)
- Low carbon development linked to mitigation activities
- Activities where adaptation and mitigation both possible, the co-benefit approach has been taken. Further sharpening has been done based on their linkages to Sustainable Development Goals-Nationally Determined Contributions (SDG-NDC), funding linkage and implementation potential.

Though for prioritization of activities, a multi criteria analysis-based score card was used, first the activities have been screened based on vulnerability/impact as well as low carbon development process. Thereafter, SDG-NDC linkage was assigned highest weight of 50percent. Implementation potential based on low barriers was assigned 30percent weight and funding linkage was assigned 20 percent weight (since our funding is mostly schematic and climate relevance for proposed activities is still not standardized). The activities based on this were scaled as (1) meagre (2) reasonable (3) significant. The weighted averages were used for ranking and prioritization.

However, sector wise resource requirement for all the proposed activities for next 10 years have been given below.

Sl. No.	Sector	Proposed Budget Rs in crore (2021-30)	From State/central budget available Rs in crore	Gap Rs in crore
1	Sustainable Agriculture	71,731.94	58,426.94	13,305.00
2	Water Resources	19,041.84	16,728.00	2,313.84
3	Forest & Biodiversity	2,834.44	2,301.44	533.00
4	Coastal Area Management	4,776.10	2,626.58	2,149.52
5	Strategic Knowledge for Climate Change	280.87	271.68	9.19
6	Enhanced Energy Efficiency and Solar Mission	98,056.68	42,522.31	55,534.37
7	Sustainable Habitat	127,489.33	98,021.77	29,467.56
	TOTAL	324,211.20	220,898.72	103,312.48

The State has proposed 199 activities that include some of the existing activities and new ones based on their linkages to NDC/SDG. The total resource requirement is expected to be Rs 324,211.20crore. Apart from accounting from all possible sources of funds, there will still be a gap of Rs 103,312.48crore.

While on the one hand, implementation of the prioritised adaptation and mitigation strategies will be monitored in regular stocktaking exercises such as the one in this document, in addition eight adaptation indicators and three mitigation indicators have been defined at the output/ outcome level, and will be tracked under the responsibility of the nodal department. Monitoring and evaluation of SAPCC implementation and effectiveness will allow assessing the effectiveness of adaptation and mitigation interventions, and thereby facilitating continuous learning and improvement. These indicators, moreover, have been designed in a way to facilitate aggregation, and to allow assessment of the actual TNSAPCC2.0 contribution towards the Indian NDC goals and the SDGs. Ultimately, information collected on TNSAPCC2.0 implementation is thought to be useful to feed into a National-level Monitoring &Evaluation system.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Climate policy and planning has become imperative in the recent years with the effects of global climate change becoming increasingly manifested and visible at the local level. Owing to India's federal structure, and introduction of India's National Action Plan on Climate Change (NAPCC) in 2008, State Governments were also encouraged to prepare their own State Action Plan on Climate Change (SAPCC) consistent with the strategies in the NAPCC. States/UTs were encouraged to integrate State-level variations in ecosystems, geographic conditions, socio-economic scenario, and other factors, while converging with the existing policies and ongoing programmes and schemes being implemented. 33 SAPCCs of States and Union Territories have been approved and are operational. Dedicated climate change institutions/cells have been established in most of the States/UTs to coordinate activities related to climate change. States/UTs have initiated capacity building activities and demonstration projects to implement SAPCCs since the formulation of SAPCCs. Tamil Nadu had formulated the Tamil Nadu State Action Plan on Climate Change (TNSAPCC) in 2014.

The National and International Climate Action and Policy Landscape have evolved since the formulation of SAPCCs. Paris Agreement has been agreed upon in the year 2015 to limit global mean temperature within 2 degree and working towards to limit 1.5 degree Centigrade. India has submitted its Nationally Determined Contributions (NDC) goals for post-2020 with eight different goals including three major quantifiable goals related to emission reduction, renewable energy and forestry. Over the years, India has pursued major domestic policies and schemes in areas of climate change mitigation and adaptation actions, particularly in the fields of clean and renewable energy, enhancing energy efficiency, development of less carbon-intensive and resilient urban development, promotion of waste to wealth, electric vehicles, etc.

The scientific and socio-economic understanding and knowledge on climate change have also advanced over the past few years. The dedicated climate change institutions/cells established in the States/UTs, with the active support of scientific, academic and research institutions, carried out several regional and sectoral vulnerability studies highlighting the impacts of climate change. The enhanced capacities and improved understanding of sectoral and regional climate variabilities and projections, Green House Gas Emissions (GHG), long-term vulnerabilities, mapping vulnerable regions/ social groups/sectors, etc. will help in the identification and prioritization of mitigation/ adaptation strategies and refining regional specific action plans and strategies.

In this context, SAPCCs need to be revised and strengthened further considering the evolving context of climate science, policy and actions. Ministry of Environment Forests & Climate Change, Government of India requested States to initiate the process of revision of the SAPCCs in January 2018 considering the principles enlisted in Figure 1.1

1.1.1 National and State-level Climate Policy and Planning

The SAPCC revision is thus intended to

1. Better align National and sub-National adaptation and mitigation planning and
2. Enhance the evidence-based character and effectiveness of climate policy and planning by integrating recent advancements in knowledge and understanding.

1.1.2 National-level Climate Policy and Planning Frameworks

As hinted at above, India's flagship climate policy document is **National Action Plan on Climate Change (NAPCC) 2008**. The NAPCC established 8 National missions "representing multipronged, long term and integrated strategies for achieving key goals in the context of climate change"¹ which are listed in Table 1.1.

¹<http://moef.gov.in/environment/climate-change/>

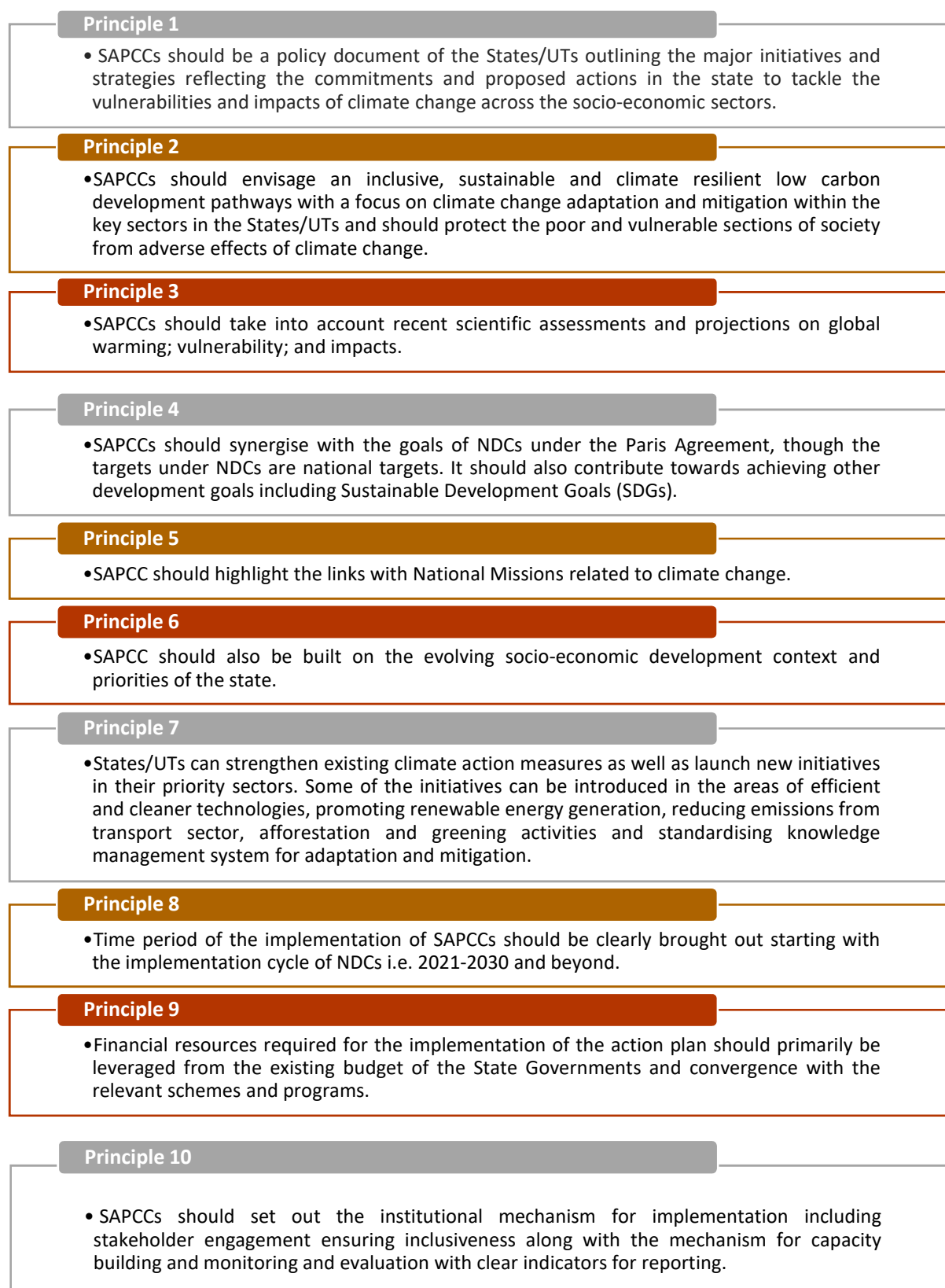


Figure 1.1: Guiding Principles, from Ministry of Environment, Forest and Climate Change, “A Common Framework for revision of State Action Plan on Climate Change”, 2019

Table 1.1: Eight Missions of the National Action Plan on Climate Change (NAPCC)

Mission name	Goals and measures
National Solar Mission	Increase the share of solar energy in the total energy mix
National Mission for Enhanced Energy Efficiency	Enhance energy efficiency through market-based certification mechanisms, cost reductions through R&D, demand-side financing mechanisms, and fiscal instruments
National Mission on Sustainable Habitat	Improvements in energy efficiency in buildings, solid waste management and modal shift to public transport
National Water Mission	Ensure integrated water resources management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within States
National Mission for Sustaining the Himalayan Ecosystem	Evolve management measures for sustaining and safeguarding the Himalayan glacier and mountain ecosystem
National Mission for a Green India	Enhance ecosystem services including carbon sinks
National Mission for Sustainable Agriculture	Devise strategies to make Indian agriculture more resilient to climate change
National Mission on Strategic Knowledge for Climate Change	Enhance the understanding of challenges of and response to climate change

A refinement of India's National mitigation and adaptation goals is provided by the mentioned Nationally Determined Contribution submitted to the UNFCCC. The NDC, initially formulated as the "Intended Nationally Determined Contribution" (INDC) in 2015, sets out eight different goals for the post-2020 period, three of which are quantitative. These goals are listed in Table 1.2, along with an indication of missions formulated in the NAPCC that are relevant to the different goals.

Table 1.2 India's NDC goals

No.	NDC goal	Quantitative/ qualitative	Relevant NAPCC missions
1	To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	qualitative	All
2	To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.	qualitative	All
3	To reduce the emissions intensity of its Gross Domestic Product by 33 to 35 percent by 2030 from 2005 level.	quantitative	• National Solar Mission • National Mission for Enhanced Energy Efficiency • National Mission on Sustainable Habitat • National Mission for a Green India

No.	NDC goal	Quantitative/ qualitative	Relevant NAPCC missions
4	To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).	quantitative	National Solar Mission
5	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.	quantitative	- National Mission for a Green India (National Mission for Sustainable Agriculture)
6	To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.	qualitative	- National Mission for Sustainable Agriculture - National Water Mission - National Mission for Sustaining the Himalayan Ecosystem
7	To mobilize domestic & new and additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.	qualitative	

Moreover, the NDC goals, are strongly linked to the other international agreements and goals, in particular the Sustainable Development Goals (SDGs). This is illustrated in Figure 1.2, which shows the number of actions of relevance to a particular SDG in the Indian NDC.



Figure 1.2: SDG- NDC Linkages for India's First NDC

Note: The size of the colored bar indicates the number of actions of relevance to a particular SDG that are mentioned in India's NDC, with bigger bars meaning more mentions.²

²<https://klimalog.die-gdi.de/ndc-sdg/country/IND>

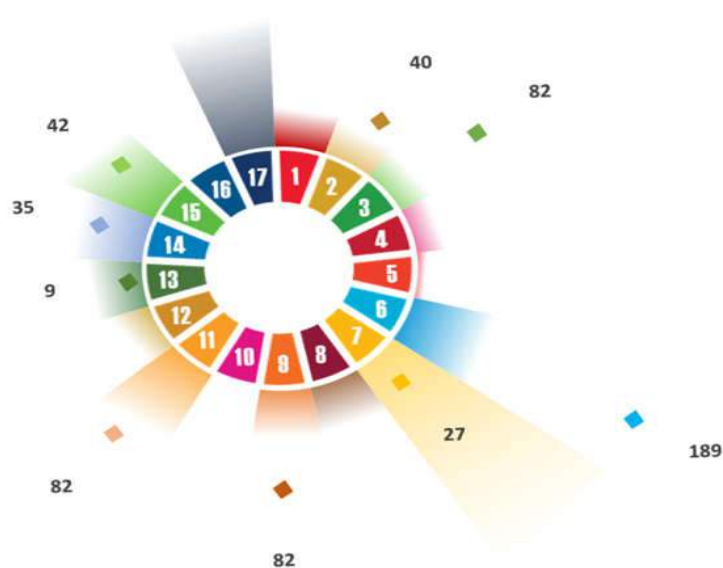
In accordance with the mandate for the SAPCCs, in Tamil Nadu formulated seven vulnerable Sectors that has grouped the proposed actions and strategies into clusters and thus extended the eight National missions listed in Table 1.1.

1. Sustainable Agriculture
2. Water Resources
3. Forest and Biodiversity
4. Coastal Area Management
5. Enhanced Energy Efficiency and Solar Mission
6. Sustainable Habitat
7. Strategic Knowledge for Climate Change

In the TNSAPCC 2.0 the following sectors are under adaptation category:

1. Sustainable Agriculture
2. Water Resources
3. Forest and Biodiversity
4. Coastal Area Management
5. Strategic Knowledge for Climate Change
6. Disaster Management and Mitigation
7. Health and Sanitation

By extending the Indian NDC to the State-level, the TNSAPCC is relevant to SDG implementation. Figure 1.3 shows results of an analysis of the linkages between proposed TNSAPCC actions with the 17 SDGs, plotted against the NDC contribution to the SDGs depicted in Figure 1.2.



5

Note: The number of proposed TNSAPCC activities of relevance to each SDG is illustrated by squares, with squares further from the center indicating more measures. The total number of proposed identified activities relating to each SDG is given next to the squares. SAPCC-SDG linkages are plotted against SDG-NDC linkages from Figure 1.3. A similar analysis for TNSAPCC 2.0 activities and strategies are presented in chapter 9.

1.2 OBJECTIVES

Considering the evolving context of climate science, policy and actions, the State Action Plan on Climate Change needs to be revised and strengthened. Therefore the objective of this document is to identify and prioritise mitigation and adaptation strategies in the light of such developments, and to refine the regionally specific action plan and strategies.

More specifically, the TNSAPCC2.0 aims to increase the level of ambition, accurateness, specificity and practicality of the mitigation and adaptation actions contained, and facilitate progress from planning to action. In order to do this, this document

- (a) stock taking for the implementation of the TNSAPCC, to derive conclusions on success factors and challenges to mitigation and adaptation planning in Tamil Nadu
- (b) updates forward-looking plans, strategies and actions for ambitious, workable mitigation and adaptation actions and strategies.

1.3 APPROACH & METHODOLOGY

The TNSAPCC 2.0 builds on the developments at the National level, various policies and programmes and the National and International commitments by India on the issues of climate change adaptation and mitigation. The steps taken for TNSAPCC 2.0 are depicted in Figure 1.4.

The detailed methodology used for each of the above steps explained in the respective chapters of this document.

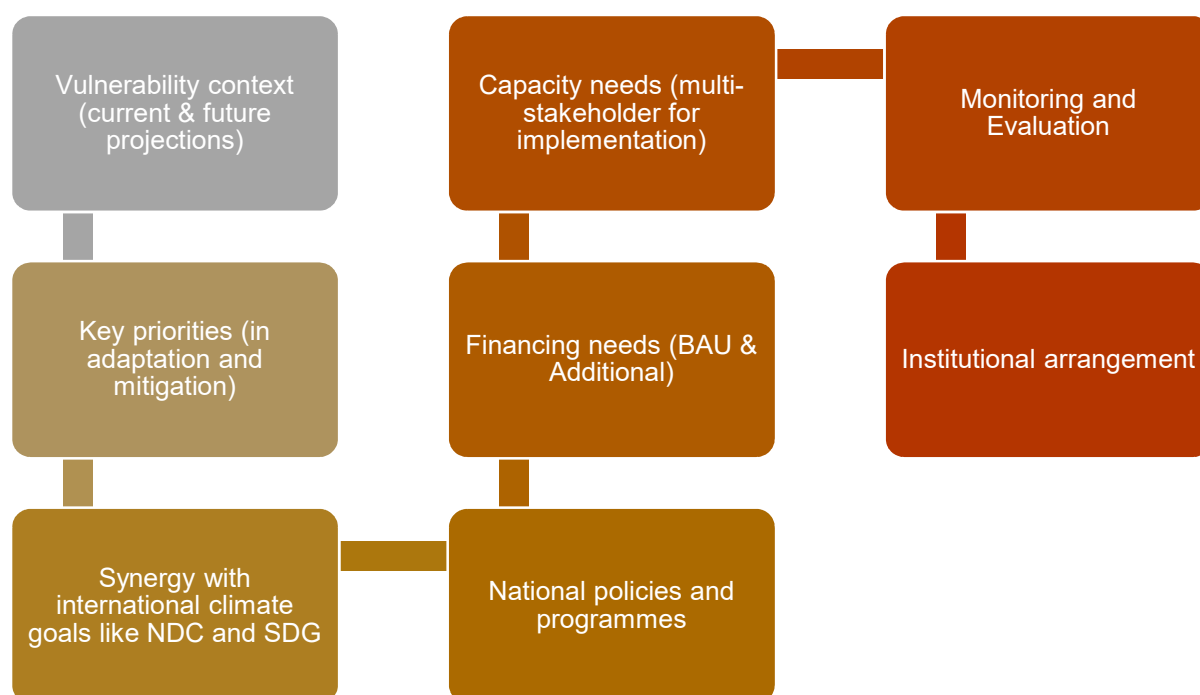


Figure 1.4 Approach and Methodology

Using the approach and referring to the climate policy context introduced in this chapter, this document aims to achieve its two fold purpose by proceeding in the following structure. Chapter 2 introduces the State profile, circumstances, resource endowments and the most important economic and societal sectors, using the latest scientific assessment, Chapter 3 then presents Tamil Nadu's Climate profile including historical conditions and observed trends and projected climatic changes. Chapter 4 deals with the vulnerability assessment for various sectors of Tamil Nadu using the sectoral & Climate information. It also presents key observed projected sectoral impacts. Chapter 5 includes both (a) stocktaking and b) adaptation planning by (a) comprehensively assessing progress towards State targets set out in the TNSAPCC and barriers related to their achievement and b) identifying forward- looking adaptation strategies for the identified key sectors and areas (Agriculture, Water Resources, Forestry & Biodiversity, Coastal Area Management, Knowledge Management, Disaster Management and Mitigation and Health). Chapter 6 focuses the same aforementioned steps for key mitigation areas namely Enhanced Energy Efficiency & Solar Mission and sustainable habitat. Out of the identified adaptation and mitigation strategies, Chapter 7 highlights the financial mechanism on how the strategies and activities prioritized will be funded. Chapter 8 then details the institutional mechanisms involved in the implementation of the SAPCC 2.0 and Chapter 9 concludes by identifying the monitoring and evaluation framework to be followed for monitoring and evaluating the implementation of the plan.

CHAPTER 2: STATE PROFILE

2.1 LOCATION, DEMOGRAPHY, ECONOMY

2.1.1 Location, Geography and Size

Tamil Nadu extends from 8° 5' and 13° 35' N latitude and between 76°15' and 80°20' E longitude with a total area of 1,30,060 sq.km., It accounts for about 4 percent of the total area of the country. The State lies at the South Eastern extremity of the Indian Peninsular surrounded by Karnataka on the north-west, Andhra Pradesh on north, by Bay of Bengal in the east, by the Indian Ocean in the south and by Kerala State in the west. The State has a coastal line of 1076 km.

2.1.2 Demographic Profile

As per the Census of India 2011, the State has a population of 7.21 Crore, an increase from 6.24 Crore in 2001 Census. The State accounts for 5.96 percent of India's population. The share of urban population in the State is 48.4 percent whereas the share of rural population is 51.6 percent. The decadal population growth rate of Tamil Nadu is estimated at 15.61 percent whereas the national rate of growth during the last ten years was 17.6 percent. The State has a population density of 555 persons per sq. km. as per the Census 2011, whereas India has only 382 persons per sq. km. In 2011, out of the 7.21 Crore population, the Scheduled Caste population constituted 20.01 percent and the Scheduled Tribe population constituted 1.10 percent of the total population of the State. The effective literacy rate of Tamil Nadu as per Census 2011 is 80.09 percent (Rural-73.54percent, Urban – 87.04 percent) while in 2001, literacy rate of the State was 73.45 percent. As per Census 2011, the sex ratio of the State of Tamil Nadu is 996F/1000M. When compared to 2001 Census, sex ratio has increased by 9 points. The demographic profile of the State is outlined in Table 2.1.

Table 2.1 Demographic Features of Tamil Nadu as per Census of India, 2001 & 2011

Particulars	Tamil Nadu		India	
	2001	2011	2001	2011
Population (in Crore)	6.24	7.21	10,2.87	12,1.02
Urban Population (%)	43.86	48.45	27.78	37.7
Population Decadal Growth Rate (%)	11.7	15.61	17.60	21.50
Population Density (person per sq. km)	478	555	324	382
% of Scheduled Tribe Population	1	1.10	8.2	8.63
Sex Ratio (Per 1000 Males)	987	996	933	943
Literacy Rate (%)	73.47	80.33	64.83	74.04
Male Literacy Rate (%)	82.33	86.81	75.26	82.14
Female Literacy Rate (%)	64.55	73.86	53.67	65.46

There are few important indicators that must be analysed for gender integration into Natural Resources Management and Climate change. Some of them have been highlighted in the section below.

Sex Ratio

The overall Sex Ratio in the State is a total of 996 females per 1000 males which is higher than that of India (943 females per 1000 males). It can also be observed that the sex ratio gap is nil in urban areas of Tamil Nadu whereas rural are as lag behind at 993 females per 1000 males (Figure 2.1).

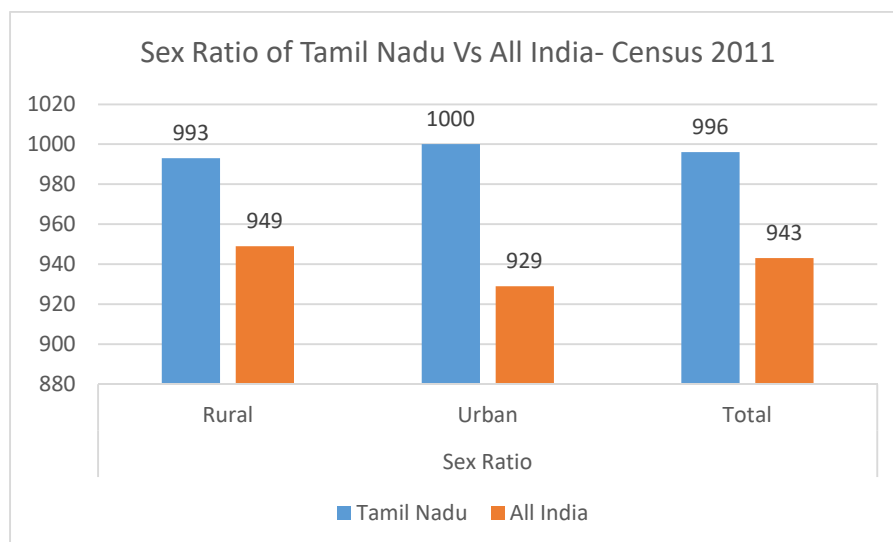


Figure 2.1 Sex Ratio of Tamil Nadu Vs All India, Census 2011

Female Literacy Rate

Female literacy is an integral part of Human Development, which supports the fulfillment of Sustainable Development Goals and several National strategies. Improvement in the overall education level has a positive response in terms of decreased maternal mortality, better health and education and reduction in poverty and hunger on a regular basis. Provision of better and enhanced educational support to females will inturn contribute towards reduced child mortality, improved child nutrition and health and the overall development. This may also increase productivity, skills and innovation, which directly affects the human capital and economic growth in developing countries like India³.

The female literacy rate has increased from 64.4 to 73.4 in Tamil Nadu when compared to all India levels which saw a rise from 53.7 to 64.6 according to thr census 2001 and 2011 respectively. The overall female literacy rate of Tamil Nadu is higher than that of the average of all over India. (Figure 2.2)

³<http://sh.diva-portal.org/smash/get/diva2:576144/FULLTEXT01>

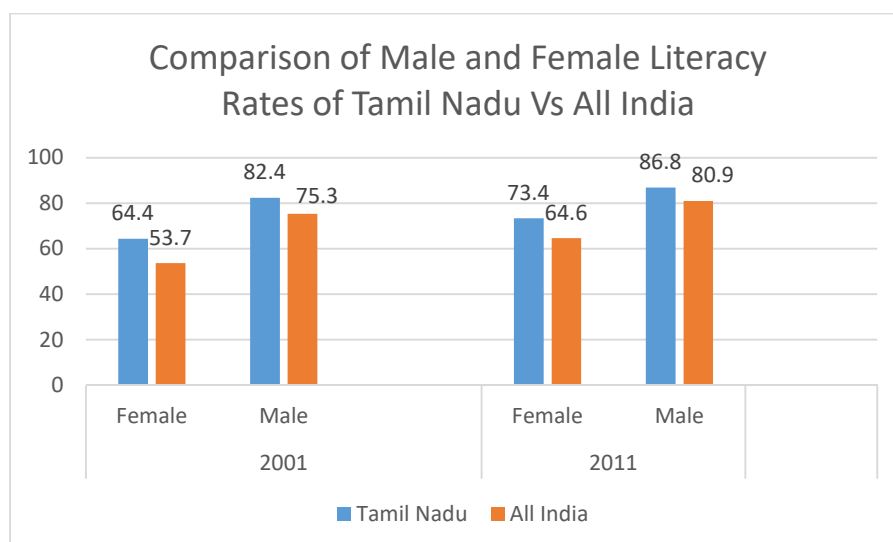


Figure 2.2 Comparison of Male and Female Literacy Rates of Tamil Nadu Vs All India

Employment Status

The employment status is another important indicator which could be understood by studying the following: Average wage earning, Labor force participation, Proportion of unemployment. The average wage earning (in Rs.) received per day by Casual laborers of Age 15-59 years in specified works (2011-12) is shown in Table 2.2. Rural employment consists of MGNREGA Public Works, Public Works other than MGNREGA, Public Works and Works other than Public Works. Urban employment consists of only Works other than Public Works. The table clearly shows the male-female wage gap in the State.

Only in MGNREGA, Public Works under Rural employment and Works other than Public Works under Urban employment the wages earned by females is higher than that of males.

Table 2.2 Average Wage Earning of Males and Females in Specified Works (2011-12)

State	Rural Urban							
	Works other than Public Works		Public Works other than MGNREGA Public Works		MGNREGA Public Works		Works other than Public Works	
	Female	Male	Female	Male	Female	Male	Female	Male
Tamil Nadu	110	197	94	96	94	88	228	127
All India	103	149	111	127	112	102	182	111

Women's labor force participation and access to decent work is a necessary element of an inclusive and sustainable development. The numbers vary in rural and urban set up as well as in terms of developed and developing countries. The participation is largely represented in informal economy, where their exposure to risk of exploitation is higher due to least formal protection. The female workers in rural areas engage mostly in informal, subsidiary or marginal employment, which does not reflect in labor participation³. In Tamil Nadu, the proportion of women involved in contributing to economy through their labor activities in rural areas and urban areas are 55.2 percent and 25 percent respectively. The proportion is more than the overall average of India, which is 31.7 percent in rural areas and 16.6 percent in urban areas (Table 2.3).

Table 2.3 Labor Force Participation Rate for persons aged 15 years and above (2015-16)

State	Rural			Urban			Total		
	Female	Male	Person	Female	Male	Person	Female	Male	Person
Tamil Nadu	55.2	81.2	68.2	25	69.1	46.8	41.5	75.8	58.5
All India	31.7	78	55.8	16.6	69.1	43.7	27.4	75.5	52.4

In terms of unemployment, 2.8 percent women are unemployed in rural areas compared to 1.6 percent in urban areas (Table 2.4). The proportion in rural areas is more by 1.5% when compared to overall rural India and less by 1.8% when compared to over-all rate of India.

Table 2.4 Proportion Unemployed for persons aged 15 years and above (2015-16)

	State			Rural			Urban		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Tamil Nadu	2.8	2.6	2.7	1.6	1.7	1.6			
All India	1.5	2.3	1.9	1.8	2.1	1.9			

Maternal Mortality

The maternal deaths due to complications during pregnancy or childbirth is referred to as the Maternal Mortality Ratio (MMR) and is represented as deaths per 100,000 registered live births. The Maternal Mortality Rate is defined as the total number of maternal deaths in a population divided by the number of women of reproductive age and is expressed as number of maternal deaths per 1,000 women⁴. MMR is an indicator of Millennium Sustainability Goals (MDG), Sustainable Development Goals (SDG) and overall Human Development. Gender discriminations are systematic in nature and occur at macro, societal and house hold levels and thereby, a potential relationship can be tracked between gender inequality, health expenditure and maternal mortality. Mortality in pregnant women is a component of Gender Inequality Index (GII) as mentioned earlier and the countries with higher gender inequality were observed to be associated with higher maternal mortality as compared to countries with lower sex-based discriminations. Also, the spending on maternal health by respective countries is directly correlated with maternal mortality cases⁵.

Tamil Nadu has worked on lowering the maternal mortality rate and achieved a much-decreased number of 66 deaths per 100,000 live births in the year 2014-16. Figure 2.3 shows the maternal mortality rate of Tamil Nadu as compared to that of All over India from 2001 to 2016.

⁴new_ <https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-delhi/document>

⁵s/genericdocument/wcms_342357.pdf

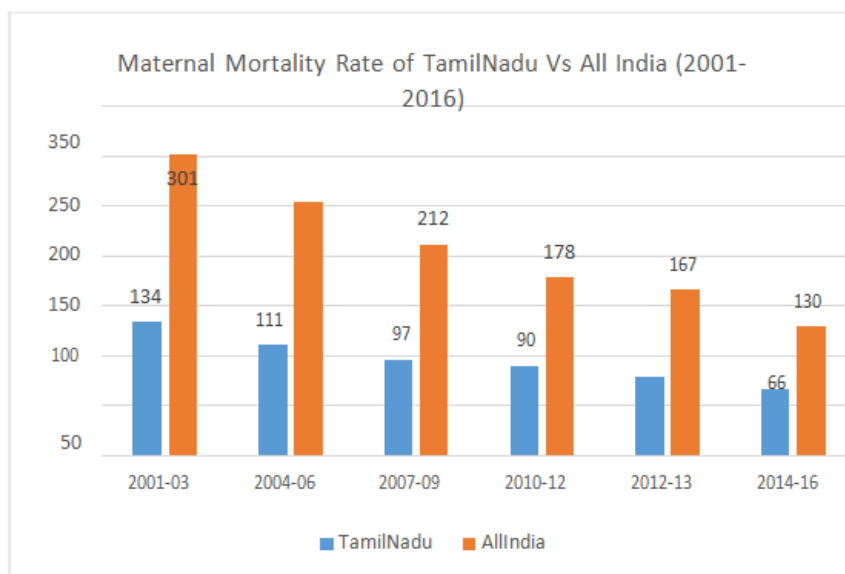


Figure 2.3 Maternal Mortality Rate of Tamil Nadu Vs All India (2001-2016)

2.1.3 Economic Profile

Between 2011-12 and 2017-18, Gross State Domestic Product (GSDP) increased at a Compound Annual Growth Rate (CAGR) of 11.28 per cent to Rs 14.27 trillion (US\$ 221.42 billion) whereas the Net State Domestic Product (NSDP) increased at a CAGR of 11.27 percent to Rs 12.80 trillion (US\$ 198.59 billion).⁶ According to the Department of Industrial Policy and Promotion (DIPP), the cumulative Foreign Direct Investment (FDI) inflows in Tamil Nadu and Puducherry during April 2000 to June 2018 stood at US\$ 27.95 billion. During 2017-18, total merchandise exports from the State stood at US\$ 29.75 billion. During 2018-19, the exports stood at US\$ 15.17 billion. The percentage of population below poverty line had decreased from 35.97 to 26.10 percent at the National level and from 35.03 to 21.12 per cent in Tamil Nadu.⁷ Figure 2.4 shows the GSDP of the State at constant price from 2011 to 2018.

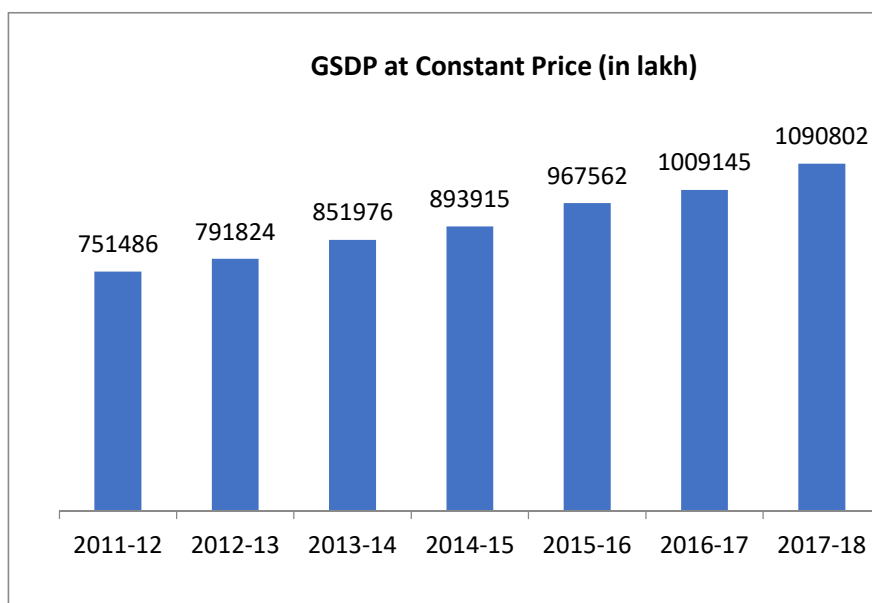


Figure 2.4 Tamil Nadu GSDP at Constant Price (Rs. in lakhs)

⁶<https://www.ibef.org/industry/tamil-nadu-presentation>

⁷ Planning Commission, GOI, New Delhi

The PerCapita Income of Tamil Nadu for the year 2016-17 is projected at Rs.1,84,210 as against the National Per Capita Income, which is projected at Rs.1,03,219. The State continues to achieve a phenomenal success by attaining Per Capita Income above the National average. The growth rate of the Primary Sector comprising of Agriculture and Allied activities in 2017-18 at constant (2011-12) price is 22.17percent when compared to the previous year. The share of Manufacturing & Industry Sector has been gradually increasing whereas the share of services sector has also witnessed a gradual increasing trend.

2.2 NATURAL RESOURCES: AVAILABILITY OF LAND, WATER, ENERGY, FORESTRY AND BIODIVERSITY RESOURCES

The total geographical area of Tamil Nadu is 130.33 ha as stated above. The land use pattern for the same is given in Table 2.5

Table 2.5 Land use pattern of Tamil Nadu

Sl. No.	Details	Area (in lakhs ha)	% with reference to geographical area
1	Forest	21.57	16.55
2	Net Cropped Area	43.47	33.35
3	Area under Misc. Tree Crops	2.32	1.78
4	Permanent Pastures	1.08	0.83
5	Current fallow	13.61	10.44
6	Other fallow	18.47	14.17
7	Culturable Waste	3.23	2.48
8	Land put to non-agricultural use	22.01	16.89
9	Barren and unculturable land	4.58	3.51
	Total Geographical Area	130.33	100.00
	Cropping Intensity (%)	118	-

Tamil Nadu is one of the most water starved States and is endowed with only 2.5 percent of the Nation's water resources putting high stress on irrigation water availability and vulnerable to seasonal fluctuations causing uncertainty in agriculture production. The average annual rainfall of the State is around 987 mm which is less than the National average of 1,200 mm. The quantum of rainfall received during winter (January - February), summer (March - May), South-West Monsoon (June – September) and North-East Monsoon (October - December) is 3, 14, 35 and 48 percent respectively. The per capita availability of water is 900 cubic meters per year as compared to the all India average of 2,200 cubic meters. The source wise net area irrigated in the State is given in the Table 2.6.

Table 2.6 Water Source wise net area irrigated

Source	Availability (Nos.)	Net Area Irrigated (in lakhs ha)	% with reference to Net Area Irrigated
Canals	2,239	5.27	22.10
Tanks	41,127	3.02	12.66
Wells	18,72,088	15.54	65.16
Others		0.02	0.08
TOTAL		23.85	100.00

The State has harnessed around 13,000 million units of wind energy and 2,905 million units of solar energy during 2017-18. By way of harnessing the Green Energy, the State has reduced use of hard coal and thus reduced about 5,406 Million Tonnes of Carbon emission. Tamil Nadu, from 2018-19, is

a power surplus State with an energy surplus of 15,116 Million Units and with a peak power supply of 2,235 MW.⁸

The forest cover of the State is currently 21.76 percent of the geographical area of the State of which 30.92 percent has been declared as protected areas.⁹ The total carbon stock of forests in the State is 229.338 million tonnes (840.906 million tonnes of CO₂ equivalent) which is 3.24 percent of total forest carbon of the country.¹⁰ The total Wetland area in Tamil Nadu is about 9,02,524 ha comprising of 6.92 percent of the geographical area of the State. At present there are 15 wetlands which have been notified as wildlife sanctuaries under Wildlife Protection Act, 1972 for protection of Wildlife including birds.

The Government has established 5 National parks, 15 Wildlife sanctuaries, 15 bird sanctuaries, 2 Conservation Reserves and 4 Tiger Reserves in the State. The State has a unique distinction of having 3 Biosphere Reserves known for its rich and unique biodiversity. The Western Ghats are one of the 25 global hotspots and one of the 3 mega centres of endemism in India. Four Elephant Reserves are located within the landscape of Tamil Nadu.¹¹

2.3 AGRICULTURE AND LIVESTOCK

The Net cropped area of Tamil Nadu is 43.47 lakh hectare which is 33.35 percent of the State's geographical area. 77 percent of the total gross cropped area under irrigation is brought under food crops and 23 percent under non-food crops in the State. The Cropping Intensity of the State is 118 percent.¹² According to Census 2011, the number of operational land holders in the State is 81.18 lakh, operating cultivable land of 64.88 lakh hectare. Small and marginal holders account for 92 percent of the total holdings operating 61 percent of the area occupied. The average size of the land holding in the State is 0.80 hectare which is lower than the average size of land holding of the country (1.15 hectare). The per capita availability of water is 900 cubic meters per year when compared to the all India average of 2,200 cubic meters. The net irrigated area is 23.85 Lakh hectare of which wells account for 65.16 percent. Tamil Nadu ranks first among all Indian States in the productivity of Maize, Cumbu, Groundnut and total oilseeds and ranks second in the productivity of rice, coarse cereals, sugarcane and coconut.¹³ The total food grain production in the State was 109.37 lakh Metric Tonnes in 2017-18.¹⁴

State's total livestock and total poultry population as per the 2012 census are 227.23 lakh numbers and 1,173.49 lakh numbers respectively and as per the 2007 census are 307.58 lakh numbers and 1312.54 lakh numbers respectively. Tamil Nadu is home to 88.14 lakh cattle out of which 72.11 percent are cross bred and exotic and 27.89 percent are indigenous.¹⁵ The State has a poultry population of about 11.73 Crore out of which the commercial poultry population is about 10.34 Crore. The contribution of livestock sector to the Gross State Domestic Product (GSDP) is 5.47 percent and that to the Agriculture and allied activities is 45.62 percent in the State.¹⁶ Values of few of the important parameters related to animal husbandry for the base and latest year for the State are given in the Table

Table 2.7 State Statistics for Animal Husbandry

Parameters	Unit	Base year	Latest year
Gross value of output of livestock	Rs in Crore	11,535.23 (2006-07)	64,166.34 (2016-17)
Estimated Milk Production	Lakh Metric Tonnes (LMT)	54.74 (2005-06)	77.42 (2017-18)
Estimated Egg	Lakh Numbers	62,225 (2005-06)	1,74,161 (2017-18)

⁸ Energy Department Policy Note, Demand No.14, 2018-19, GoTN

⁹ State Forest Policy 2018, Tamil Nadu Forest Department

¹⁰ Tamil Nadu ISFR report 2017

¹¹ Environment and Forests Department Policy Note, Demand No. 54, 2018-19, GoTN

¹² Policy Note, Demand No.5- Agriculture, 2018-19, Government of Tamil Nadu

¹³ Agricultural Statistics at a glance, 2016 released by Gol, 4th Advance Estimate

¹⁴ Policy Note, Demand No.5- Agriculture, 2018-19, Government of Tamil Nadu, Third Advance Estimate

¹⁵ 19th quinquennial livestock census

¹⁶ Animal Husbandry Policy Note, 2018-19, Demand no.6, Government of Tamil Nadu, 2018

Production			
Estimated Meat Production (including poultry meat)	Metric Tonnes (MT)	1,18,616 (2005-06)	6,03,352 (2017-18)
Per capita availability of milk per day	Gram	231 (2005-06)	268 (2017-18)
Per capita availability of eggs per annum	Numbers	100 (2005-06)	220 (2017-18)

There are 775 veterinary sub-centers, 2701 veterinary dispensaries, 143 veterinary hospitals, 17 clinician centers, 12 veterinary polyclinics and 56 mobile veterinary units. Using these veterinary services, 372.60 lakh cases were treated in the year 2017-18. Under breeding services, a total of 51.82 lakh Artificial inseminations were performed during the year 2018-19.

For the year 2017-18, area under fodder cultivation is 69,400 acres and the fodder production is 16 LMT.

2.4 ENERGY PROFILE INCLUDING PRIMARY ENERGY SUPPLY, ENERGY DEMAND AND ELECTRICITY INSTALLED CAPACITY

The daily average State consumption of electricity has increased from 200 MU during 2011 to 330 MU in 2018 and the maximum consumption met was 355.733 MU on 27.04.2018. The present average power demand of Tamil Nadu is about 14,800 MW to 15,300 MW and an all-time high maximum demand of 15,440 MW was met on 27.04.2018. The total installed capacity of the State as on 31.03.2018 was 29,859.99 MW of which total conventional sources account for 18,747.28 MW and total non-conventional sources account for 11,112.71 MW.

2.5 STATE DEVELOPMENT ISSUES AND PRIORITIES

The development in the State has been analysed with the help of key policies that are in place and the performance of the State against the same. Highlights of the State performance against the key policy elements were depicted in Table 2.8.

Table 2.8 Key Policies and State Performance

Key Policy Elements	State Performance
National Action Plan on Climate Change	The State has all eight sectors aligned to NAPCC
State Action Plan on Climate Change	The State Action Plan on Climate Change (SAPCC) for Tamil Nadu was formulated in 2014 and the final draft of TNSAPCC was endorsed by MoEF&CC in March 2015
Sustainable Agriculture	The main policy of the State is to usher in the Second Green Revolution, and thereby raise farm-based incomes through Rashtriya Krishi Vikas Yojana (RKVY) Agriculture Programmes like Paddy Mission, Millet Mission, Pulses Mission under National Agricultural Development programme (NADP), National Food Security Mission, Rain-fed Area Development Program (RADP), Irrigated Agriculture Modernization and Water-Bodies Restoration and Management (IAMWARM) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) Horticulture Programmes like Integrated Horticulture Development Scheme Animal Husbandry Programmes Revised Breeding Policy for Cattle 2008 Dairy Development Programmes Tamil Nadu Bovine Breeding Act 2019 Fisheries programmes
Water Resource	The Tamil Nadu Additional Assessment and Additional Water

	Cess Act 1963 The Water (Prevention and Control of Pollution) Act, 1974 Chennai Metropolitan Area Ground Water (Regulation) Act, 1987 State Water Policy, 1994 The Tamil Nadu Panchayat Act, 1994 The Tamil Nadu Farmers Management of Irrigation Systems Act, 2000 National Water Policy, 2002 Tamil Nadu State Groundwater Development and Management Act, 2003 The National Environment Policy, 2006 The Tamil Nadu Protection of Tanks and Eviction of Encroachment Act, 2007 On-going Programmes and Projects- National Action Plan on Climate Change for Cauvery delta, Tamil Nadu Irrigated Agriculture Modernisation and Water Bodies Restoration and Management Project (TN IAMWARM), Coastal Protection Works, Flood Management Programme, Dam Rehabilitation and Improvement Project
Forest& Biodiversity	The forests in Tamil Nadu are managed in line with the provisions of the National Forest Policy (1988) National Forest Policy 2017 National Environment Policy 2016 Tamil Nadu State Environment Policy, 2017 National Afforestation Programme Tamil Nadu Forest Act, 1882 Forest (Conservation) Act, 1980 Tamil Nadu Rosewood Tree (Conservation) Act, 1994 Environment Protection and Renewable Energy Development Fund (EPRED) Ongoing State Programmes/Schemes- Nature Conservation, Community Waste Land Development Programme, Tamil Nadu Afforestation Project (Phase II), Tamil Nadu Biodiversity Conservation and Greening Project, Sandalwood Plantation, Teakwood Plantation, Minor Forest Produce, Forest Research, Consolidation of Forests, Raising of free supply of seedlings, Erection of Solar Fence to protect the farm land from wild animals, Hill Area Development Programme, Eco-Development (Western Ghat Development Programme), Asian Elephant Depredation and Mitigation Measures, Creation of fodder tree plantation in forest areas to improve the wildlife habitat, Eco-restoration and Conservation of Pallikaranai Marsh Land Centrally sponsored programmes and schemes like Conservation and Management of Biosphere Reserves, Tamil Nadu Biodiversity conservation and Greening Project (TBGP)
Coastal Zone Management	Coastal Aquaculture Act 2005 Coastal Aquaculture Rules 2005 Developing an Integrated Coastal Zone Management Plan for Tamil Nadu which include Shoreline management, Biodiversity conservation, Controlling Coastal Pollution like Solid Waste Management, Livelihood improvement plans, Improvement of fishery resources, Encourage development of ecotourism Disaster Risk Management Programme

	Gulf of Mannar Biosphere Reserve (GoMBR) Coastal Area Management Project of Tamil Nadu Forest Department Coastal Regulation Zone (CRZ) Notification
Energy Efficiency, Renewable Energy and Solar Mission	New and Renewable Sources of Energy Policy (NRSE) 2012 Policy on net metering for Grid Interactive Roof-Top Solar Photo Voltaic Power Plants Roof Top Solar Energy The Chief Minister's Solar Powered Green House Scheme Perform, Achieve and Trade (PAT) Scheme aimed at industrial efficiency State has reported 100 percent electrification¹⁷
Sustainable habitat	Several water supply schemes under TNUDP-III, JNNURM, KfW, JICA, IUDM, IGFF and Capital Grant Fund. Housing for All Mission – Tamil Nadu Slum Clearance Board (TNSCB) is the nodal agency and has been implementing various housing schemes under BLC and AHP by In-situ and resettlement and rehabilitation. TNSCB has also proposed to rehabilitate all the slums along the waterways (Adyar, Cooum and Buckingham Canal) within a period of five years. (2019 – 2023). Underground Sewerage Scheme Satellite Town Schemes Integrated Municipal Solid Waste Management (IMSWM) system Special Solid Waste Management (SWM) Fund Tamil Nadu Common Development Promotion Rules, 2018 National Urban Transport Policy (2006) aims to ensure safe, affordable, comfortable, quick, reliable and sustainable access for the growing number of city residents.

Key development priorities for the State according to Tamil Nadu Vision Document 2023 are enlisted below:¹⁸

1. Achieving economic prosperity by ensuring a six-fold growth in per capita income over the next 11 years.
2. Exhibiting a highly inclusive growth pattern by ensuring a poverty-free State with high employment opportunities.
3. Achieving a higher Human Development Index (HDI) ensuring greater social development.
4. Providing best infrastructure services in terms of universal access to Housing, Water & Sanitation, Energy, Transportation, Irrigation, Connectivity, Healthcare, and Education.
5. Becoming one of the top investment destinations in Asia by ensuring efficiency and competitiveness.
6. Becoming the innovation hub and knowledge capital of India in various fields and best human talents.
7. Ensuring peace, security and prosperity for all citizens and business, enabling free movement and exchange of ideas, people and trade with other Indian states and rest of the world.
8. Preserving and caring for ecology and heritage.
9. Addressing the causes of vulnerability of the State and its people due to uncertainties arising from natural causes, economic downturns, and other man-made reasons and mitigate the adverse effects.
10. Nurturing a culture of responsive and transparent Governance that ensures progress, security and equal opportunity to all stakeholders.

¹⁷Saubhagya Dashboard

¹⁸ Tamil Nadu Vision Document 2023

2.6 SECTORAL HIGHLIGHTS

This section highlights an overview of the sectors of TNSAPCC 2.0, Sustainable Agriculture and allied, Water Resources, Forest and Biodiversity, coastal area management, energy and sustainable habitat. The sectors have been further dealt under separate sectors in details in the TNSAPCC 2.0.

2.6.1 Agriculture & Allied Sector

As a result of the geographic position of Tamil Nadu, it enjoys a semi-arid to dry sub humid climate, which permits higher crop productivity under irrigation. But it is one of the most water starved States endowed with only 3 percent of Nation's water resources placing high stress on irrigation water availability and is also vulnerable to seasonal fluctuations causing uncertainty in agriculture production. According to the Agriculture census 2010-11, the number of operational land holders in the State was 81.18 lakh, operating cultivable land of 64.88 Lakh Hectare. Small and Marginal holders account for 92 percentage of the total holdings operating 61 percentage of the area occupied. The average size of the land holding in the State is 0.80 hectare which is lesser than the average size of land holding of the country (1.15 hectare). The net irrigated area in the State is 23.85 lakh hectare for the year 2016-17. The area irrigated by wells accounted for 65 percentage followed by canals (22 percent) and tanks (13 percent). Out of Gross Cropped Area under irrigation (28.45 Lakh ha.) 77 percent is brought under food crops and 23 percent under non-food crops in the State. Table 2.9 depicts State profile of Agriculture and allied sectors.

Table 2.9 Agriculture and Allied Sector – State Profile

Agro Climatic Zones	• Cauvery Delta Zone • North Eastern Zone • Western Zone • North Western Zone • High Altitude Zone • Southern Zone • High Rainfall Zone
Soil Profile	• Type: Red Loam, Laterite, Black, Sandy Coastal Alluvium and Red Sandy • Texture: Sand to Clay (18% sandy surface, 53% loamy and 22% clay)
Gross Cropped Area	51.29 Lakh ha
Net Sown Area	4819000 ha (As of 2014-15)
Cropping Intensity	118 % (As of 2016-17)
Percentage area under irrigation	57% of Gross Cropped Area (As of 2014-15)
Rainfed Area	54% of cultivated area
Total food-grain production	113.85 Lakh Metric tonnes (2015-16), 52.38 Lakh Metric tonnes (2016-17) and 109.37 Lakh Metric tonnes (2017-18).
Whether food surplus or deficient	Surplus
Crops grown in State	Paddy, millets, pulses, oilseeds, cotton and sugarcane
Major Crop	Paddy
Area under Paddy (lakh ha)	18.551 in 2017-18

Productivity of rice (Kg/ha)	3687 in 2015-16, 17-18?
Horticulture crops grown in State	Fruits (<i>Mango, Banana, Lemon, Guava, Amla, Sapota, Orange, Jackfruit, Grapes, Papaya, Pomegranate, Pineapple</i>), Vegetables (Tapioca, Onion, Tomato, Brinjal, Ladies Finger, beans, Potato, Bitter gourd, Carrot, Leafy vegetables), Spices (Chillies, <i>Turmeric, Tamarind, Coriander, Black Pepper, Cardamom, Betel Vine</i>), Plantation crops (Cashew nut, Tea, Coffee, <i>Areca nut, Cocoa</i>), Medicinal and aromatic Plants Flowers (Jasmine, Chrysanthemum, Tube Rose, <i>Rose, Marigold</i>)
Livestock reared	Cattle, Buffalo, Sheep, Goat, Pigs, Horses, Ponies and Donkeys
Meat production in Metric Tonnes (including poultry meat)	6,03,352 (2017-18)
Estimated brackish water area under fish culture	56,000 ha is under capture fisheries and 6235.942 ha is under aquaculture (mainly shrimp aquaculture)
Inland fishery resources	3.83 lakh ha
Population of inland fishers	2.35 lakh (projected)
Total fish production	6.82 lakh tonnes (2017-18)
Per capita consumption of fish	9.81 kg
Key Issues and Challenges	• Small farm holdings, highly vulnerable to changing climate • More than 48% of the area is under dryland farming depending on highly variable rainfall. In these areas, crop production is limited to only one season from September end to December. • Labour shortage during peak seasons such as planting and harvesting • Stagnation in yield levels even with high input application • Indiscriminate use of fertilizers and pesticides that increases the cost of cultivation as well as pollution levels • Pollution of water bodies due to mixing up of industrial effluents affects human and animal health • Lack of minimum support price for most of the crops lead to uncertainty in income of the farmers • Political instability also hinders the smooth functioning of the sector.

2.6.2 Water Resources Sector

Tamil Nadu constitutes 4 percent of India's land area and is inhabited by 6 percent of India's population, but has only 2.5 percent of India's water resources. More than 95 percent of the surface water and 80 percent of the ground water have already been put into use. Agriculture is the largest consumer of water in the State using 75 per cent of the State's water resources. Demands from other sectors such as domestic and industries have been growing significantly. Assessing the impact of climate change on the quantity and quality of groundwater resources is of prime importance as it plays a major role in increasing the food production and achieving food security in the State.

Total water potential in Tamil Nadu is ascertained as 46375 million cubic metres, out of which surface water potential contributes to 23995 MCM and ground water potential of about 22380 MCM and the ground water development in Tamil Nadu as a whole is about 85 percent, where in North agro climatic zone the maximum ground water development of 129.1 percent owing to the over exploited blocks in the region. The projected demand of water in 2050 has increased from 54395 MCM in 2010 to 57725 MCM in 2050 and ultimately the supply demand gap has risen from 16.88 percent in 2010 to 24.05 percent in 2050. In order to meet this demand, augmentation of existing water resources by identifying additional sources of water and improving the capacity of the existing water bodies in order to impound more water and its conjunctive use will be needed. Table 2.10 depicts the State water sector profile.

Table 2.10 Water Sector – State Profile

Average Annual Rainfall	987 mm
Per capita availability of water	900 cubic meters per year
Net irrigated area	23.85 lakh ha
Availability of canals (Nos.)	2239
Availability of tanks (Nos.)	41127
Availability of wells (Nos.)	1872088
Important drainage systems	Drained by several major and minor rivers like, Palar, Ponnaiyar, Cheyyar, Kortallaiyar and Araniyar in the north, river Cauvery in the centre (Bhavani, Noyil and Amaravathi are its tributaries) and Vellar, Vaigai, Vaippar and Tambaraparani in the south
Artificial Recharge to Ground Water (AR)	- Area identified for AR: 17292 sq. km. - Quantity of Surface Water to be Recharged: 3597 MCM - Feasible AR structures: 8612 percolation tanks, 18170 check dams, 5 lakh rainwater harvesting structure
Annual Replenishable ground water resource during Monsoon season (recharge from rainfall) (in billion cubic metre)	7.12
Annual Replenishable ground water resource during non-monsoon season (recharge from rainfall) (in BCM)	1.52
Natural Discharge during non-monsoon season (In BCM)	2.07
Net Annual Ground Water Availability (In BCM)	18.59
Annual Ground Water Draft (In BCM)	14.36
Projected Demand for Domestic and Industrial (In BCM)	1.53
Ground Water availability for future irrigation (In BCM)	4.08

Stage of Ground Water development (%)	77
Key Issues and Challenges	• Gap between demand supply of water • Poor water harvesting techniques and storage mechanisms • Over exploitation of Ground water • Frequent Droughts • Frequent Flood • Low Water Use Efficiency • Cyclones • Migration

2.6.3 Forest & Biodiversity Sector

Tamil Nadu has a spectrum of nine major forest types ranging from wet evergreen forest to moist deciduous, dry deciduous, sholas, grass lands and scrub forest. The Western Ghats, the longest hill range in the State is one of the 25 global hotspots of biodiversity and one of the three mega centres of endemism in India. The 9 major forest types of Tamil Nadu are: Tropical wet evergreen, Tropical semi evergreen, Tropical moist deciduous, Littoral & swamp, Tropical dry deciduous, Tropical thorn, Tropical dry evergreen, Sub-tropical Broad-leaved hill and Montane wet temperate. Mangrove cover in the State is 49 sq.km as per India State of Forest Report (ISFR 2017) assessment. There has been a net increase of 2 sq.km in the mangrove cover of the State when compared to the 2015 assessment.

With 5640 angiosperm species, Tamil Nadu ranks first among all States in the country and accounts for nearly 1/3rd of the total flora of India. According to the Compensatory Afforestation Management and Planning Authority (CAMPA) reports the red-listed species under faunal diversity include 126 species of pisces, 56 species of Amphibians, 77 species of reptiles, 32 species of birds and 40 species of mammals.¹⁹ The Gulf of Mannar region in the Indian coast between Rameswaram to Kanyakumari is among world's richest region from the marine bio-diversity perspective. Considering the biological and ecological richness of the area, the GoTN has bought the 21 uninhabited islands and their shallow waters around along the coast in Ramanathapuram and Thoothukudi district as the first marine National Park of the country. The Gulf of Mannar Biosphere Reserve (GOMBR) extending over 10,500 sq.km and includes 21 islands of the National park (560 sq.km) is the first Marine Biosphere Reserve in the Country. The GOMBR is rich both in species and habitat biodiversity. This richness also makes the reserve a high productive area for marine resources of fisheries. The reserve has been accorded a special status of concern because of its rich diversity and the special multiple use management status Table 2.11 depicts State profile of Forest and Biodiversity Sector.

Table 2.11 Forest and Biodiversity Sector

Total Forest Cover	26,281 sq. km
Percentage of State area under forest	20.21%
Area under VDF (Very Dense Forest)	3672 sq.km
Area under MDF (Moderately Dense Forest)	10979 sq.km
Area under OF (Open Forest)	11630 sq.km
Reserved Forests	88.7% of the recorded forest area
Protected forests in the State	7.79% of the recorded forest area
Unclassified Forests	3.51% of the recorded forest area
Total tree cover (under forest cover outside recorded forest area)	4671 sq.km
Total forest and tree cover (under forest cover outside recorded forest area)	30,952 sq.km
Bamboo bearing area within forest area of State	4154 sq.km

¹⁹http://tnenvvis.nic.in/tnenvvis_old/forest.htm

Total carbon stock of forest	229.338 million tonnes (840.906 million tonnes of CO ₂ equivalent); 3.24% of total forest carbon of country
Extent of water bodies within forest	732 sq.km
Species diversity of the State	Floral diversity- 5640 angiosperm species, 64 gymnosperm species and 184 pteridophyte species Faunal diversity- 165 species of fresh water pisces, 76 species of Amphibians, 177 species of reptiles, 454 species of birds and 187 species of mammals
Key Issues and Challenges	• Degradation of Habitats • Encroachment of Forest Lands • Forest Fires • Natural Disasters • Threats to the Sacred Groves • Human-Animal Conflict • Illicit removal of Firewood, Bamboo, Minor Forest Produce (MFP) and Timber • Illegal Trade in Flora and Fauna • Depleting NTFP • Meeting Fuelwood Demand • Groundwater water availability • Productivity of Forests • Invasive Alien Species • Fragmentation of Forests

2.6.4 Coastal Area

Tamil Nadu covers an area of 13 million hectares and has a coastline of 1,076 kms which is about 15 percent of the coastline of India. The 13 coastal districts of the State are Thiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, Nagapattinam, Thiruvarur, Thanjavur, Pudukottai, Ramanathapuram, Tuticorin, Tirunelveli and Kanyakumari. The identified ecologically important areas in Tamil Nadu are Gulf of Mannar in Ramanathapuram and Tuticorin districts, with coral reefs and seagrass beds; Palk Bay in Thiruvarur, Thanjavur, Pudukottai and Ramanathapuram districts, with seagrass beds and patch corals; Vedaraniyam and Muthupettai in Nagapattinam district, with mangroves, Pichavaram in Cuddalore district, with mangroves; and Pulicat Lake in Thiruvallur district, with lagoon.

Tamil Nadu's geographic location, increased anthropogenic pressure and climate change phenomena have rendered the coastal State vulnerable to the natural hazards and disasters sustaining heavy loss of life and property. Storm surges and Cyclones, Sea-level Rise and Coastal Inundation due to it, sea erosion are the major issues posed by disasters in the State for which an array of Climate Change adaptation, disaster preparedness and mitigation strategies have been developed. Disposal of domestic and industrial wastes (both solid and liquid) on river channels and water bodies leads to the quality degradation of the water body and threatens life-forms. Therefore, it is necessary to manage the waste at starting point, so that they do not alter the marine water quality. Table 2.12 depicts State profile of Coastal Area Management.

Table 2.12 Coastal Area Management – State Profile

Coastal Length	1076 km
Share of total coast length of India	15%
Number of Coastal Districts	13
Number of Fishing Villages	608
Fishermen Population (Marine, in Lakhs)	10.29
Major Fishing Harbours	9
Medium Fishing Harbours	3
Fish landing centres	39
Marine Fish Production (Quantity in Tonne)	4,96,889.1 (2017-18)
Marine Fish Production (Value in Rs. Lakh)	1184,90,382.17 (2017-2018)
Fish and Fish Products Exports	1,16,664

(Quantity in Tonne)	
Fish and Fish Products Exports (Value in Rs. Lakh)	5420.30
Estimates of coral reef	94.30 sq.km.
Area covered by mangroves	1,100 ha (Pichavaram) and 6,800 ha (Muthupet)
Key Issues and Challenges	• Activity-wise funding is not available for specified strategies • Absence of a separate coastal area management body, for fund channelization and management • Clear demarcation of the coastal Exclusive Economic Zone (EEZ) is not available • Commercial fishing • Domestic and Industrial pollution • Unsustainable coastal tourism • Coastal Habitat destruction • Saltwater intrusion • Lack of fish-catch, resulting in lower incomes for fisherman • Increased number of economic activities in coastal belts by local communities • Awareness to conserve marine resources • Inter departmental cooperation • Resistance from fishermen in delineation of GOMMNP (Gulf of Mannar Marine National Park)

Health and Sanitation

During 2010, Infant Mortality Rate (IMR) of the State was 24 that significantly reduced to 16 per 1,000 live births during 2017 as per SRS data 2017 against the National IMR of 33. According to Sample Registration Systems (SRS) data 2014-16, during 2010-12, the Maternal Mortality Ratio (MMR) in the State was 90 and that reduced to 62 as per 2016-17 State Health Management Information System Data against the National MMR of 130. The present Total Fertility Rate (TFR) in the State is 1.6 against India's status of 2.3.⁶ Table 2.13 shows the health infrastructure of the State in the year 2017.

Table 2.13 Health Infrastructure in 2017

Category	Number
Sub Centres	8712
Primary Health Centres (PHCs)	1835
Community Health Centres (CHCs)	385
Sub Divisional Hospital	279
District Hospital	31

Source: District-wise Health Care Infrastructure 2017

The report from the National Family Health Survey (NFHS-4) 2015-16, explained that 53.1 percent of urban residences avail public health sector services and 46.3 percent of urban residences avail private health sector services.

Sanitation plays a critical role in public health which directly impacts the wellbeing of people and enhances the quality of life. Climate Change has impacted not only urban weather and environmental patterns but also urban health in direct and indirect ways. Septage Management involves proper treatment and safe disposal of waste. Underground Sewerage Schemes have also been taken up

for Implementation in the State and is functioning in 9 Corporations (including Chennai), 27 Municipalities and 3 Town Panchayats.²⁰ The total number of households with toilet in the State is 92, 51, 320. The total number of household toilets constructed under Swachh Bharat Gramin is 48, 29, 789. The total number of Individual Household Latrine (IHHL) application received under Swachh Bharat Urban is 6, 21, 775. As per Census 2011, 75.1 percent of urban households were availing latrine facilities whereas 23.22 percent of rural households were availing latrine facilities.

Figure 2.5 shows the status of surveyed Urban Local Bodies for Open Defecation Free. From the surveyed 666 ULBs, 634 ULBs (95.2%) are declared ODF and 32 (4.8%) are non-ODF.

Source: Swachh Certificate for Open Defecation free status (<http://sbmodf.in>)

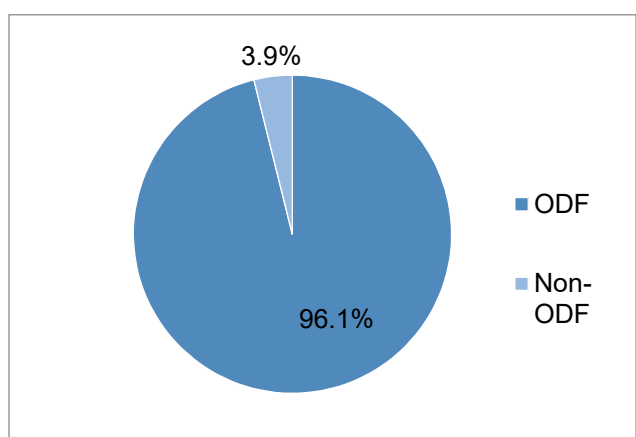


Figure 2.5 Status of surveyed Urban Local Bodies for ODF

Majority of the core areas in Chennai avail sewerage facilities and most of the sewer connections are managed by Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB). The State has launched sewerage network provision in all corporations, municipalities and Town Panchayats. According to 2011 Census, 75 percent of the urban households had drainage connections and out of which 44.8 percent had closed drainage, 30.2 percent with open drainage and the remaining 25% of urban households had no drainage.

2.6.5 Enhanced Energy Efficiency and Solar Mission Sector

Tamil Nadu is a leader in Renewable Energy sector among all States and has a total installed capacity of 11,113 MW as on 31.03.18 against 10,480MW on 31.05.2017. The State has harnessed around 13,000 million units of wind energy and 2,905 million units of solar energy during 2017-18. By way of harnessing the Green Energy, the State has reduced the use of hard coal and thus reduced about 5,406 million tonnes of Carbon emission. The present average power demand of Tamil Nadu is about 14,800 MW to 15,300 MW and the maximum demand met was 15,440 MW on 27.04.2018. Chennai alone has met an all-time high demand of 3,386MW on 08.05.2018. The daily average State consumption has increased from 200 MU during 2011 to 330 MU in 2018 and the maximum consumption met was 355.733 MU on 27.04.2018. The Southern Regional Power Committee of the Central Electricity Authority (CEA) in its draft Load Generation Balance Report (LGBR) has stated that as in the previous years, Tamil Nadu will continue to be a power surplus State in the year 2018-19 with an energy surplus of 15,116 million units and with a peak powersurplus of 2,235 MW.

From the year 2011, 402 Nos. substations have been commissioned and 11,714 circuit kms of Extra High Tension (EHT) lines have been energized. Further in the Distribution front, 23,107 kms of High Tension (HT) lines and 71,564 kms of Low Tension (LT) lines and 89,528 Distribution transformers have been energized. Also, 62.55 lakhs new service connections have been affected under various categories. Table 2.14 depicts the State profile of Enhanced Energy Efficiency and Solar Mission.

²⁰ Health and Family Welfare Department

Table 2.14 Enhanced Energy Efficiency and Solar Mission – State Profile

Total Installed capacity	11,113 MW (as of 2017-18)
State's share from Thermal	14.47 %
State's share from Wind	27.30 %
State's share from Hydropower	7.73 %
Total energy demand	96172 MU (in 2017-18)
Total energy supply	96096 MU (in 2017-18)
Per Capita electricity Consumption	1280 KWh (as of 2016-17)
Per Capita consumption of Petroleum Products	184.1 Kg(as of 2016-17)
Household Electrification Status as of Sept 2018	100%
Electricity tariff	6.6 Rs/KWh (highest slab)
LPG Penetration as of September 2018	96.90%
AT & C losses	14.04 %
Reduction in carbon emission	5,406 Million Tonnes
Firewood Consumption for cooking	37.2% of the rural household and 9.2% of the urban household
Unmet Peak Demand in 2017-18	0.2 % (in the year 2017-18)
Solar energy harnessed in 2017-18	2,905 million units
Key Issues and Challenges	• Lack of financing for energy efficient projects • Shortage of adequately trained personnel in the field of energy efficiency • Lack of Awareness among General Public on the importance of energy conservation • Lack of technical knowledge and information on the benefits of modern energy management systems and sector specific new technologies launched globally.

2.6.6 Sustainable Habitat Sector

The major and naturally occurring variations in climate conditions including climate extreme events affect both rural and urban regions. Climate change and its impacts are basically related with unsustainable, unplanned and rapid development. Rising issues like food insecurity, inequitable water supply, improper sewerage, more accumulation of solid wastes, health issues, vehicular growth, pollution etc. make urban regions more vulnerable to the impacts of climate change.

The sustainable habitat focuses on housing, drinking water, urban and rural development, health and sanitation, waste management, transport, energy, pollution and greening of urban spaces. The increasing rate of urban population is creating humongous stress on housing demand and space thereby making living conditions unsustainable. There is also unplanned settlement and construction. Table 2.15 depicts the State Profile of Sustainable Habitat Sector.

Table 2.15 Sustainable Habitat Sector- State Profile

Total Population	72,147,030
Urban Population	34,917,440
Urban Male Population	17,458,910
Urban Female Population	17,458,530
Urban Pop Growth Rate	27.05%
Urban Sex Ratio	1000
Urban Literacy Population	27,335,312
Urban Literacy Rate	87.04%
Male Literacy Rate	91.8%
Female Literacy Rate	82.31%
Total individual household (urban) latrine application	6, 21, 775

Total constructed toilet	48,29,789
Number of ODF cities	600
Number of wards for 100% door to door waste collection	11,917
Key Issues and Challenges	• Unavailability of flexible housing finance schemes • Lack of awareness about new sustainable building technologies • Changes in the scope and design of the scheme like pro-rata supply, design of conduits and other infrastructures that results in variation in the sanction of the schemes • Lack of promotion of localised solutions for waste management and converting waste reclamation for reuse or recycling • Lack of enough technical expertise in departments • Low public awareness about the overall scarcity and economic value of water resulting in its wastage • Identification and location of sustainable sources of drinking water supply • Implementation is dependent on fund flow from Central Financial Assistance (CFA) and grants from different funding agencies • Paucity of funds results in delay of implementation leading to cost overrun of the schemes

2.7 CONTRIBUTION TO NDC IN TERMS OF KEY INDICATORS

There is a strong correlation between GSDP and emissions of the State. It is important to track the GSDP growth for moderation of emission intensity by switching to alternative energy sources which is an important NDC requirement as well. List below shows the indicator value for the base year 2011-12 and has been projected till 2030.

The per capita energy consumption and forest carbon sink are important aspects of NDC and the same for the State has been compared with the National average in the Table 2.16 to understand where the State stands in terms of fulfilling its NDC targets.

Table 2.16 Key Indicators with respect to NDC

Indicators	Unit	2011-12	2030
GSDP at current prices	Rs in Crore	14,27,074 ²¹	28, 27, 639
Population	in lakhs	721.47	723.17
Urban population	in lakhs	349.17	534
Per capita GSDP	Rs in lakhs	1, 97, 800	3, 91, 006
Electricity demand	in GWh	1, 18, 260	1, 32, 742.80
The status of energy consumption and carbon sink as on 2017			

²¹Economic Survey of Tamil Nadu

		Tamil Nadu	All India
Per capita energy Consumption	in kWh	1210.81 ²²	1119.37
Forest carbon sink	in million tonnes	840.906 CO ₂ eqv ²³	7082.063 25991.171 CO ₂ eqv

2.8 PERFORMANCE OF THE STATE UNDER KEY NDC AREAS

There are certain important NDC areas that need to be focussed and prioritised for achieving the targets. Some of them have been detailed in this section and the performance of the State has been noted in each area.

2.8.1 Poverty and Food Security

Availability and access to food stand as a major factor determining the incidence of poverty. Tamil Nadu is one of the fastest growing States and in terms of poverty alleviation, the State has shown a steady decline in poverty levels. The State has lower levels of poverty than most of the other States in the country. The important factors that could be cited for the rapid decline in poverty ratio in the State are the adoption of a three-pronged approach: promotion of economic growth, promotion of human development and targeted programmes of poverty alleviation to address the multidimensional nature of poverty.

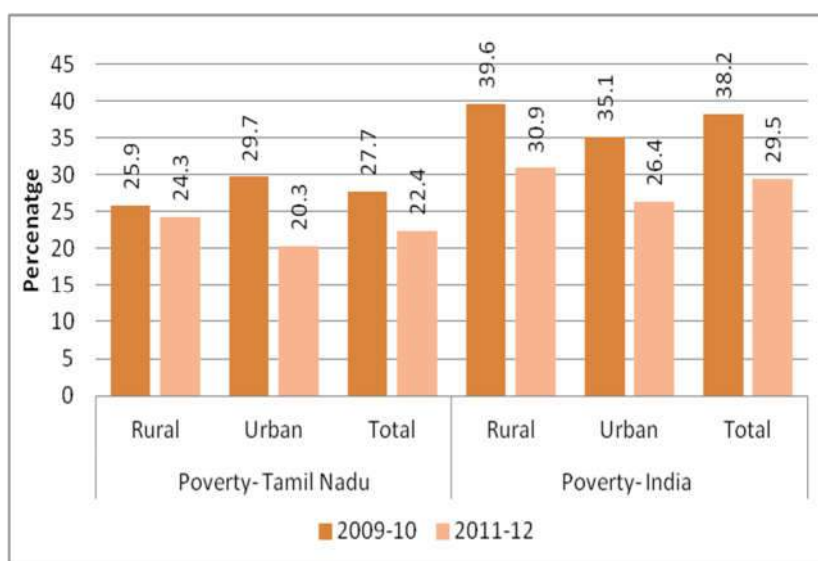


Figure 2.6 Percentage of people below poverty line

(Source: Report of the expert group to review the methodology for measurement of poverty, Government of India Planning Commission June 2014)

The trend in the poverty level reduction across rural and urban regions of Tamil Nadu shows a different pattern. In rural areas, the percentage share of population below poverty line declined from 25.9 to 24.3 whereas in urban regions, the percentage share of population below poverty line had declined from 29.7 to 20.3. By 2030, the poverty level is expected to be in the range of 3.3 percent as per this criterion (Figure 2.6).

²²Per Capita Consumption of Electricity In India (State-Wise Chart)

²³Tamil Nadu ISFR 2017

National Food Security Mission (NFSM), which is an important investment for improving the adaptive capacity in the vulnerable areas, is being implemented in the State for the paddy, pulses, coarse cereals, cotton and jute. It aims to improve the production by expanding area, productivity enhancement, restoring soil fertility and creation of employment opportunities.

Figure 2.8 and Figure 2.9 shows the allocations, release and expenditure under National Food Security Mission (NFSM) for Tamil Nadu and India respectively.

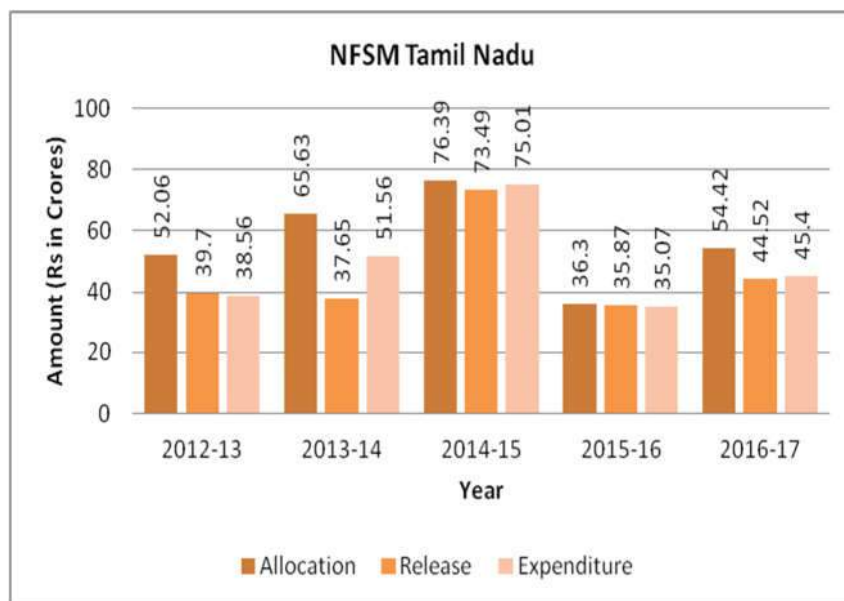


Figure 2.7 Allocations, Release and Expenditure under National Food Security Mission, Tamil Nadu

(Source: Allocation and Release under NFSM)

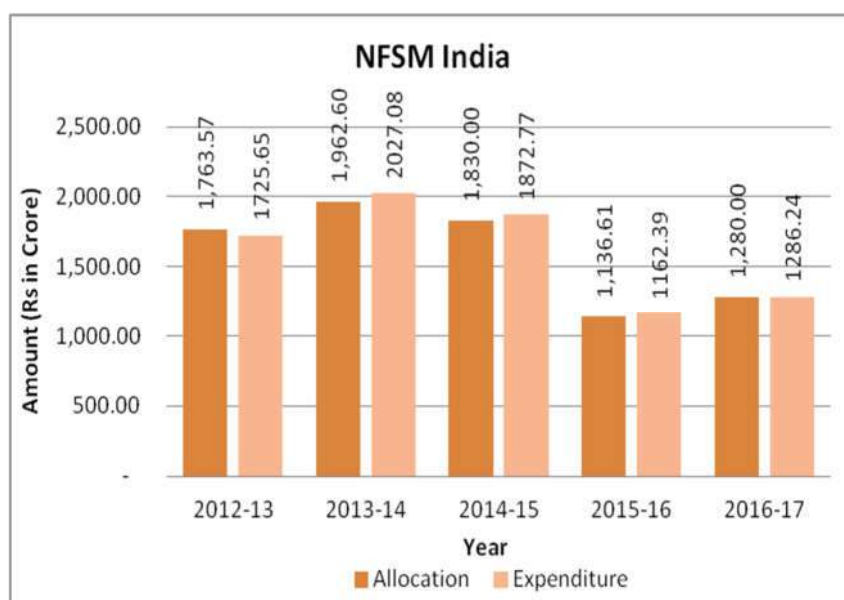


Figure 2.8 Allocations, Release and Expenditure under National Food Security Mission, India

(Source: Allocation and Release under NFSM)

2.8.2 Sustainable Agriculture (NMSA)

Agriculture is the fulcrum of rural economy because it provides livelihood security and food security. As a productive sector, agriculture helps to provide a pathway out of poverty. The State has shown accelerated growth in agriculture production (Figure 2.10) which has resulted in obtaining more than 100 Lakh Metric Tonnes of food grain production during 2011-12 (101.52 Lakh Metric Tonnes), 2013-14 (110.02 Lakh Metric Tonnes), 2014-15 (127.95 Lakh Metric Tonnes) and 2015-16 (113.85 Lakh Metric Tonnes).²⁴ Tamil Nadu Vision 2023 aims to make Tamil Nadu a “Numero Uno” State with additional focus on agriculture so as to achieve rapid economic growth for all its farmers.

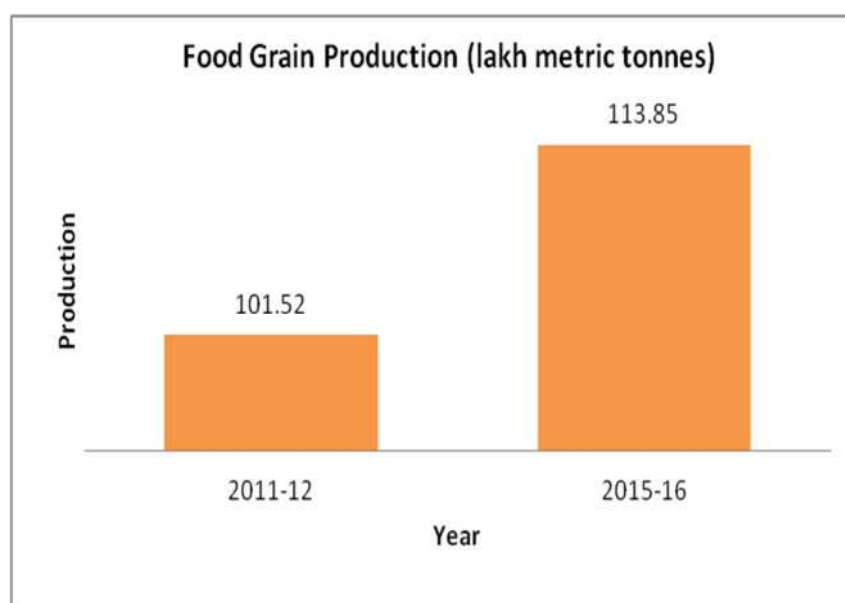


Figure 2.9 Food Grain Productions

(Source: Agriculture Policy Note 2018-19)

National Mission for Sustainable Agriculture (NMSA) has been developed for increasing agricultural productivity and aims at making agriculture more sustainable. This component has a strong adaptation linkage to NDC. As NDC clearly outlines the appropriate climate resilient farming systems and allied activities for income generation and value addition, this component also aims at soil health management, farmland management and indigenous farming techniques for resource conservation and water use efficiency. Rainfed Area Development and Sub- Mission on Agro forestry are the components implemented under this scheme.

²⁴Agriculture Department Policy Note 2018-19

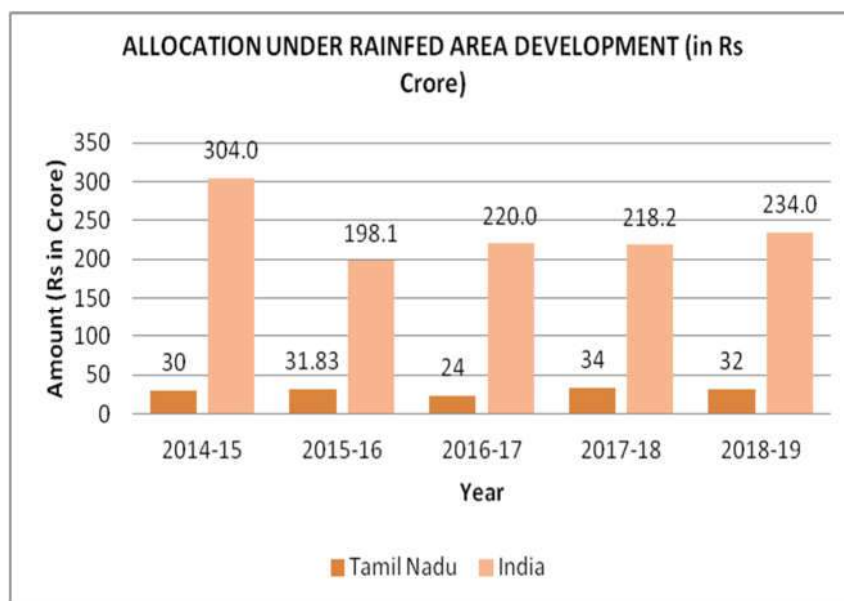


Figure 2.10 Allocation under National Mission on Sustainable Agriculture, rainfed area development

(Source: National Mission on Sustainable Agriculture Website)

The chart in

Figure 2.10 shows the allocation under rainfed area development in the State. Rainfed Area Development Programme (RADP) aims to promote Integrated Farming System (IFS) with importance on multi-cropping, rotational cropping, inter-cropping, mixed-cropping practices with allied activities like horticulture, livestock, fishery, agro-forestry, apiculture, conservation/promotion of NTFPs etc. so as to enable farmers not only in increasing the farm returns for sustaining livelihood, but also to mitigate the impacts of drought, flood or other extreme weather events.²⁵

Figure 2.11 shows the allocation and release under sub-Mission on agro forestry in the State. Sub-Mission on Agro forestry aims at increasing the tree coverage in farm areas complementary with agricultural crops. The State had fund allocation for sub-Mission on agro forestry only during 2016-17.

²⁵National Mission for Sustainable Agriculture (NMSA), Operational Guidelines

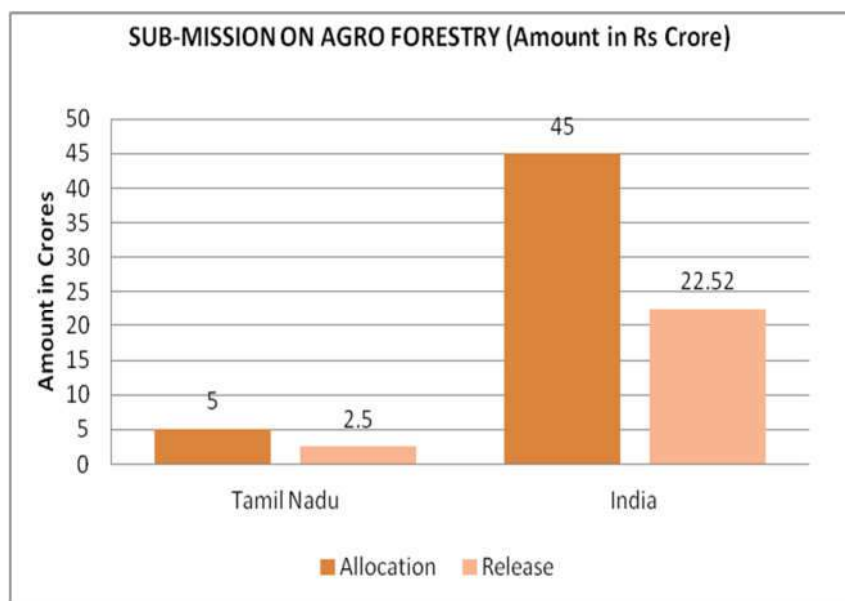


Figure 2.11 Allocation and Release under National Mission on Sustainable Agriculture, sub-Mission on agro forestry

(Source: National Mission on Sustainable Agriculture Website)

RashtriyaKrishiVikasYojana (RKVY)

The objective of **RashtriyaKrishiVikasYojana (RKVY)** is to assist the States to make agriculture development plans and achieve sustainable growth in agriculture sector by ensuring a holistic development of agriculture and allied sectors. It is an important contributor to poverty reduction and food security. Figure 2.12 shows the allocation release and expenditure of the State under RKVY for different years.

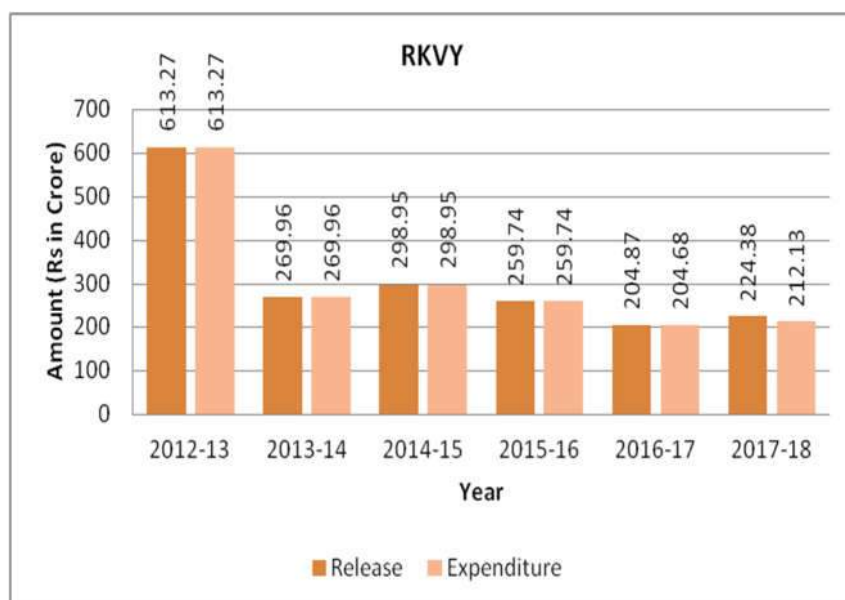


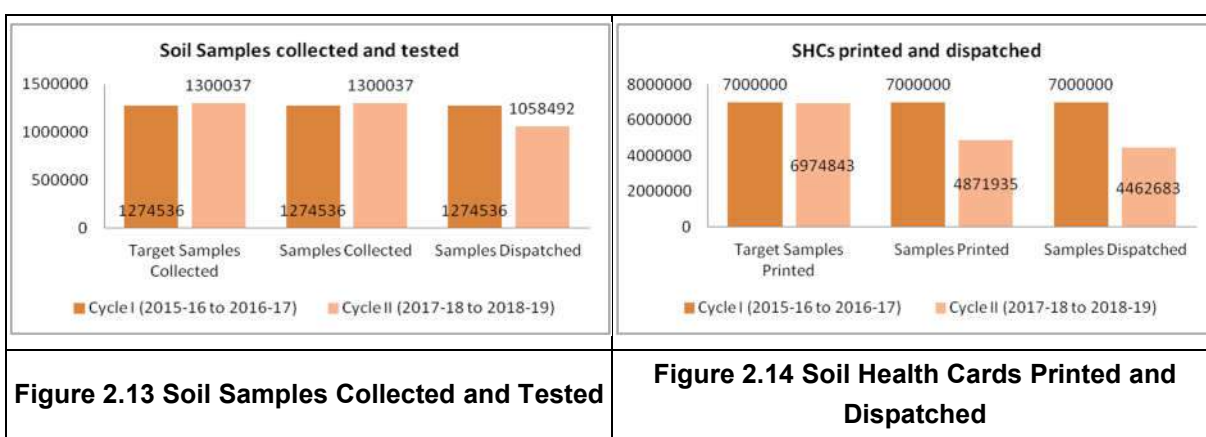
Figure 2.12 Releases and Expenditures under RashtriyaKrishiVikasYojana, Tamil Nadu

(Source: Statement Showing allocation release and expenditure of the State under RKVY for different years)

The activities are spread out across agriculture, horticulture and allied sectors and have strong contribution to livelihood and employment generation.

Soil Health

Declining soil health in terms of soil erosion, pollution, losses of organic matter can impact livelihoods in future. Soil testing is an important aspect of climate resilient agriculture. Department of Agriculture, Tamil Nadu has carried out soil testing and preparation of Soil Health Cards (SHC) in the State. In the first cycle, 100 percent of the target soil samples was collected and tested whereas in the second cycle, 100 percent of the target soil samples were collected and 81.4 percent was tested. In the first cycle, 100 percent of the SHCs were printed and dispatched whereas in the second cycle, only 69.9 percent percent of the SHCs were printed and only 63.98 percent of the SHCs were dispatched in figure 2.13 and 2.14



(Source: Soil Health Card Website, Scheme Progress)

2.8.3 Enhancement of Carbon Sink and Forest & Biodiversity Mission

Forest & Biodiversity Mission aims for the protection, restoration and enhancement of forest cover. It focuses on adoption of adaptation and mitigation measures to respond to climate change. Major goals include, increase in forest cover to extent of 5 Mha and improvement of forest/tree cover; improvement of eco system services like carbon sequestration and storage, biodiversity, hydrological services and provision of fuel, fodder and Non-Timber Forest Products (NTFPs); and to increase forest-based income.

Compensatory Afforestation Management and Planning Authority (CAMPA) have been created to monitor the effective implementation of the compensatory afforestation efforts in the country. The allocation of funds under CAMPA was to reduce the impact of diversion of forest land for non-forest purpose. Figure 2.15 shows the allocation of funds to the State under CAMPA scheme.

As per the ISFR 2017 by FSI, the forest cover in the State is 26,281 sq km, which is 20.21 percent of the State's geographical area. The total carbon stock in the forest of Tamil Nadu is 229.338 million tonnes (840.906 million tonnes of CO₂ equivalent) which is 3.24 percent of the total forest carbon stock of the country.²⁶

²⁶Tamil Nadu State of Forest Report, ISFR 2017

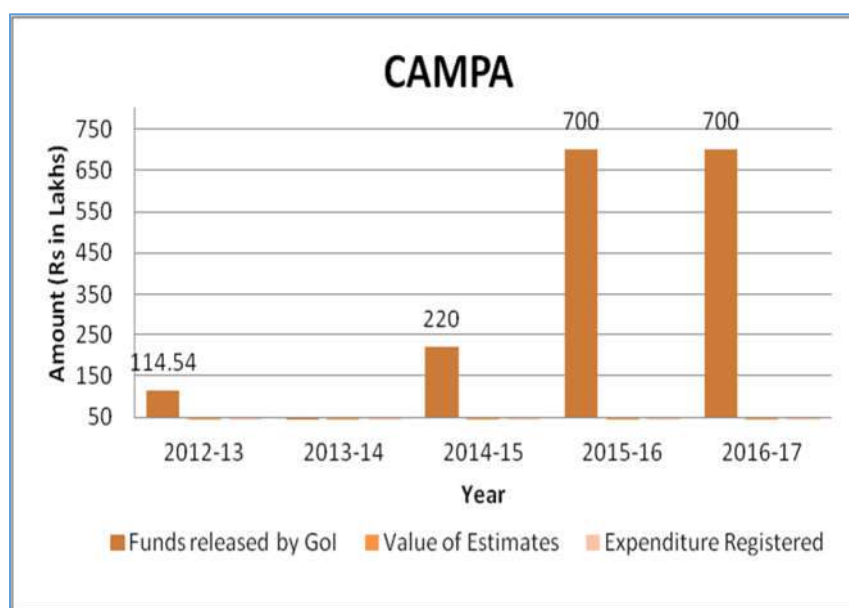


Figure 2.15 Allocations under Compensatory Afforestation Management and Planning Authority (CAMPA)

(Source: egreenwatch.nic.in)

2.8.4 Water Resources and Water Use Efficiency

National Water Mission was constituted with an objective of conserving water, minimizing its wastage and ensuring its equitable distribution. The overall goal of this Mission is to improve water use efficiency by 20 percent. Schemes like more crop per drop (micro-irrigation), harkhetkopani, watershed activities, plantation and farm ponds, etc. were implemented in convergence with Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) to contribute to the achievement of this goal. This sector possesses strong adaptation capacity with mitigation co-benefits through efficient energy use as well as carbon sequestration. The percentage of gross irrigated area in the State was 3.5 percent of the gross irrigated in India, and percentage of irrigated area to gross cropped area in the State ranges between 56-60 percent as shown in the Table 2.17.

Table 2.17 Total Cropped Area, Gross Irrigated and Un-Irrigated Area in Tamil Nadu

Year	Total Cropped Area ('000 Ha)	Gross Irrigated Area ('000 Ha)	Gross Un-Irrigated Area ('000 Ha)	Irrigated area as % of Gross Cropped areas
2010-11	5753	3348	2405	58
2011-12	5890	3519	2371	60
2012-13	5140	2991	2148	58
2013-14	5897	3311	2587	56
2014-15	5995	3394	2600	57

Source: Directorate of Economics & Statistics, Ministry of Agriculture and Farmers Welfare

Table 2.18 State-wise ground water resources availability

(In BCM)

State	Annual Replenishable Ground water Resource				Total	Natural Discharge during non-monsoon season	Net Annual Ground Water Availability
	Monsoon Season		Non-monsoon				
	Recharge from rainfall	Recharge from other source	Recharge from rainfall	Recharge from other source			
Tamil Nadu	7.12	9.87	1.52	2.15	20.65	2.07	18.59

Table 2.19 State-wise ground water resources utilization and stage of development

(In BCM)

State	Annual Ground Water Draft			Projected Demand for Domestic and Industrial	Groundwater Availability for future irrigation	Ground Water Development (%)
	Irrigation	Domestic and industrial uses	Total			
Tamil Nadu	12.98	1.38	14.36	1.53	4.08	77

Source: Ground Water Yearbook India 2016-17

As per Central Ground Water Board (CGWB) estimate, the annual replenishable ground water resource of the State has been estimated as 20.65 bcm and net annual ground water availability is 18.59 bcm as shown in Table 2.18. The annual ground water draft is 14.36 bcm and stage of ground water development is 77 percent as shown in Table 2.19.

The rain fed lands form a large proportion of the cultivated area in the State. The objective of watershed development programmes is to control soil erosion, optimize rainwater utilization; encourage sustainable land use pattern, cropping and other farming practices that will elevate the production potential of the land in an integrated way by taking all categories of land in a watershed. Figure 2.16 shows the financial allocations under Integrated Watershed Management Programme.

The watershed structures include ooranis, kanmais, farm ponds, nala bund, percolation tanks and some recharge structures.

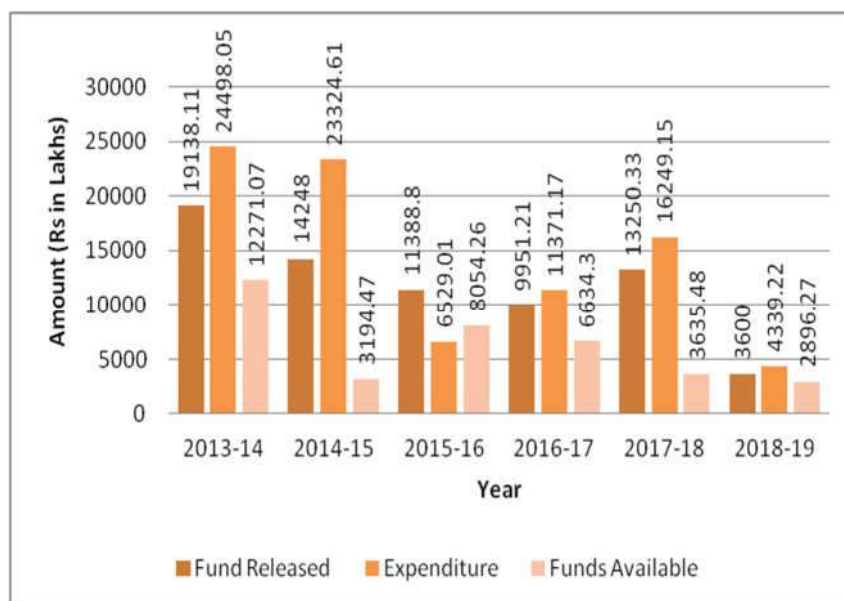


Figure 2.16 Financial Allocations under Integrated Watershed Management Programme

(Source: IWMP MIS Dashboard)

2.8.5 Drinking Water and Sanitation

Special thrusts are given by the National government to revamp the conditions of water and sanitation in India. The introduction of **Swachh Bharat Mission** is a transformational step in this pathway. It aims to make the villages open defecation free; apart from numerous social benefits the Mission has potential to reduce emission, disease burden and livelihood improvement. The number of households with toilets in the State is 98,32,970. Figure 2.17 shows the trend of household toilet coverage in Tamil Nadu. The status of open-defecation free (ODF) under Swachh Bharat Gramin in Tamil Nadu is given in Table 2.20 & the progress has been depicted in figure 2.18.

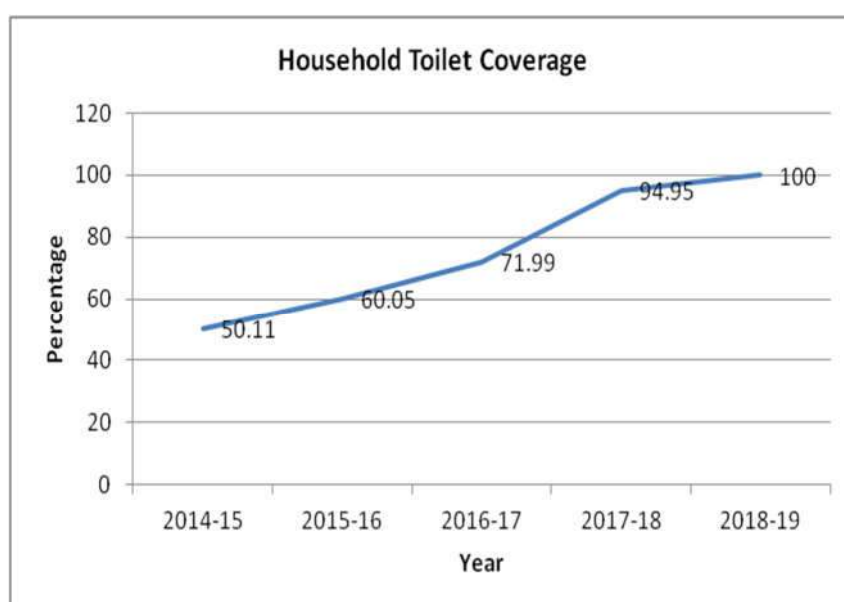


Figure 2.17 Trend of Household Toilet Coverage in Tamil Nadu

(Source: Swachh Bharat Mission Gramin Dashboard IHHL)

Table 2.20 Status of ODF under Swachh Bharat Gramin in Tamil Nadu

Tamil Nadu		Block					GramPanchayat								
		Total	Declared ODF		Verified ODF			Total	Declared ODF		Verified ODF (1st Level)				
		385	385		385			12524	12524		12524				
Village															Verified ODF (2nd Level)
Total	No. of Not Exist / Unhabitated Villages	Declared ODF					Verified ODF (1st Level)					Not Declared ODF	Not Verified ODF (1st Level)		
		2015-2016	2016-2017	2017-2018	2018-2019	Total	2015-2016	2016-2017	2017-2018	2018-2019	Total				
12524	0	1118	2395	6162	2849	12524	838	8	826	10852	12524	0	0	0	

(Source: Swachh Bharat Mission Gramin Website)

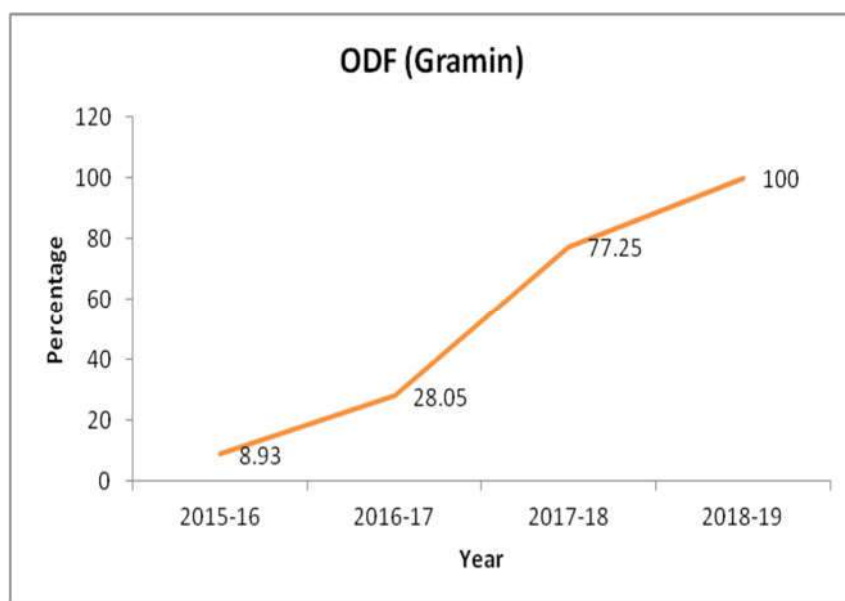


Figure 2.18 Trend of ODF in Tamil Nadu

(Source: Swachh Bharat Mission Gramin Dashboard ODF)

The drinking water supply coverage and year-wise expenditure has been given in Figure 2.19

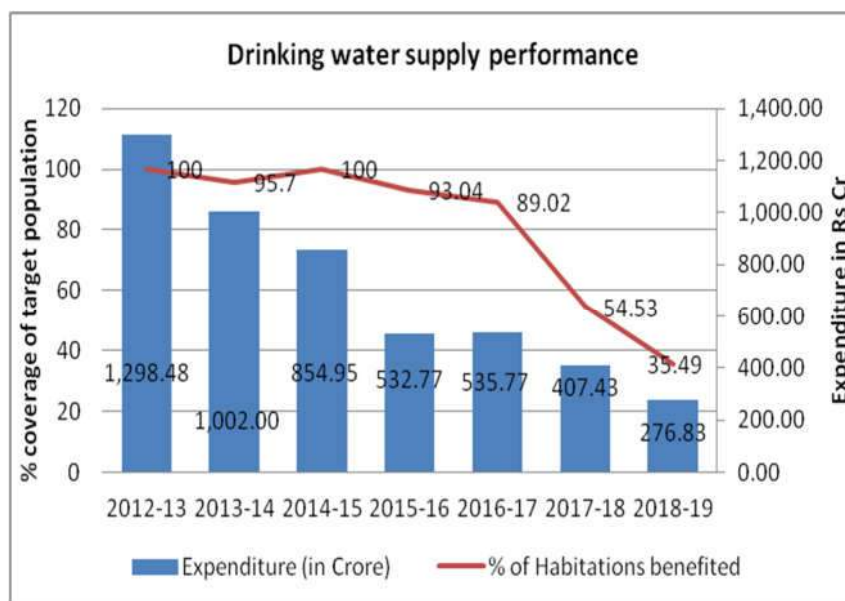


Figure 2.19 Performance of drinking water supply
(Source: Ministry of Drinking water and Sanitation, NRDWP)

2.8.6 MGNREGA and Climate Benefits

The key activities of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and the climate benefits helping in adaptation and reduction of vulnerability in the State is given in Table 2.21.

Table 2.21 NREGA and Climate benefits

Key activities	Key benefits helping in adaptation and vulnerability reduction
Public works related to NRM activities	Groundwater recharge, soil moisture conservation, soil erosion control, soil quality (nutrient cycling), Flood control (reduced risk), providing irrigation and drinking water
Plantations	Soil quality improvement with increase in soil organic carbon, carbon sequestration, soil moisture retention, reduction in diurnal variability in temperature, biodiversity (reduced risk), biomass production (fuel wood) and local climate regulation
Community Assets or Individual Assets	Improvement in irrigation command, reclamation of agricultural land, better yield and livelihood
Overall	Wage employment and social protection for the poor

Figure 2.20, Figure 2.21 and Figure 2.22 shows the Expenditure of Major Works taken up under MGNREGA, Number of Gram Panchayats (GPs) with Nil Expenditure and Percentage of Expenditure against available fund respectively.

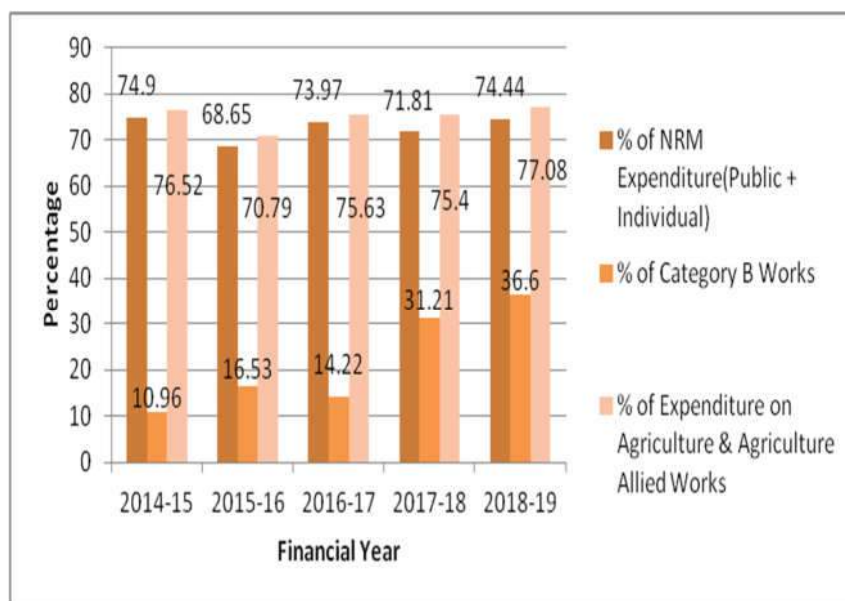
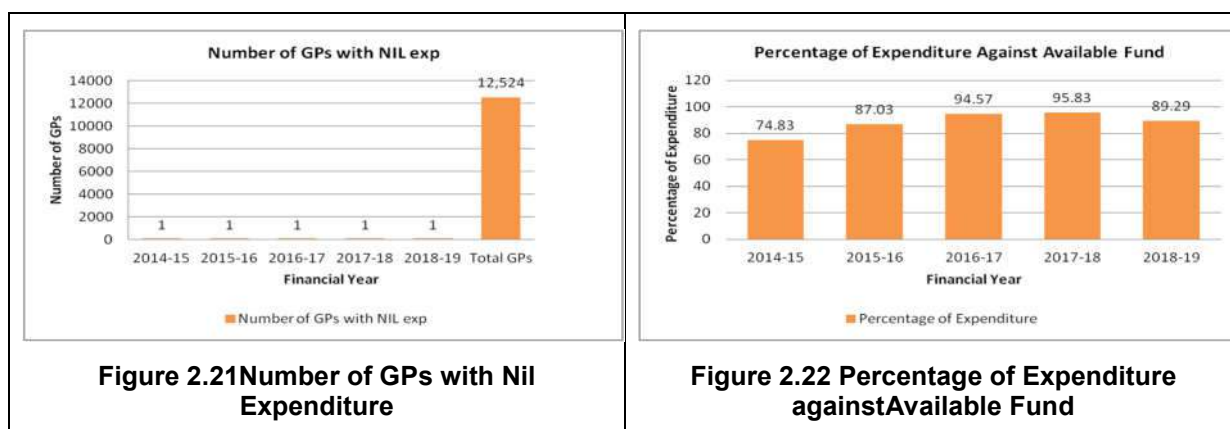


Figure 2.20 Expenditure of Major Works taken up under MGNREGA
(Source: MNREGA Official Website)



(Source: MGNREGA Official Website)

Under MGNREGA, total job cards issued in Tamil Nadu till 2018 were 81.61 lakhs which covered 118.95 lakhs workers. Of the total job cards issued, total active job cards were 69.81 lakhs. The total number of active workers in the State is 87.24 lakhs, out of which the percentage of SC workers against active worker is 28.02 whereas the percentage of ST workers against active worker is 1.39. Figure 2.23 shows the participation of SC and ST workers in MGNREGA in the State.

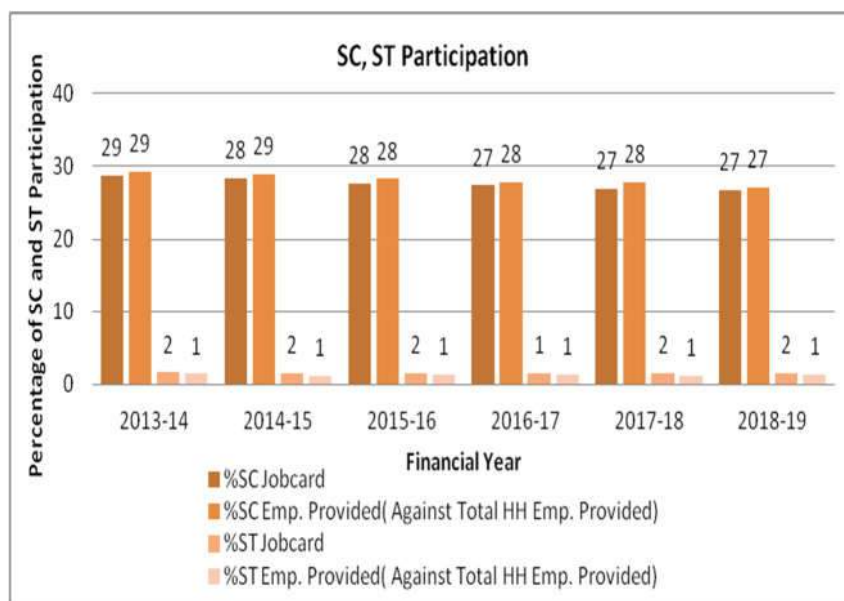


Figure 2.23 SC, ST Participation in MGNREGA in Tamil Nadu

(Source: MGNREGA Official Website)

2.8.7 Jal Shakti Abhiyan

The Jal Shakti Abhiyan (JSA) was launched on 1st July 2019 by the Ministry of Rural Development (MoRD), GOI. For Tamil Nadu, this campaign was planned to be done in two phases. Phase I of implementation was planned during the South West Monsoon period i.e., between 1st July 15th September, 2019 and Phase II during the retreating monsoon season i.e., North east monsoon period between 2nd October – 30th November 2019. In Tamil Nadu, Jal Shakti Abhiyan campaign is carried out under the leadership of the Additional Chief Secretary, Rural Development & Panchayat Raj (RDPR), with the full involvement of Gram Panchayats, Women Self-help Group members and the community.

The five intervention areas identified by MoRD, GOI, for the implementation of MGNREGS works under Jal Shakti Abhiyan:

1. Water Conservation and Rain Water Harvesting
2. Renovation of Traditional and other Water harvesting
3. Re-use, Borewell recharge structure
4. Water shed Development
5. Intensive Afforestation

The main focus of this campaign being Water conservation and rain water harvesting works, the works are being implemented through MGNREGS. According to the Annual Master Circular 2019-20 of MGNREGS, 260 kinds of works/ activities have been identified as permissible works, of which 181 kinds of works relate to Natural Resource Management works. JSA campaign is carried out in all water stressed Village Panchayats/ Blocks in full swing by engaging MGNREGS workers.

2.8.8 Health Outcomes

Tamil Nadu has appeared to be a model State in India in not only giving “State of Art” health care services but also in providing excellent human resources and infrastructure. Tamil Nadu is having 42 Health Unit Districts (HUD) in addition to Chennai Corporation and it has the lowest Total Fertility Rate (TFR) of 1.6. In case of Infant Mortality Rate (IMR), it has reached 17 per 1,000 live births as per Sample Registration System (SRS) 2016. Tamil Nadu has reached the Maternal Mortality Ratio (MMR) figure of 66 as per the SRS 2014-16 and according to State records, it has attained a figure of

62 per lakh live births.²⁷Figure 2.24 shows the comparison of under-five mortality rates from 1990-2016 for Tamil Nadu and all-India. Figure 2.225 shows the disease burden profile of Tamil Nadu.

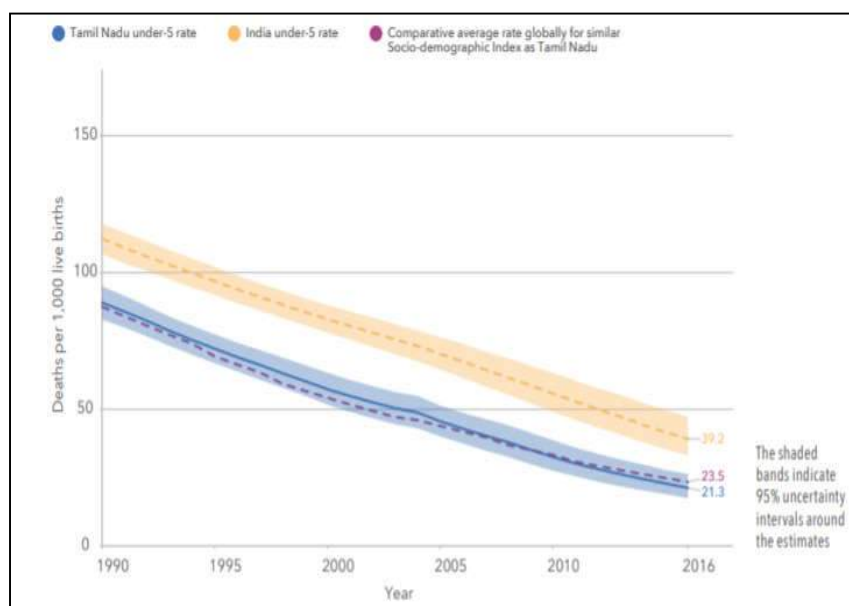


Figure 2.24 Under five mortality rates from 1990-2016 for Tamil Nadu and all-India
(Source: Tamil Nadu Disease Burden Profile)

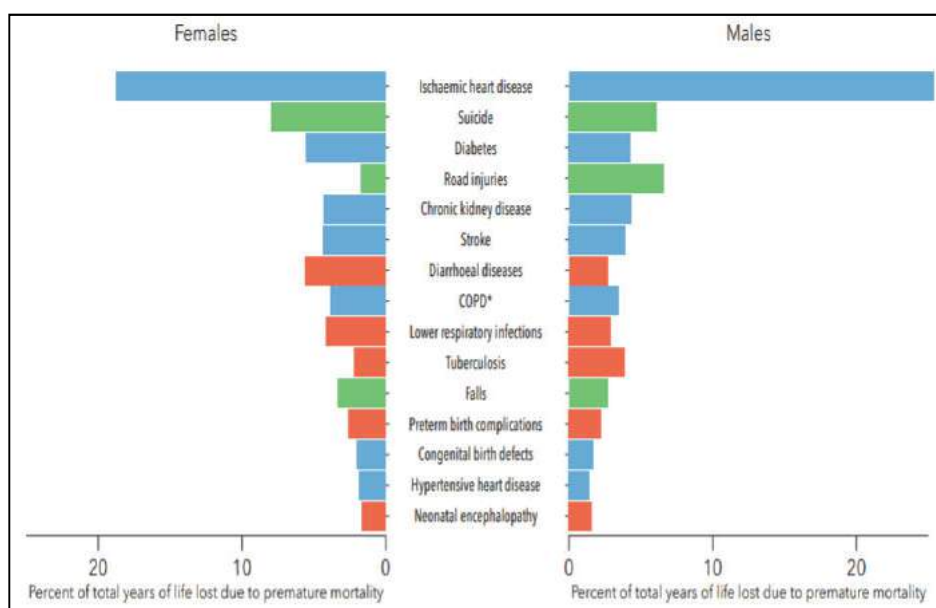


Figure 2.25 Pattern of disease burden in Tamil Nadu
(Source: Tamil Nadu Disease Burden Profile)

Diseases contributing to loss in maximum years due to premature mortality in 2016 are Heart diseases, diabetes, respiratory diseases and diarrhoeal diseases (Figure 2.25). The major risk factors are high blood pressure, dietary risk, air pollution and malnutrition. Reasons for water borne diseases can be attributed to non-availability of safe drinking water, increase in water pollution. Most of the risk factors have strong association to climate and other environmental changes.

²⁷Health and Family Welfare Department Policy Note 2018-19

National Health Mission helps reducing health related vulnerability. The key aims of NHM are as follows:

- To provide accessible, affordable, accountable effective and reliable primary health care facilities, especially to the poor and vulnerable sections of the population
- To bridge the gap in Rural Health Care services through creation of a cadre of Accredited Social Health Activists (ASHA) in certain pockets like the tribal areas and improved hospital care, decentralization of programme to district level to improve intra and inter-sectoral convergence and utilisation of resources
- To provide overarching umbrella to the existing programmes of health and family welfare including Malaria, blindness, iodine deficiency, filaria, kalaazar, TB, leprosy and rural disease surveillance

The Financial allocation, release and expenditure of the State under National Rural Health Mission (NRHM) from 2014-2018 is depicted In Figure 2.26.

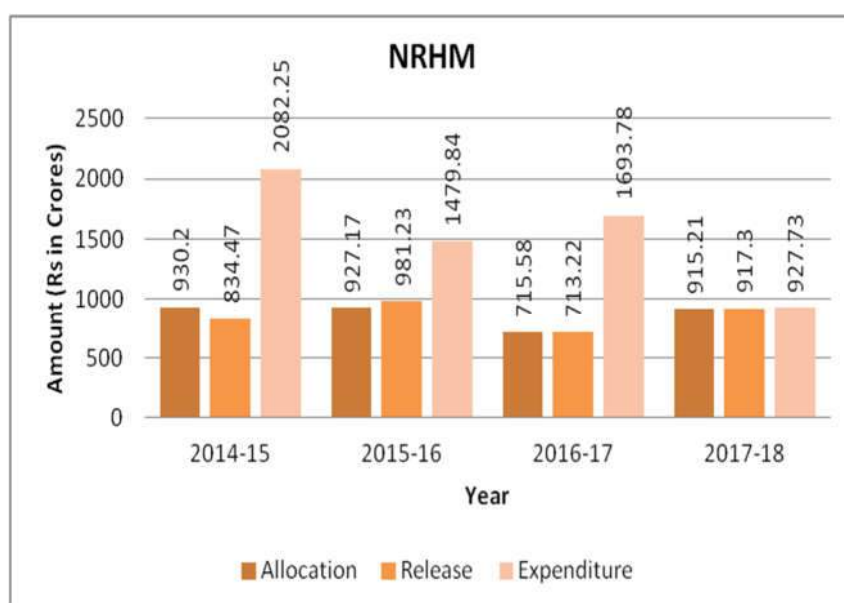


Figure 2.26 Financial allocation, release and expenditure of the State under NRHM
(Source: Achievements under NRHM and NUHM, Published- 06-February-2018)

There was reported improvement in institutional deliveries in the State. Sex ratio of Tamil Nadu has increased from 987 to 996 and Child sex ratio has increased from 942 to 943 from 2001 to 2011.

2.8.9 Strategic Knowledge for Climate Change

Strategic Knowledge for Climate Change attempts to develop a dynamic knowledge system that would aid in achieving the objective of ecologically sustainable development and in creating a better understanding by bridging up knowledge gaps, acquiring and upgrading information available about climate science and its impacts. Strategic Knowledge Climate Change aims to address several issues by identifying different climate sensitive actions and educating on activities with the objective of development, adaptation and mitigation.

The objective of Tamil Nadu Strategic Knowledge Climate Change is to build a greater understanding of the climate variability, its effect on various sectors and vulnerabilities associated with the sector. It tries to allow for sustainable adaptation to climate change and mitigation the impact of drivers of climate change. The State has also developed a State Action Plan on Climate Change (TNSAPCC) for assessment, adaptation and mitigation measures with an aim to examine the targets, objectives and achievements of the National Missions specified by the National Action Plan on Climate Change (NAPCC). On this front, the TNSAPCC seeks to fulfil the following outcomes (which are linked to the Knowledge Management Strategy):

- Keep track of climate variability and identify different climate sensitive actions
- Study the vulnerability of different sectors and the adaptation practices
- Develop the adaptation and mitigation projects for different climate sensitive areas
- Build a common framework for sharing of information to reduce the sector vulnerability

2.8.10 Sustainable Habitat

The Government of India has launched two important Missions that focus on urban habitations, waste handling and emission reduction in the cities. These two Missions are Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Smart City. Beside this, it has also launched the National Urban Livelihood Mission (NULM). In Tamil Nadu, 12 cities are included under the Smart City Mission, namely Chennai, Coimbatore, Madurai, Tiruchirappalli, Vellore, Salem, Erode, Tiruppur, Dindigul, Thanjavur, Tirunelveli, Thoothukudi.

The aim of Atal Mission for Rejuvenation and Urban Transformation (AMRUT) is to provide basic services (that include water supply, sewerage facilities, storm water drainage; non-motorized transport and upgrade green spaces) to households and build amenities in cities that will aid in improving the quality of life for all the sections of the society. Under AMRUT, 32 Cities / Towns have been selected in Tamil Nadu 12 City Municipal Corporations (includes 5 ULBs merged with Corporations), 14 Municipalities and 1 Town Panchayat. Recently, Rameswaram Municipality has also been added under AMRUT by Government of India. For the year 2016-17, allocation of funds for AMRUT under Central Share is Rs 1582.80 Crore, allocation of funds for Administrative and Office Expenses under Central Share is Rs 42.21 Crore, allocation of funds under State and ULB share is Rs 2251.6 Crore. The total AMRUT fund allocated to the State during 2016-17 is Rs 3876.61 Crore.²⁸ The Sector Wise Proposed Total Project Fund and Sharing Pattern for the year 2017-20 in AMRUT as per the Tamil Nadu State Annual Action Plan (SAAP) for 2017-20 is given in Table 2.22.

Table 2.22 Sector Wise Proposed Total Project Fund and Sharing Pattern for the year 2017-20 in AMRUT

(Amount in Crore) – Year 2017-20						
Sl. No.	Sector	No of Project	Gol	State	ULB	Total
1	Water supply	3	275.27	146.74	311.69	733.7
2	Sewerage and Septage management	13	1482.44	657.46	1147.4	3287.29
3	Storm Water Drainage	0	0	0	0	0
4	Non-Motorized transport	0	0	0	0	0
5	Green Space	28	45.03	18.01	27.02	90.07
	Grand Total	44	1802.74	822.21	1486.11	4111.06

(Source: Tamil Nadu State Annual Action Plan (SAAP) 2017-20)

Tamil Nadu is taking steps to unveil its electric vehicle policy which would result in a change in the development regulations for installing charging points and stations in buildings and public places. Hyundai, a private automobile manufacturer, is planning to launch their electric vehicle in the State. The State is focusing on fleet transition programmes, vehicle to grid system, pilots and charging infrastructure development. The State has a strong engineering and manufacturing base which brings out the best talents that can be capitalised for the Electric Vehicle industry.

²⁸Tamil Nadu State Annual Action Plan (SAAP) 2016-17

2.8.11 Energy Efficiency and Solar Mission

By 2022, India has announced to achieve the target of 175 GW of installed capacity from renewable energy. This target includes 100 GW of solar energy generation, 60 GW of wind energy generation, 10 GW of small hydro and 5 GW of biomass power project. Tamil Nadu is a leader in Renewable Energy sector among all States and has a total installed capacity of 11,113 MW as on 31.03.18 against 10,480 MW on 31.05.2017. Tamil Nadu Solar Energy Policy, 2012 aims for developing Tamil Nadu as a world leader in solar energy. Tamil Nadu Vision 2023 forecasts a creation of incremental generation of 5000 MW of wind energy and 5000 MW of solar energy by 2023. Tamil Nadu has a total solar installed capacity of 2034 MW as on 31.03.2018. Tamil Nadu has a total wind power installed capacity of 8152 MW as on 31.03.2018. The total biomass installed capacity is 238 MW and total co-generation installed capacity is 688 MW.²⁹

2.9 PERFORMANCE OF THE STATE UNDER SDG

The Sustainable Development Goals (SDGs) are a collection of 17 global goals set by the United Nations General Assembly in 2015 for the year 2030. The SDGs are part of Resolution 70/1 of the United Nations General Assembly, the 2030 Agenda. The TNSAPCC 2.0 contains adaptation and mitigation strategies that are in line with the SDGs.

According to SDG India Index Baseline Report 2018 of National Institution for Transforming India (NITI) Aayog, the performance of Tamil Nadu towards the SDG goals is shown in Table 2.23. With a composite score of 66, Tamil Nadu is above India's average composite score of 57.

Table 2.23 Performance of Tamil Nadu under SDG goals

	SDG Goal	Score	Performance Category
Goal 1	No Poverty	76	Front Runner
Goal 2	Zero Hunger	61	Performer
Goal 3	Good Health & Well Being	77	Front Runner
Goal 4	Quality Education	75	Front Runner
Goal 5	Gender Equality	38	Aspirant
Goal 6	Clean Water & Sanitation	66	Front Runner
Goal 7	Affordable & Clean Energy	89	Front Runner
Goal 8	Decent Work & Economic Growth	71	Front Runner
Goal 9	Industry Innovation & Infrastructure	46	Aspirant
Goal 10	Reduced Inequalities	85	Front Runner
Goal 11	Sustainable Cities & Communities	33	Aspirant
Goal 15	Life on Land	74	Front Runner
Goal 16	Peace, Justice & Strong Institution	61	Performer
	Composite Score	66	Front Runner

Several actions proposed in the TNSAPCC had linkages to SDG outcomes. The relative performance of Tamil Nadu with respect to other states in the listed sectors in Table 2.24 has been analysed for the base year and recent year to understand the progress achieved in the indicators over the period. The percentage change over the time period has also been calculated.

²⁹Energy Policy Note 2018-19

Table 2.24 State wise ranking according to performance

Sector		Unit	Year	Tamil Nadu	India	Rank	Year	Tamil Nadu	India	Rank	Percent Change from base year
Agriculture											
	Food grain production	000 Tonnes	2012-13	18981.8	257134.6	4	2015-16	11478.5	251566.3	9	-0.40%
	Horticulture area	000 MT	2012-13	20175.11	268847.45	6	2016-17	18148.4	300642.95	11	-0.10%
	Livestock	Numbers	2007	15886679	117852723	2	2012	140071878	1241266621	2	-0.12%
Water											
	Area irrigated/cultivable area (Gross Area Irrigated)	000 hectare	2010-11	3348	88933	12	2013-14	3311	95772	12	-0.01%
Forest											
	Enhancement of Forest Cover	Area in sq.km.	2013	23844	697898	10	2017	26281	708273	9	0.10%
Energy											
	Capacity addition	Mega Watt	2012-13	19433	223344	3	2015-16	24747	298060	3	0.27%
	Electrification (village electrification)	Percentage	2011-12	100.00	93.75	1	2014-15	100.00	96.69	1	0.00%
Sustainable Habitat											
	Slum population accommodation (year-wise house completed under PMAY-Gramin)	Numbers	2013-14	6357	134728	3	2016-17	76140	2549979	9	10.98%
Health											
	Reduction in vector borne diseases (No. of Malaria cases in specific)	Numbers	2012	18869	1067824	14	2017	5449	842095	17	-0.71%
	Reduction in IMR	Rate	2012	21	42	29	2016	17	34	27	-0.19%

CHAPTER 3: TAMIL NADU CLIMATE PROFILE

Climate Change is generally defined as “a change in the state of the climate that can be identified (e.g. using statistical analysis) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer” (IPCC 2014).³⁰ Anthropogenic climate change is defined as a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere (e.g. increase in greenhouse gases due to fossil fuel emissions) or surface characteristics e.g. deforestation) and which is in addition to natural climate variability observed over comparable time periods. It is reported that, in India, the mean annual temperature is increased by 0.6 degree Centigrade over the last century; the monsoon rainfall is declined over the last three decades of the 20th century in many parts of the country, while some parts have showed an increasing trend in the observed frequency of heavy precipitation events.³¹

The climate of Tamil Nadu is strikingly different from the general climate of the country. Due to its topographical features and geographical area the climate of Tamil Nadu is referred to as semiarid and tropical monsoon. The long coastal stretch in the east, hill orography of the western rim, and plain inlands play a significant role and influence the climate of the State. The Climate of the State is tropical with little variation in summer, winter temperatures and features hot temperatures over the year except during the monsoon season. Due to proximity to the sea, the temperatures and humidity remain relatively high all the year round. The summer is hot with the temperature rising to 43°C and extends from April to June. November to February is the coolest winter period with temperatures around 18 degree Centigrade.³²

The State receives maximum rainfall during the months of October, November, and December (post monsoon), whereas in the rest of the country, the maximum rainfall is received in the months of June, July, August, and September months (monsoon). The State is frequently subjected to extreme weather conditions such as flooding in the coastal districts and severe droughts in some areas due to monsoon failure³³, which consequently affect the production and productivity of the food grains. Drought, water depletion, soil erosion, sea water incursion, forest fire, species extinction and thermal discomfort etc. are the major evidence of the climate change. Monsoon rains are major source for crop irrigation water supply, and cause people and livestock to suffer heavily when the monsoon fails or delayed. Additionally, due to Climate Extremities, the State is facing noticeably higher incidence of cyclonic events (Vardah 2016, Ockhi 2017 and Gaja 2018) severe floods (2015 and 2017) and hence, immediate action is required to analyse the current and future climate trends of the State.³⁴

Based on the latest Scientific understanding, this Chapter explains Tamil Nadu's Historical climate and climatic variability, based on IMD data for 1950-2013, observed trends and impacts within this period, as well as projected future climatic changes and related uncertainties. For a more detailed account of Tamil Nadu's climate and anticipated climatic changes, the reader may refer to Gosain and Rao (2018) and GIZ 2018 ([www. Climatevulnerability.in](http://www.Climatevulnerability.in)).

³⁰IPCC (2014) 'Summary for Policymakers', in Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Savolainen, J., Schlömer, S., von Stechow, C., Zwickel, T. and Minx, J.C.(Eds.): Climate Change 2014: Mitigation of Climate Change. Contribution of WorkingGroup III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, NY, USA

³¹IPCC (2014) 'Summary for Policymakers', in Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Savolainen, J., Schlömer, S., von Stechow, C., Zwickel, T. and Minx, J.C.(Eds.): Climate Change 2014: Mitigation of Climate Change. Contribution of WorkingGroup III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, NY, USA

³²Jeganathan A, Ramachandran A, kandasamy P (2018) Trends of the observed temperature and its variations in the Tamil Nadu State of India, Theoretical and Applied Climatology

<https://doi.org/10.1007/s00704-018-2582-6>

³³Bal, P.K., Ramachandran, A., Geetha, R. et al. TheorApplClimatol (2016) 123: 523.

<https://doi.org/10.1007/s00704-014-1367-9>

³⁴Geetha R Ramachandran A. Indumathi J, Palanivelu K, G. V. Uma, Bal P K & Thirumurugan P “Characterization of future climate extremes over Tamil Nadu, India, using high-resolution regional climate model simulation, Theoretical and Applied Climatology

<https://doi.org/10.1007/s00704-019-02901-0>

3.1 CURRENT CLIMATE VARIABILITY AND TREND

The high resolution (0.25°x0.25° latitude and longitude) daily gridded rainfall dataset for 170 precipitation grids for a period of 63 years (1951–2013) and 1.0°x1.0° latitude and longitude daily gridded temperature datasets for 12 temperature grids, spanning over 63 years (1951-2013) for maximum and minimum temperature provided by Indian Meteorological Department (IMD) (Rajeevan et al. 2006)³⁵ have been used to calculate the variability and trend in precipitation and temperature respectively.

3.1.1 Temperature

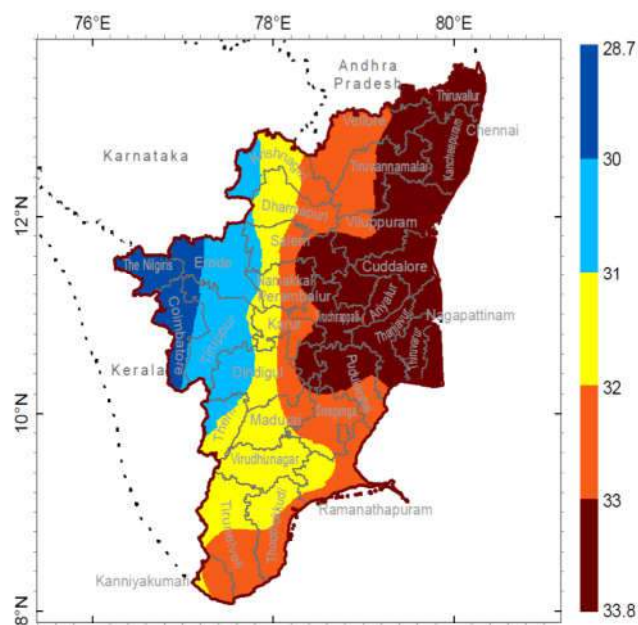
Long term monthly (1951 -2013) maximum and minimum temperature summary of Tamil Nadu State is given in Figure 3.1 and 3.2. Mean annual maximum temperature for Tamil Nadu is 32.2 degree Centigrade with arrange varying from 31.2 degree Centigrade - 33.2degree Centigrade. The highest value attained for maximum temperature (34.7degree Centigrade) is in the pre- monsoon season (MAM) while its lowest maximum value (29.8 degree Centigrade) is attained in Post monsoon season. It is also observed that for annual maximum temperature, the highest value is attained for the districts, Chennai, Tiruchirappalli, Thiruvallur and Kancheepuram while the lowest value is attained for the districts, Coimbatore, Erode and Nilgiris lying in Western Zone and the Hilly Zone of Tamil Nadu.

Mean annual minimum temperature is 22.6 degree Centigrade with a range varying from 21.9 degree Centigrade to 23.3 degree Centigrade. It is also seen that for annual minimum temperature the highest value is attained for the districts, Ariyalur, Cuddalore, Nagapattinam, Thanjavur and Thiruvarur, while the lowest value is attained for the districts, Erode - lying in Western Zone and Nilgiris - lying in Hilly Zone, for the period 1951-2013 (63 years)³⁶.

³⁵Rajeevan, M., J. Bhate, and A. K. Jaswal, 2008: Analysis of variability and trends of extreme rainfall events over India using 104 years of gridded daily rainfall data. *Geophys. Res. Lett.*, 35, doi:10.1029/2008gl035143 http://sedac.ipcc-data.org/ddc/ar5_scenario_process/RCPs.html

³⁶www.climatevulnerability.in.

Average Maximum Temperature (°C)



Average Minimum Temperature (°C)

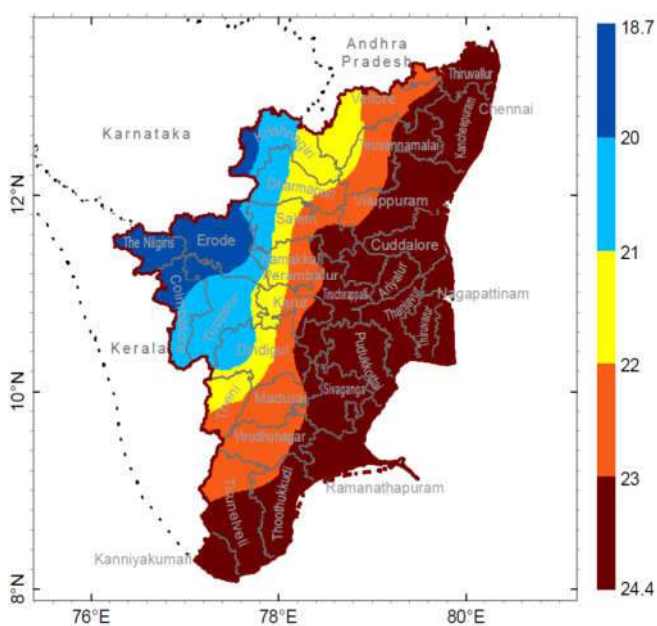


Figure 3.1 Spatial variation in Observed average annual Maximum and Minimum Temperature for TamilNadu (1951 to 2013) Source: www.climatevulnerability.in

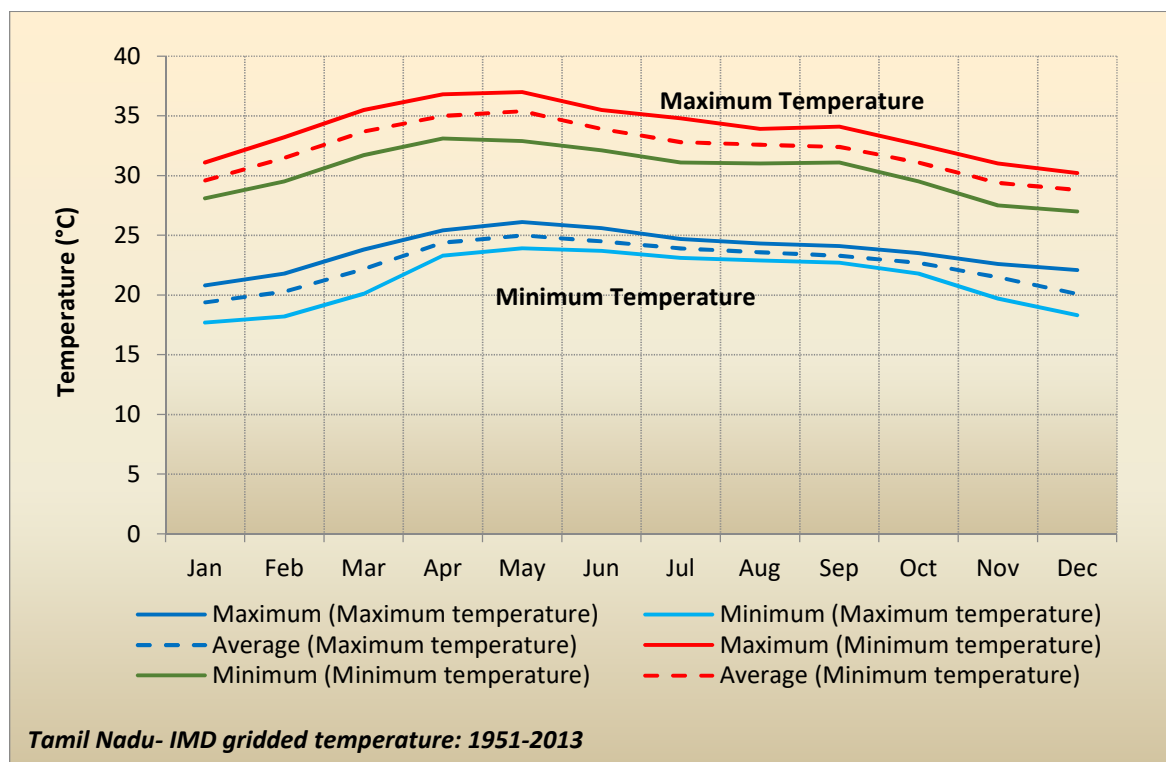


Figure 3.2 Long term monthly average, maximum and minimum temperature for Tamil Nadu (1951-2013)

3.1.2 RAINFALL

Average annual rainfall of Tamil Nadu is 987 mm with a range varying from 317.4 mm to 1890.5 mm over the 63 years period (1951-2013). Amongst all districts, Nilgiris receives the maximum average annual rainfall while districts, such as Thoothukkudi and Karur receive the least. The eastern and north-eastern districts namely, Cuddalore, Chennai, Kancheepuram, Thiruvarur, Nagapattinam and the Western district viz Nilgiris have the heaviest rainfall as compared to the other districts.

The coefficient of variation in annual rainfall lies in the range of 0.21 to 0.37 (21 to 37 percent) across the districts of Tamil Nadu, thus, a marginal variability is observed across the districts. Figure 3.3 & 3.4 envisaged that the post monsoon (October, November, December) rainfall contributes the maximum to annual rainfall amounting to approximately 50 percentage for Tamil Nadu State. Contribution of Pre – Monsoon (March, April, May) rainfall on average is 12.4 percentage, contribution of monsoon (June, July, August, September) rainfall in annual rainfall is about 34.4 percentage and winter rainfall (January & February) contribution is 3.4 percentage. However, districts' lying in Western and North Western parts of Tamil Nadu, monsoon rainfall (JJAS) is the highest contributor while for rest of the districts post monsoon rainfall (OND) is the highest contributor to annual rainfall. In north east monsoon (OND), eastern and north eastern districts receive the highest rainfall. In south West monsoon season (JJAS), north eastern and western districts of the State receive the maximum rainfall.

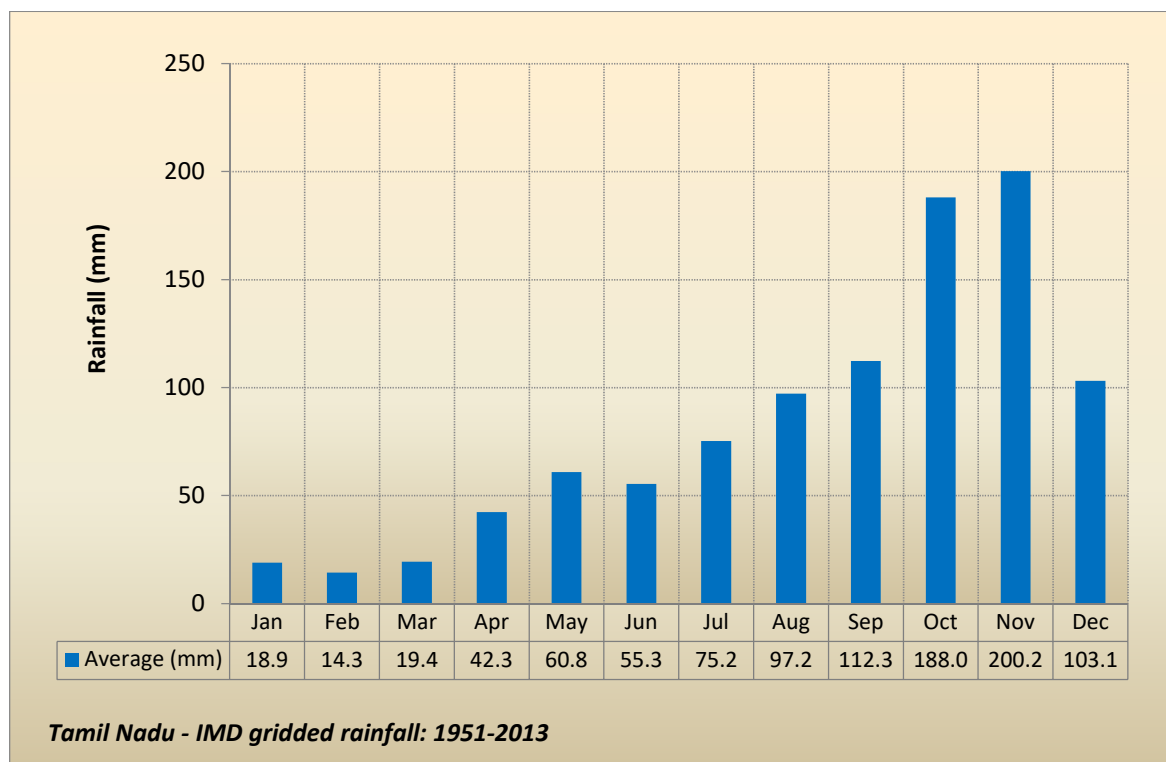


Figure3.3 Characteristics of long term average monthly rainfall distribution for Tamil Nadu (1951-2013) Source : www.climatevulnerability.in

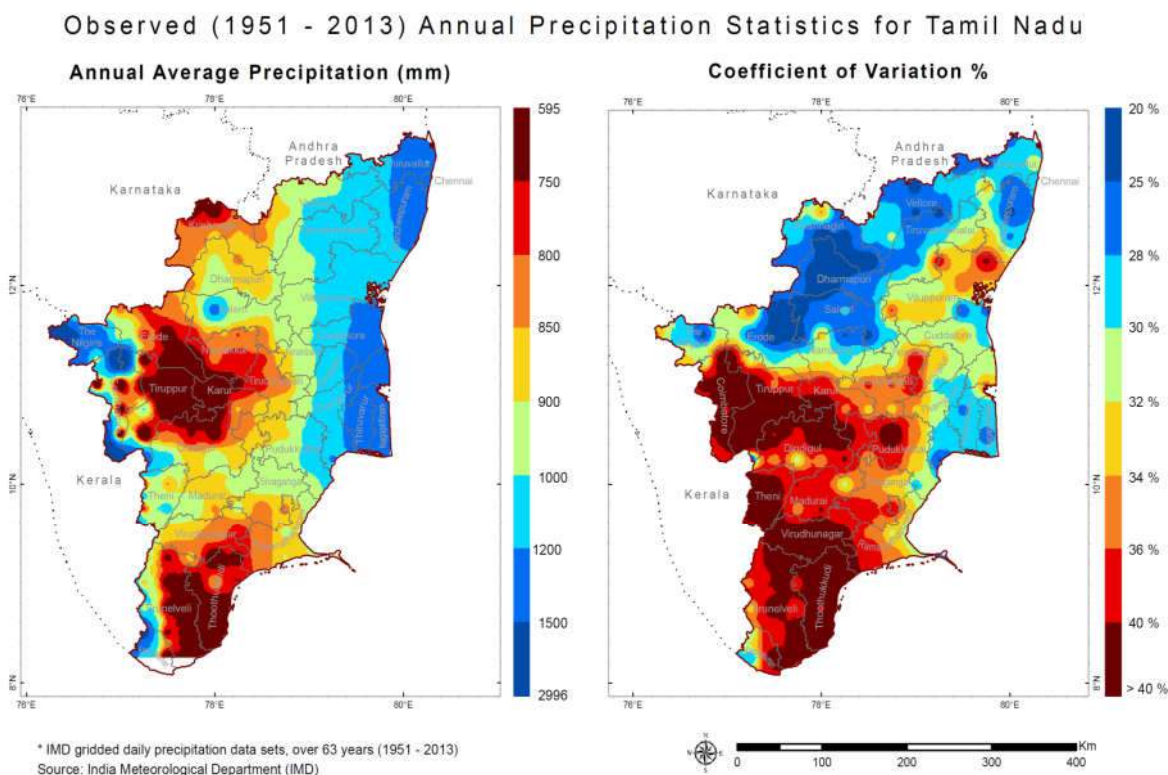


Figure 3.4 Spatial Variation in observed average annual rainfall for Tamil Nadu (1951-2013)
Source: www.climatevulnerability.in

The coefficient of variation (inter annual variation in rainfall) is relatively low during October, November, December (OND) and June, July, August, September (JJAS) season as rainfall variability is least during these months while very high during the other two seasons due to higher variability in rainfall during these months. The Co-efficient variation (CV) of winter rainfall is estimated to be the highest.

3.1.3 OBSERVED CLIMATE TRENDS AND IMPACTS

With global mean temperatures approximately 1 degree C higher than in the pre-industrial period, with even higher differences over land, climatic changes are already manifest. This section describes trends that can be detected in observations over the period 1951-2013.

Trend analysis has been carried out over the period of 1951 to 2013 and its described below. Annual average and linear trend for maximum and minimum temperature for the State of Tamil Nadu is shown in Figure **Error! Reference source not found.**3.5 and Figure 3.6& 3.7.

- Positive trend in both mean annual maximum temperature and mean annual minimum temperature is observed for Tamil Nadu State. The change per year for annual maximum temperature is 0.02°C, whereas, the same for annual minimum temperature is negligible.
- Trend analysis shows that the positive trend for annual maximum temperature and minimum temperature are statistically significant for Tamil Nadu., while annual minimum temperature shows statistically significant positive trend for all districts except for the Southern districts, Kanniyakumari and Tirunelveli.

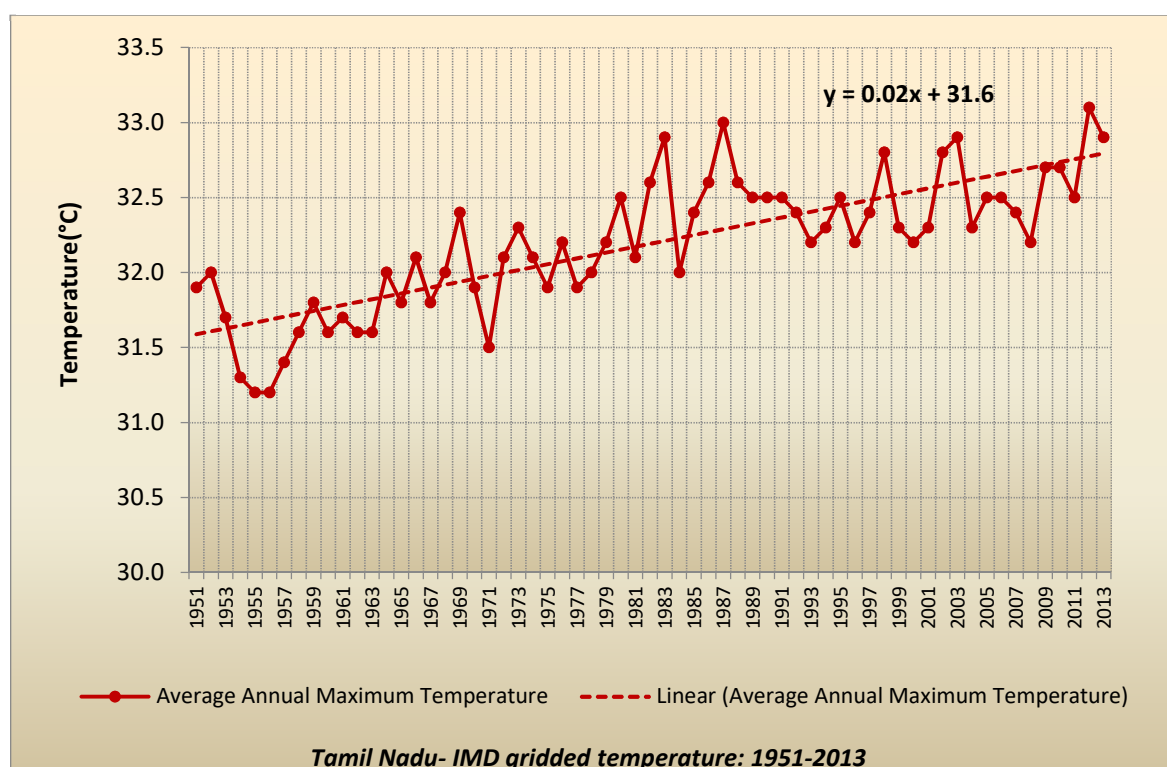


Figure 3.5 Observed average annual maximum temperature of Tamil Nadu (1951-2013)

Source www.climatevulnerability.in, 2018

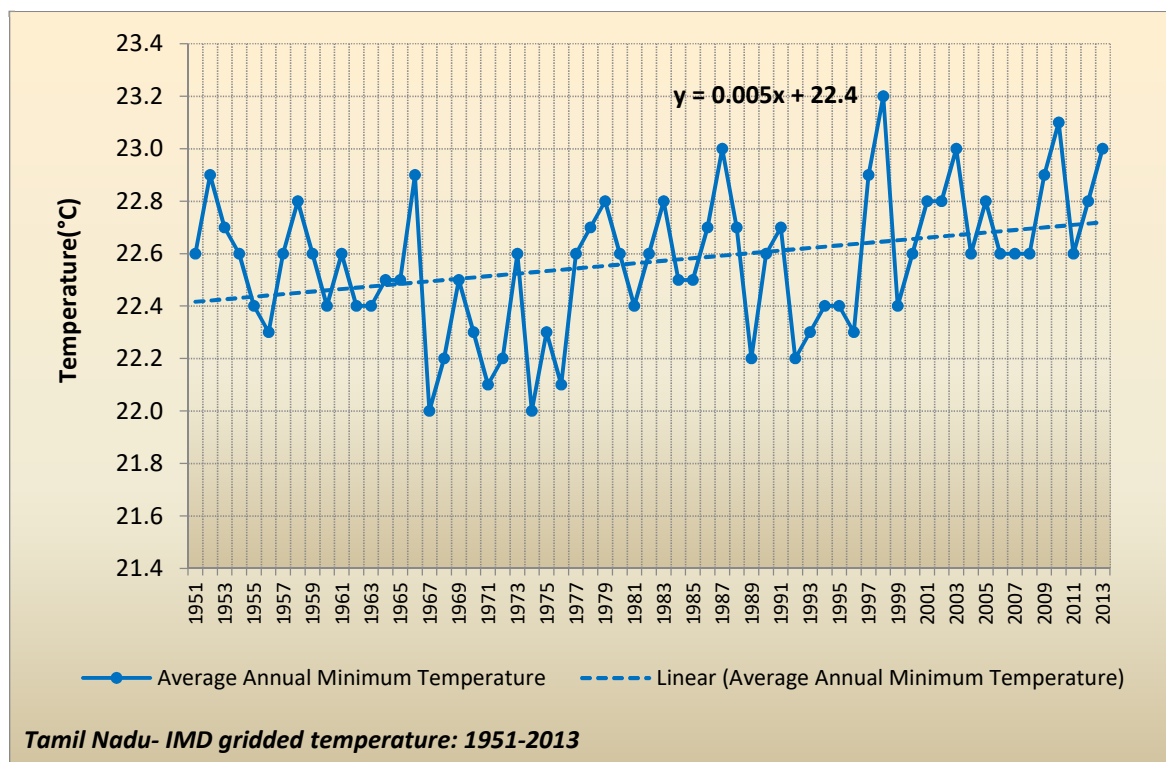


Figure 3.6 Observed average annual minimum temperature of Tamil Nadu (1951-2013)
(Source: www.climatevulnerability.in, 2018)

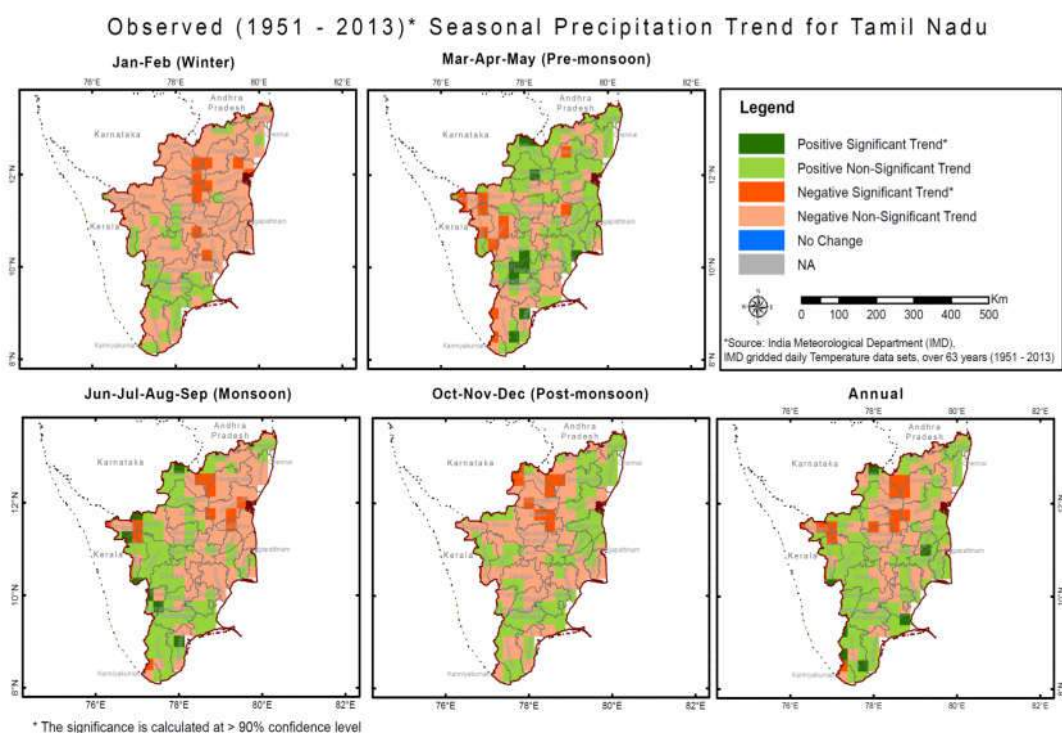


Figure 3.7 Spatial variation in observed annual and seasonal precipitation trend for Tamil Nadu (1951-2013)

Source www.climatevulnerability.in, 2018

From Figure 3.7 it can be inferred that for the period 1951-2013 annual rainfall shows positive trend and rainy days shows negative trend for Tamil Nadu. Though the decrease in rainfall days is not significant, the increase in rainfall coupled with decrease in rainy days implies an increased intensity of rainfall for the period in the State.

3.1.4 ANNUAL RAINFALL DISTRIBUTION ANALYSIS

Annual rainfall distribution analysis has been studied for Tamil Nadu and its districts. The rainfall is classified as excess, normal, deficient or scanty based on the departure of the rainfall from the long period average rainfall (LPA). Based on the India Meteorological Department (IMD) classification, if the rainfall received in that particular year is within + or - 19 percent of the LPA, that year is called as a normal rainfall year, -19 percent to -59 percent of the LPA is deficient rainfall year, <-59 percent of LPA is grouped under scanty rainfall year. On the other hand, if the rainfall is +19 percent to +59 percent of LPA, it is excess rainfall year and >+59% LPA is termed as wet year. The rainfall for the study area has been classified and Figure 3.8 & Figure 3.9 shows the frequency of excess, normal, deficient and scanty rainfall years.

From Figure 3.8 and Figure 3.9 it observed that from 1951-2013 the State on an average had 47 normal rainfall years, 8 excess rainfall years; 6 deficit rainfall years and 2 scanty rainfall years. It can be observed that 2001-2010 is the only decade in the State that had 2 years of scanty rainfall, decades 1961-1970 and 1991-2000 had no deficient rainfall years while decades 1951-1960 and 1981-1990 had no excess rainfall years.

The district wise classification in rainfall can also be seen from Figure 3.9. The Nagapattinam district is seen to have received the maximum number of 18 excess rainfall years, while Ramanathapuram and Virudhunagar districts have the maximum of 18 deficient rainfall years, compared to the other districts of Tamil Nadu over the period 1951-2013. The Nilgiris and Krishnagiri districts have maximum of 45 normal rainfall years.

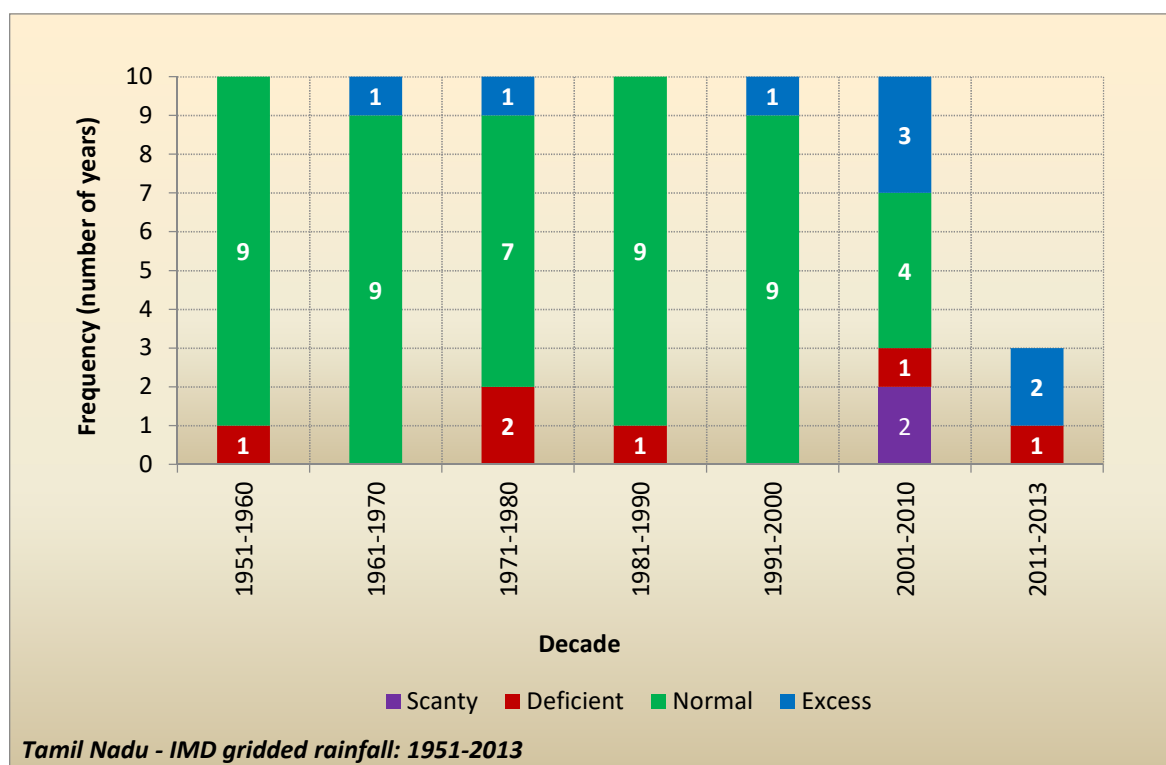


Figure 3.8 Frequency of scanty, deficient, normal and excess years of annual rainfall – Tamil Nadu's Districts (1951-2013) Source: www.climatevulnerability.in, 2018

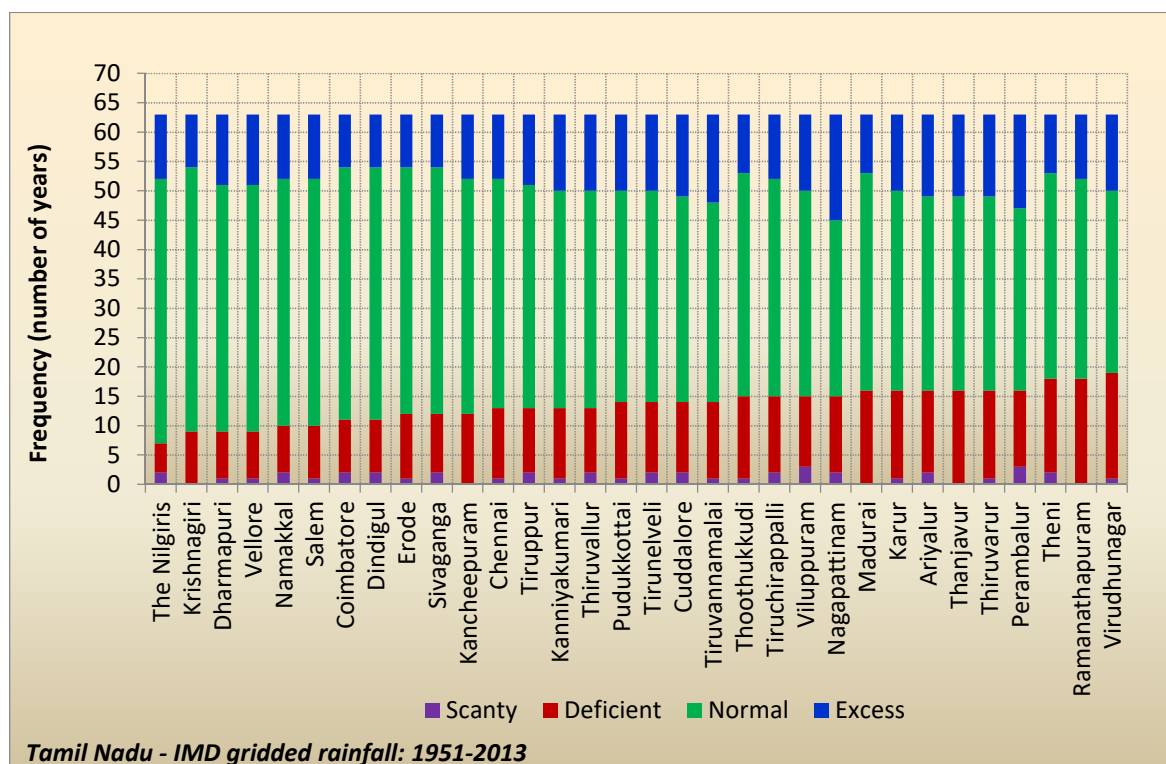


Figure 3.9 Frequency of scanty, deficient, normal and excess years of annual rainfall – Tamil Nadu’s Districts (1951-2013) Source:www.climatevulnerability.in,2018

3.1.5 EXTREME EVENTS

Beyond changes in average temperature and precipitation conditions, climate change is likely to affect the frequency and intensity of extreme events that can be temperature or precipitation-related. Maximum 1 day and maximum 5 day precipitation show positive trend for majority of the districts over the period 1951-2013. For Tamil Nadu, Gosain and Rao (2018) analyze trends in 21 Expert Team on Climate Change Detection indices (ETCCDI) of extreme events based on gridded IMD temperature and precipitation data. While detailed district-wise results are provided in Gosain and Rao (2018), the most robust (i.e. statistically significant at the 90% confidence level) trends are the following: Maximum day temperature, Warm spell duration Indicator, very wet day precipitation (R95p) and Extremely wet day precipitation (R99p), heavy and very heavy precipitation day (R10 mm and R20 mm) show positive trend. Cool night, cool days and Cold spell duration indicator shows negative trend. Precipitation shows mixed trend.

3.1.6 OBSERVED IMPACTS

Tamil Nadu is already facing various consequences of climate change, causing distress to its farmers and other local communities. State is vulnerable to different types of hazards such as floods, hailstorms, heat waves, drought, thunder and lightning, forest fires, etc. Most of these hazards mentioned above have some direct or indirect linkages with climate change. Detrimental challenges of these hazard effects Tamil Nadu agricultural crops, livestock’s milk productivity, forest’s net primary productivity etc. Some of the recent events occurred due to increasing temperature and variable rainfall in the State are as follows (source: News papers):

18,000 Hectares Of Coconut Trees Damaged In Thanjavur, Acres Of Banana, Mango Plantations Flattened In 3 Districts



Health officials on high alert

San Francisco

A little more than a year ago, health officials in San Francisco were alerted to a possible outbreak of a new disease. The disease was called "Legionnaires' disease" and was caused by a bacterium called "Legionella pneumophila." The disease was first reported in 1976 when a group of people who had attended a convention in Philadelphia died of a mysterious illness. The disease was then found to be caused by the bacterium "Legionella pneumophila." Since then, the disease has been found in many other places, including hotels, hospitals, and homes. In San Francisco, health officials are now on high alert for the disease. They are testing water samples from public buildings and homes for the bacterium. They are also advising people to be careful when using water in public buildings and homes. If you have any symptoms of the disease, such as fever, cough, and shortness of breath, you should see a doctor immediately.

GRIM SITUATION

The after-school in Huntington, Tennessee, Public Schools' Teachers and Study Students.



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58,000



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Shortage of fuel affects rescue work

MASS BLEACHING

[illegible]

SOME REASONS FOR DESTRUCTION

PROBABLY THE MOST COMMON reason for destruction is using dynamite under water. But this causes intensive damage to the corals.

CORAL, CRAB-THIEF: Beautiful white and black corals are harvested for jewelry making and branching corals are most often collected for survival. Paraglide, Kailash corals were mostly damaged because of this.

BOAT ANCHORS: Fishermen anchor their boats into the shallow parts of water when they go for seed fishing. When the anchor hits on the coral at the boat's keel, the fisherman hauls the coral and catches it.



POB LIFEBOATS: Corals are very sensitive to oil and metal pollution. Reefs in Gulf of Mexico areas marked are located near the PortBoreas are instantly deceased.

Bleaching means the change in colour of the corals because of the decay in algae living in their tissues as symbiotic partners

Amniodushad Coral reefs — the animals wonders that leave us awestruck by their rich pools of vibrant — are under climate threat. A recent study published in the reputed science journal *Current Science*, shows that they are slowly disappearing away.

...the fact that I have a very good relationship with my mother-in-law, who is a very good person. I have a very good relationship with my mother-in-law, who is a very good person. I have a very good relationship with my mother-in-law, who is a very good person.

Normally corals can re-establish themselves (or return to their pre-bleaching state)

KING OF EATERS: Nalin Koteel (R) who took 14 as Karnataka BJP chief in Bengaluru on Tuesday

[illegible][illegible]

- Past-tailed flycatcher (common from Central America and Central Asia)
- Blue-tailed bee-eater (common from North-West Persia, Uttar and parts of north India)
- Cardinal flycatcher (common in higher elevations of peninsular India and Central Asia)
- Yellowish flycatcher (common from Persia, India, USSR, and West Borneo)
- Ash-throated flycatcher (from Hindustan and the Western Ghats)
- Marsh-wren (common from South Asia)
- Blue-throated white flycatcher (from South India)
- Common bulbul
- Warbler sp.
- Black-winged stilt



- Past-tailed flycatcher (common from Central America and Central Asia)
- Blue-tailed bee-eater (common from North-West Persia, Uttar and parts of north India)
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- Marsh-wren (common from South Asia)
- Blue-throated white flycatcher (from South India)
- Common bulbul
- Warbler sp.
- Black-winged stilt

Possibility of light rain in Chennai, says Met Department

SPECIAL CORRESPONDENT
CHENNAI

Thunderstorm activity is likely to continue over parts of the State, particularly in coastal areas for the next few days, according to the Meteorological Department.

A cyclonic circulation over Tamil Nadu, extending between 4.5 km to 5.8 km will bring rainfall over rainfall over several districts. The rain may be heavy at a few places in Cuddalore, Vellore, Kanniyakumari and Thoothukudi districts, till

Friday. During the past 24 hours, ending 8.30 a.m. on Thursday, Jayamkondam in Ariyalur district recorded the highest volume of 14 cm of rainfall, followed by Mayiladuthurai in Nagapattinam district with 13 cm. Many areas in Tiruvallur district, including Cholavaram and Chembarambakkam, received 3 cm of rainfall.

Cyclonic activity

N. Puviarasan, director, Area Cyclone Warning Centre, Chennai, said coastal areas would receive

thunder showers during evening hours.

The Kancheepuram-Nagapattinam belt would get light to moderate rain. Another cyclonic circulation around September 15 could bring rainfall over the State.

Chennai will experience a partly cloudy sky.

There is a possibility of light to moderate rain in some areas during evening or night hours.

This season, Chennai district registered 42 cm of rainfall.

IPCC: Fast rising sea levels put Chennai, three more Indian cities at high flood risk

Yishu Mohan
@timesgroup.com

New Delhi: The coastal cities of Chennai, Kolkata, Mumbai and Surat will be severely threatened due to sea level rise while several others in northern India will be exposed to acute water crisis due to melting of Himalayan glaciers by the end of the century, a UN body on climate change hinted on Wednesday.

Sea levels, rising faster than ever before, are on course to rise one metre higher due to melting of ice in the business-as-usual scenario by 2100, severely affecting more than 1.4 billion people globally, a special report on "oceans and

KOLKATA, MUMBAI, CHENNAI UNDER THREAT

- Sea levels are rising faster than previously thought
- 30-50cm rise by 2100 nearly certain even if carbon emissions are sharply reduced, global warming limited to below 2°C
- 60-110cm rise if emissions continue to increase
- If levels rise by 50cm, 45 cities with 5 lakh-plus residents will be flooded
- Kolkata, Mumbai, Surat, Chennai, New York under threat
- 1.4bn people will be hit by sea level rise, melting ice & glaciers

cryosphere" released by the Intergovernmental Panel on Climate Change (IPCC) warned on Wednesday. Four Indian cities are among 45 such coastal port cities globally where even an increase of sea level by 50cm will lead to flooding. In fact, the ex-

ting of the oceans and accelerated sea level rise would lead to widespread death of marine life leading to a seabed crisis and increasingly destructive cyclones.

The cryosphere is the frozen component of Earth, including snow, glaciers, ice sheets and ice shelves, icebergs and sea ice, ice on lakes and rivers as well as permafrost and seasonally frozen ground.

The IPCC report, which referenced nearly 7,000 research papers, warns that sea levels are rising faster than previously thought due to accelerating rate of melting of ice.

Rise by 15cm, P 13

Seawater intrudes 700m into aquifers along ECR, finds study

Groundwater At Some Locations Not Potable, Has TDS Five Times Normal



FORCED CHANGE

- WHAT WAS FOUND?**
 - Pumping of groundwater for domestic purposes is around 11.5M to 17.5M (million litres a day)
 - Seawater intrusion found up to 700m from the sea on the stretch
 - 700m (about 100m) in groundwater is in the range of 2,000-3,000 ppm. As per BIS standards, acceptable TDS in drinking water is 500 ppm (100 parts per million)
 - Land use map indicates rise in salinity which may have upped high pumping rate
- WHAT'S THE SOLUTION?**
 - Reduce pumping of groundwater by increasing piped water supply
 - Water pumping wells away from sea
 - Increase recharge (as of now, rainfall is the only source to replenish groundwater)
 - Flow of wells parallel to sea to inject fresh water
 - Constructing subsurface barrier wall (it is not environmentally friendly)
 - Excessive water extraction leads to a dip in the level of fresh groundwater reducing its pressure and lets saltwater to flow inland
- HOW INTRUSION OCCURS?**
 - Hydraulic connection between groundwater and seawater enables saltwater intrusion
 - Saline water has higher external content than freshwater, has more density and hence has higher water pressure
 - Higher pressure means saltwater can push inland through freshwater
 - Excessive water extraction leads to a dip in the level of fresh groundwater reducing its pressure and lets saltwater to flow inland
- WHY INTRUSION IS BAD?**
 - Seawater intrusion will increase salinity of groundwater and render less and less fit for drinking

Depression turns cyclonic storm; 'Maha' may intensify further

Heavy rain expected to hit 22 districts today; nearly 80 weather stations across the State have already recorded significant downpour

Storm warning

The current sea speed that started in the southern districts on Tuesday evening is expected to intensify as 22 districts. Thunder due to a cyclonic storm.

CHENNAI FORECAST
Light to moderate rain to continue till Friday

Rainfall during the 24 hours ending 8.30 a.m. on Wednesday:
Nungambakam 4cm, Alwarpet 6cm, Mambalam 7cm, Tambaram 8cm, Sripurambudur 8cm

WHAT'S IN STORE FOR STATE
A depression that developed in the Bay of Bengal on Tuesday evening is expected to intensify into a cyclonic storm 'Maha' with a speed of 35 km per hour in the central part of Lakshadweep and adjoining southern districts like Malappuram, Kozhikode, Kannur, Wayanad, and Idukki. It is likely to intensify into a severe cyclonic storm.

CHENNAI FORECAST
Light to moderate rain to continue till Friday

Rainfall during the 24 hours ending 8.30 a.m. on Wednesday:
Nungambakam 4cm, Alwarpet 6cm, Mambalam 7cm, Tambaram 8cm, Sripurambudur 8cm



Tamil Nadu has become warmer over the years: Experts

TNN | Updated: Oct 21, 2016, 11:18 IST

Crack any professional entrance exam with M Academy
Meluha Educational Society



A three-day workshop on climate change got under way on Tuesday.

COIMBATORE: The state had witnessed a rise in temperature by 0.02C every year between 1951 and 2010 and it has affected the mercury levels in the day and at night, said a weather expert here on Tuesday.

Dr S Balachandran, scientist with the Regional Meteorological Centre in Chennai, said rainfall received during monsoons and their patterns have also been changing. He was in the city to attend the inaugural function of the three-day workshop on climate change.

Climate change: Crisis is here & now

Updated: Aug 14, 2015, 4:58 IST

अपना क्रेडिट स्कोर मुफ्त में चेक करिए सिर्फ 30 सेकंड में
ETMoney



climate will become the norm in the coming years. Is the state prepared to deal with the situation?

By S Gopikrishna Warriar

Longer summers and erratic rainfall in Tamil Nadu have raised doubts over whether the state is experiencing impacts of climate change. Even if present-day weather uncertainties cannot be conclusively linked to climate change, there are several indications that unpredictable

INDIA REAL TIME

Cyclone Nilam Kills 12, Displaces Thou

By Preetika Rana

Nov 1, 2012 5:05 pm IST

0 RESPONSES



ASSOCIATED PRESS Sailors held on to a lifeboat near Chennai, Wednesday. Click here to view related slideshow.

Cyclone Nilam, which hit India's southeastern coast late Wednesday, forced thousands to flee their homes in the state of Tamil Nadu, and claimed at least 12 lives across southern India.

Though the tropical cyclone, which evoked fears of large-scale destruction, weakened as it traveled northwest, it caused "significant damage" to infrastructure, plantations and livestock along Tamil Nadu's eastern coast, M. Jayaraman, a senior disaster management official, told India Real Time.

Cyclone Gaja damaged nearly 1 crore coconut trees, 70,000 farmers hit: Tamil Nadu

Three weeks after the cyclonic storm struck the state on November 16, leaving 65 people dead and more than 1.34 lakh electricity poles damaged, officials in the state agriculture department said at least 70,000 coconut farmers have been directly affected in mainly four districts - Thanjavur, Pudukottai, Thiruvarur and Nagapattinam.



13/02/2018

Climate change impact significant on insects and plants - The Hindu

THE HINDU

COIMBATORE

Climate change impact significant on insects and plants



STAFF REPORTER

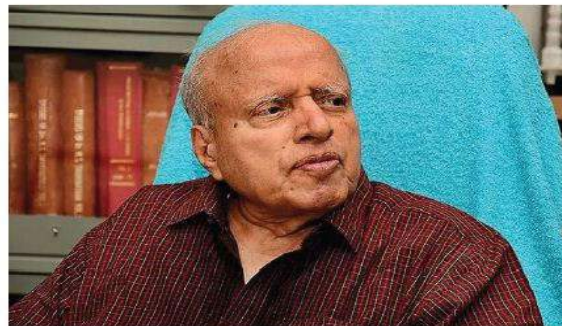
COIMBATORE, AUGUST 20, 2011 14:04 IST
UPDATED: AUGUST 20, 2011 14:04 IST

The Inter-Governmental Panel on Climate Change, a panel of international experts assessing the current scientific knowledge on climate, has asserted that warming of the earth's climate system is 'unequivocal'. Fr. Ignacimuthu, Director, Entomology Research Institute, Loyola College, Chennai, said here recently.

Inaugurating an international congress on "Global Warming on Biodiversity of Insects: Management and Conservation", organised by the Department of Zoology, School of Life Sciences of Bharathiar University, he said the panel's conclusions were based on mounting evidence of shifts in the climate and consequent effects on ecological processes and biodiversity.

"The effects of climate change and habitat destruction and their interaction are likely to be the greatest challenge to animal and plant conservation in the 21st century," he said.

'Coral reefs in danger due to climate change'



T Appala Naidu

KARIMNADA, SEPTEMBER 17, 2010 01:07 IST
UPDATED: SEPTEMBER 17, 2010 07:24 IST

It will have direct impact on coastal communities in A.P. and T.N., says M.S. Swaminathan

Geneticist M.S. Swaminathan on Monday said that many coral reefs in the country were in danger due to climate change.

In his inaugural video-speech from Chennai during the three-day national workshop on 'Climate Change', Mr. Swaminathan has stressed that the climate change would have direct impact on the coastal communities in Andhra Pradesh and Tamil Nadu.

3.2 PROJECTED CLIMATE VARIABILITY AND TREND

This section presents future projections of relevant climatic variables for different socio-economic scenarios, namely the RCPs4.5 and 8.5 used for IPCC AR5. This section is primarily based on projections analyzed by Gosain and Rao (2018) who report the multi-model mean (MMM) of for a 10-run ensemble of 3 regional climate models (RCMs) that were run for the South Asia region under the CORDEX initiative,³⁷ nested into a set of diverse Global Circulation Model (GCM) boundary conditions. While the ensemble and multi-model mean are used to mitigate climate model uncertainty, it ought to be borne in mind that multiple sources of uncertainty remain (including inter alia related to socio-economic scenarios and climate model accuracy) and that projections reported here are consequently subject to these (Sharma et al. 2017)³⁸.

3.2.1 IPCC AR5 CLIMATE CHANGE SCENARIOS – TAMIL NADU

The CORDEX South Asia modelled climate data on precipitation, maximum temperature, and minimum temperature, have been analysed for Tamil Nadu and 32 of its districts for mid-century (MC, 2021-2050) and end-century (EC, 2071-2100) with respect to baseline (BL, 1981-2010). Projected change in climate for precipitation, maximum temperature and minimum temperature has been assessed.

3.2.2 REPRESENTATIVE CONCENTRATION PATHWAYS (RCPs)

The IPCC scenarios provide a mechanism to assess the potential impacts on climate change. Global emission scenarios were first developed by the IPCC in 1992 and were used in global general circulation models (GCMs) to provide estimates for the full suite of greenhouse gases and their potential impacts on climate change. Since then, there has been greater understanding of possible future greenhouse gas emissions and climate change as well as considerable improvements in the general circulation models. The IPCC, therefore, developed a new set of emissions scenarios. The process by which these new scenarios are being produced differs from earlier scenario development.

The new process aims to both shorten the time required to develop and apply new scenarios, and to ensure better integration between socio-economic driving forces, changes in the climate system, and the vulnerability of natural and human systems. Rather than starting with socio-economic scenarios that give rise to alternative greenhouse gas emissions, the new scenarios take alternative futures in global greenhouse gas and aerosol concentrations as their starting point. These are called Representative Concentration Pathways (RCPs). The Representative Concentration Pathways (RCP) are based on selected scenarios from four modelling teams/models working on integrated assessment modelling, climate modelling, and analysis of impacts.

RCPs are four greenhouse gas trajectories adopted by the IPCC for its Fifth Assessment Report (AR5). The four RCPs; RCP2.6, RCP4.5, RCP6, and RCP8.5, are named after a possible range of radioactive forcing values in the year 2100. Table 3.1 gives the overview of four RCPs.

³⁷ Namely, REMO (MPI), RCA4 (SMHI) and CCAM (CSIRO)

³⁸ Tarul Sharma; H. Vittal; Surbhi Chhabra; Kaustubh Salvi; Subimal Ghosh; Subhankar Karmakar (2018) *Understanding the cascade of GCM and downscaling uncertainties in hydro-climatic projections over India*. International Journal of Climatology Volume 38 Issue 51 ppe178-e190

Table 3.1 Overview of Representative Concentration Pathways (RCPs) adopted by IPCC AR5

RCP	Description	IA Model	Publication – IA Model
RCP8.5	Rising radioactive forcing pathway leading to 8.5 W/m ² in 2100.	MESSAGE	Riahi et al. (2007), Rao&Riahi (2006)
RCP6	Stabilization without overshoot pathway to 6 W/m ² at stabilization after 2100	AIM	Fujino et al. (2006), Hijioka et al. (2008)
RCP4.5	Stabilization without overshoot pathway to 4.5 W/m ² at stabilization after 2100	GCAM (MiniCAM)	Smith and Wigley (2006), Clarke et al. (2007), Wise et al. (2009)
RCP2.6	Peak in radiative forcing at ~ 3 W/m ² before 2100 and decline	IMAGE	van Vuuren et al. (2006; 2007)

(Source: http://sedac.ipcc-data.org/ddc/ar5_scenario_process/RCPs.html)

Source: www.climatevulnerability.in, (2018)

Resolution of the projected climate data is at a grid-spacing of 0.5°x0.5° for IPCC AR5 scenarios, namely, RCP8.5 (a scenario of comparatively high greenhouse gas emissions and does not include climate policy interventions) and RCP4.5 (moderate emission scenario and assumes climate policy intervention to transform associated reference scenarios). Ensemble mean of 3 regional climate models (RCM), namely, REMO (from MPI), RCA4 (from SMHI) and CCAM (from CSIRO) has been used for the analysis. Ensemble mean is chosen to reduce model related uncertainties and ensemble mean climate is closer to observed climate than any individual model.

3.3 CLIMATE CHANGE PROJECTIONS FOR TAMIL NADU

For Tamil Nadu State and districts, IPCC AR5 RCP4.5 and RCP8.5 scenarios has been analysed for the annual maximum and minimum temperature and precipitation.

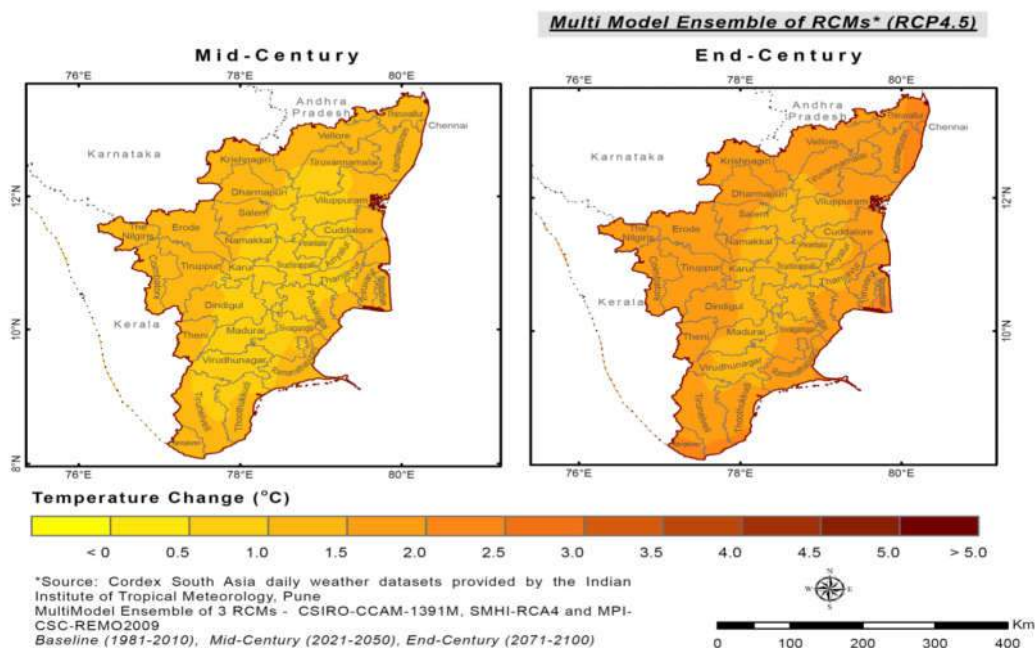
3.3.1 Projected Temperature

The MMM climate projections analysed for mid –Century (2021-2050) and end –century (2071-2100) with respect to base line period of (1951-2013) for the State of Tamil Nadu indicate that the annual mean maximum temperature in the State may rise by up to 1.7 degree Centigrade to 3.4 degree C by end century under RCP4.5 and RCP8.5 scenarios respectively. By mid – century, the MAM projected change in this statistics is 1.0 degree C and 1.2 degree C for RCP4.5 and RCP8.5 respectively.

While spatial differences in changes of annual mean maximum temperature are higher increase in RCP8.5 than that of RCP4.5 (Figure 3.10), Seasonal differences between the degree of change are more pronounced, with the increase being highest for March- May (MAM) pre monsoon season (Figure 3.11).

As similar for global trends, projected changes for annual mean minimum temperature are even more pronounced. The average minimum temperature in the district is predicted to 2.2 degree Centigrade to 3.8 degree Centigrade for the MMM under RCP4.5 and 8.5 scenarios, respectively, by the end of the century (Figure 3.12). For mid- century, this increase would be of 1.2 degree Centigrade to 1.4 degree Centigrade for RCP4.5 and RCP8.5 respectively. Spatial differences in projected changes again are small whereas seasonal differences are pronounced, with the increase being most notable for the period June- September for both pathways and time periods considered (Figure 3.13)

Projected Future Changes in Annual Maximum Temperature for Mid-Century and End-Century with respect to Baseline (1981 - 2010) for Tamil Nadu



Projected Future Changes in Annual Maximum Temperature for Mid-Century and End-Century with respect to Baseline (1981 - 2010) for Tamil Nadu

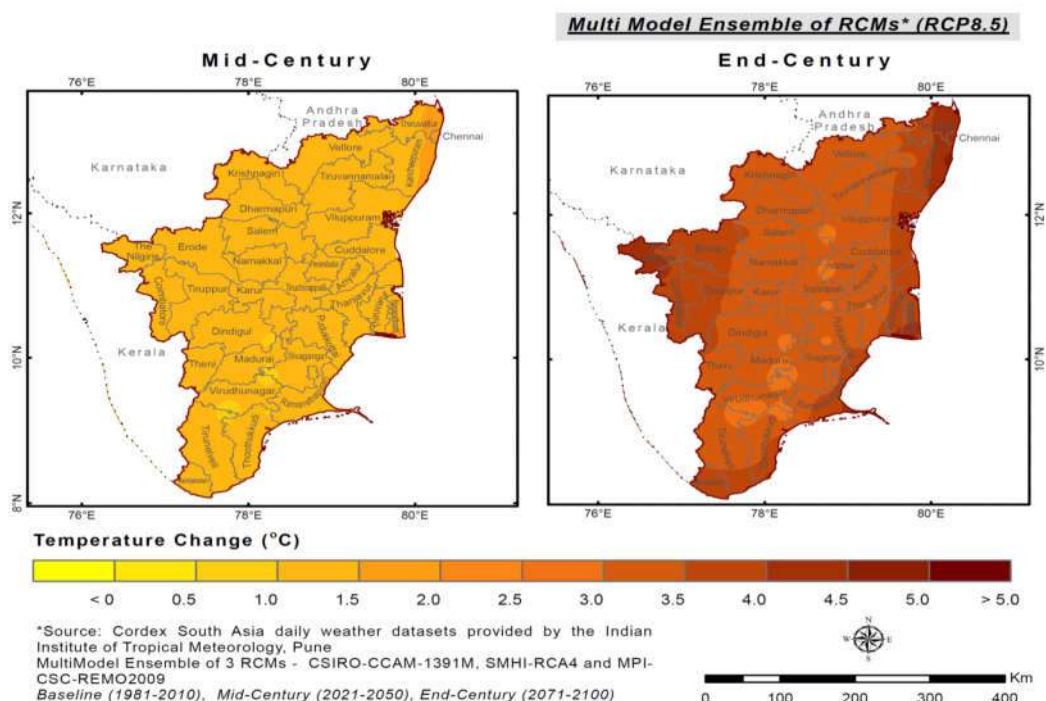


Figure 3.10 Projected Changes in Mean Annual Maximum Temperature for RCP4.5 (top) and RCP 8.5 (bottom)

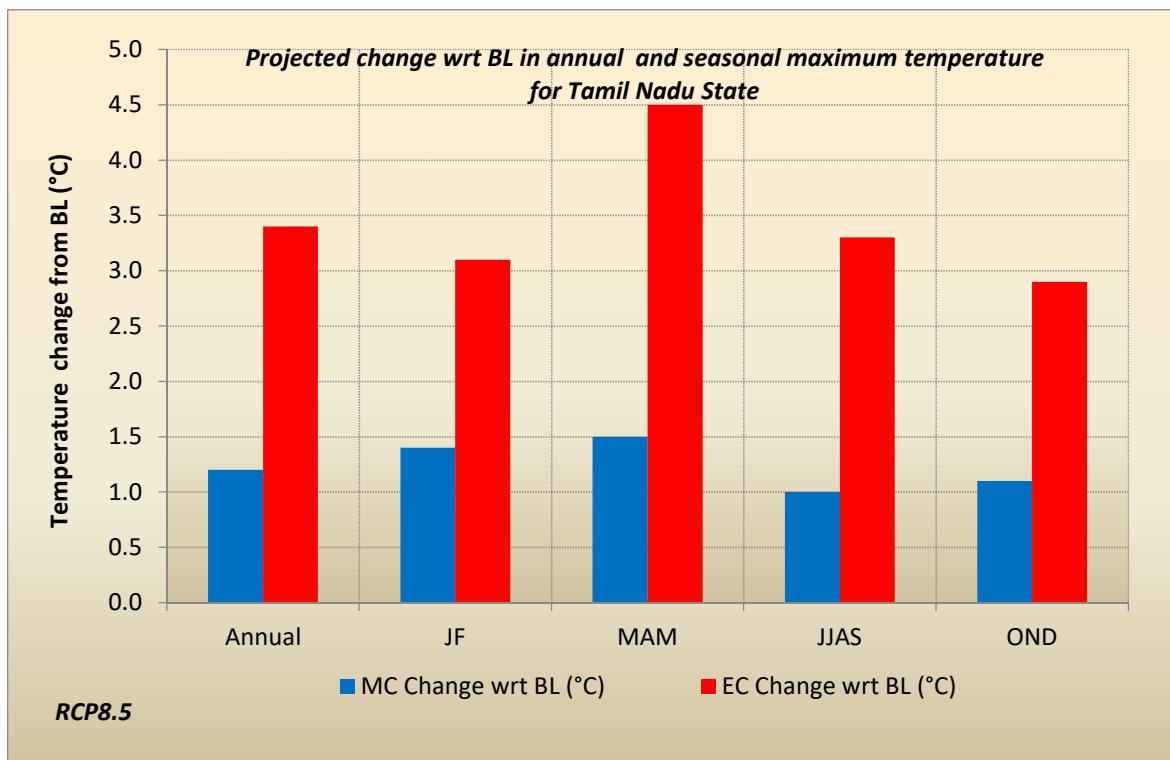
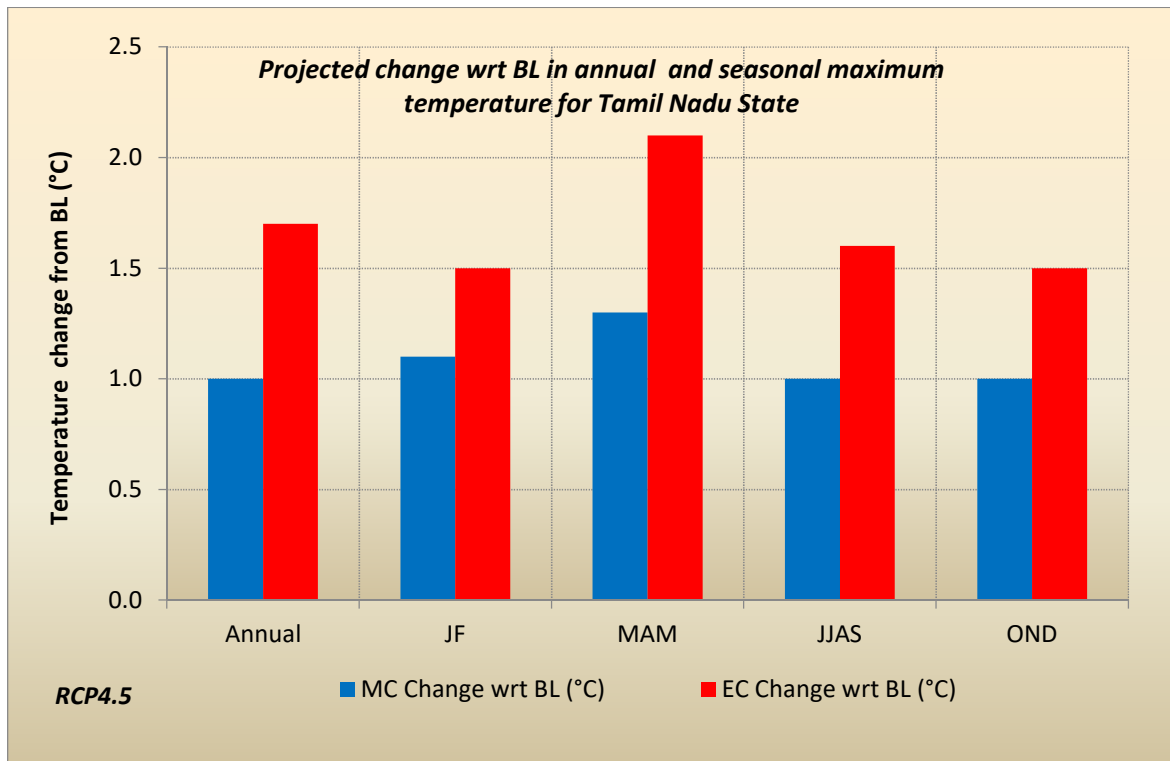
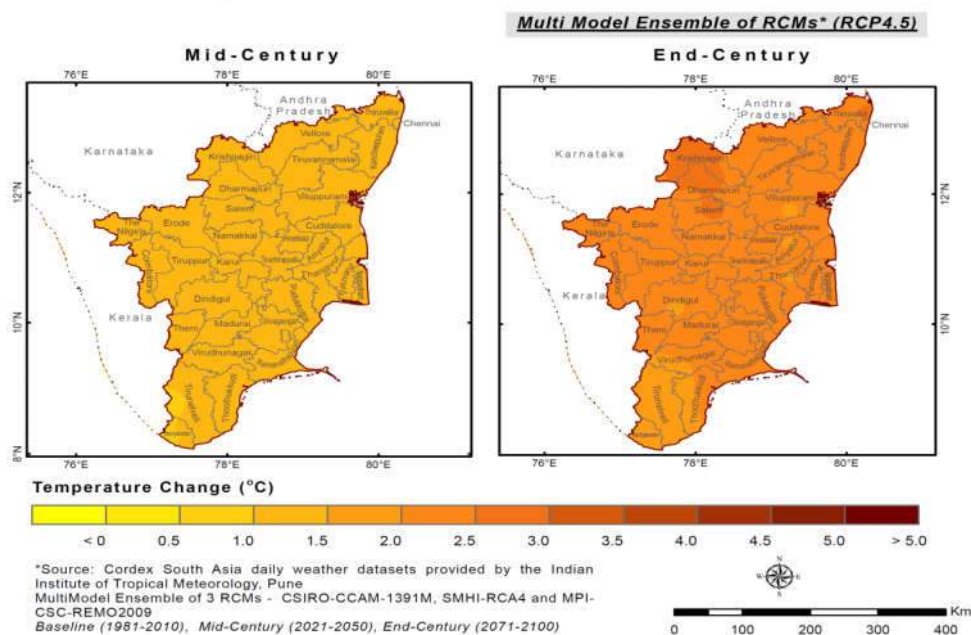


Figure 3.11 Projected change wrt baseline (BL) in annual and seasonal maximum temperature by mid-century (MC) and end of century (EC) under RCP4.5 (top) and RCP8.5 (bottom)
Source: www.climatevulnerability.in, 2018

Projected Future Changes in Annual Minimum Temperature for Mid-Century and End-Century with respect to Baseline (1981 - 2010) for Tamil Nadu



Projected Future Changes in Annual Minimum Temperature for Mid-Century and End-Century with respect to Baseline (1981 - 2010) for Tamil Nadu

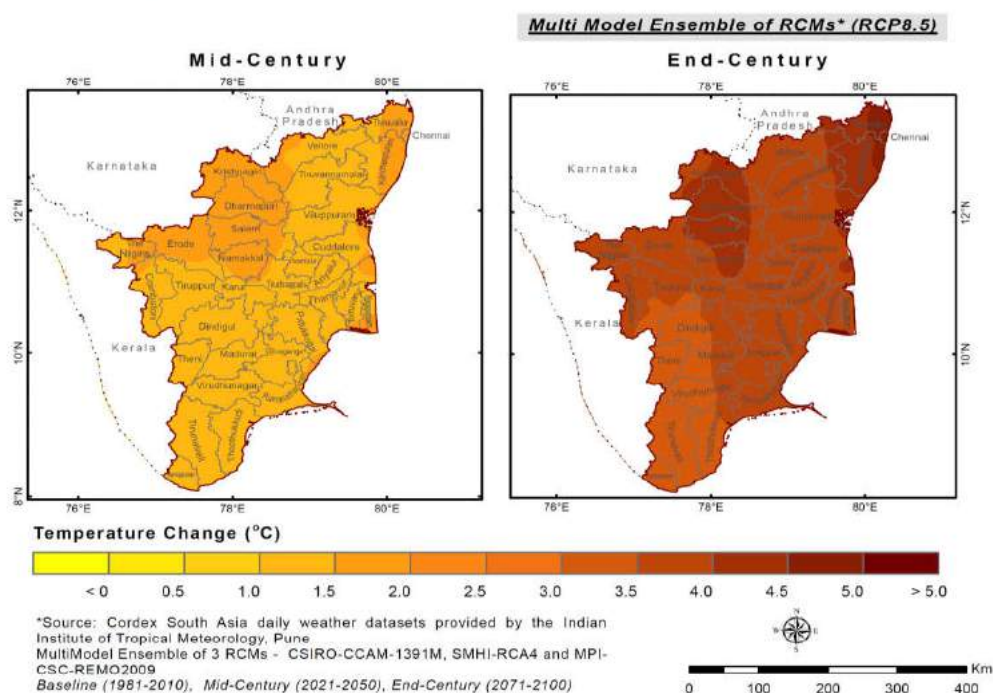


Figure 3.12 Projected Changes in Annual Minimum Temperature for RCP4.5 (top) and RCP 8.5 (bottom)

Source: www.climatevulnerability.in, 2018

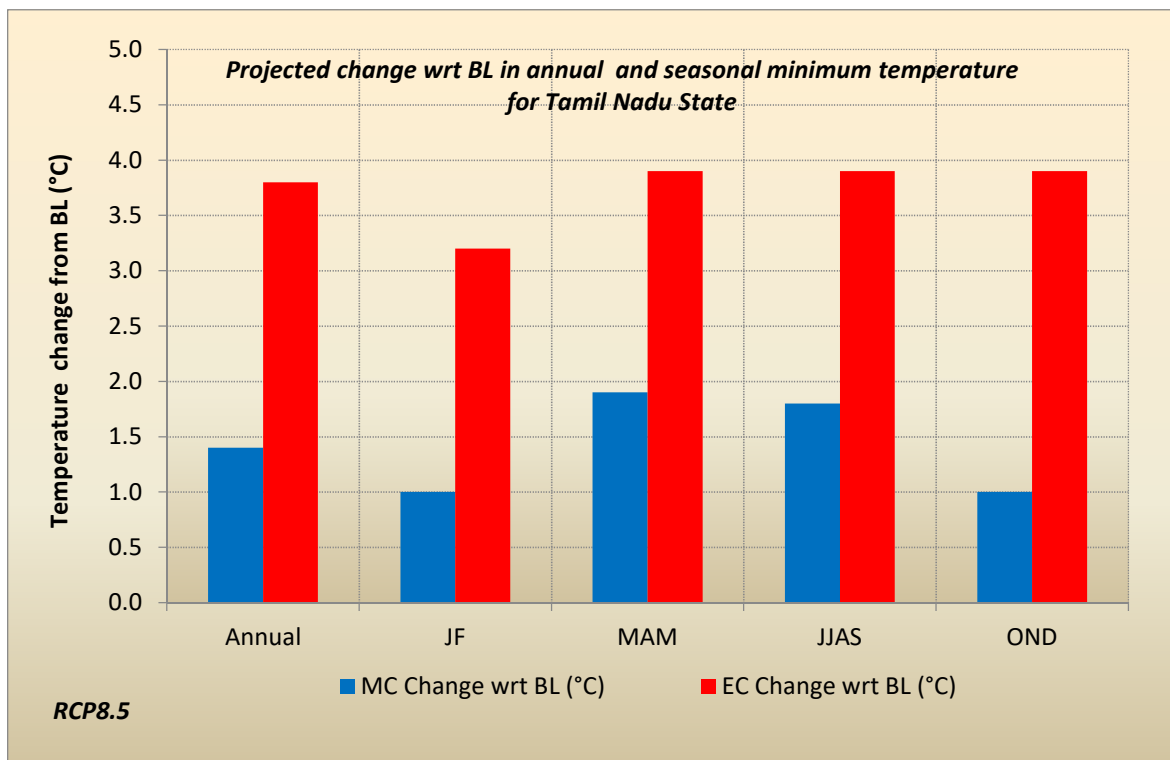
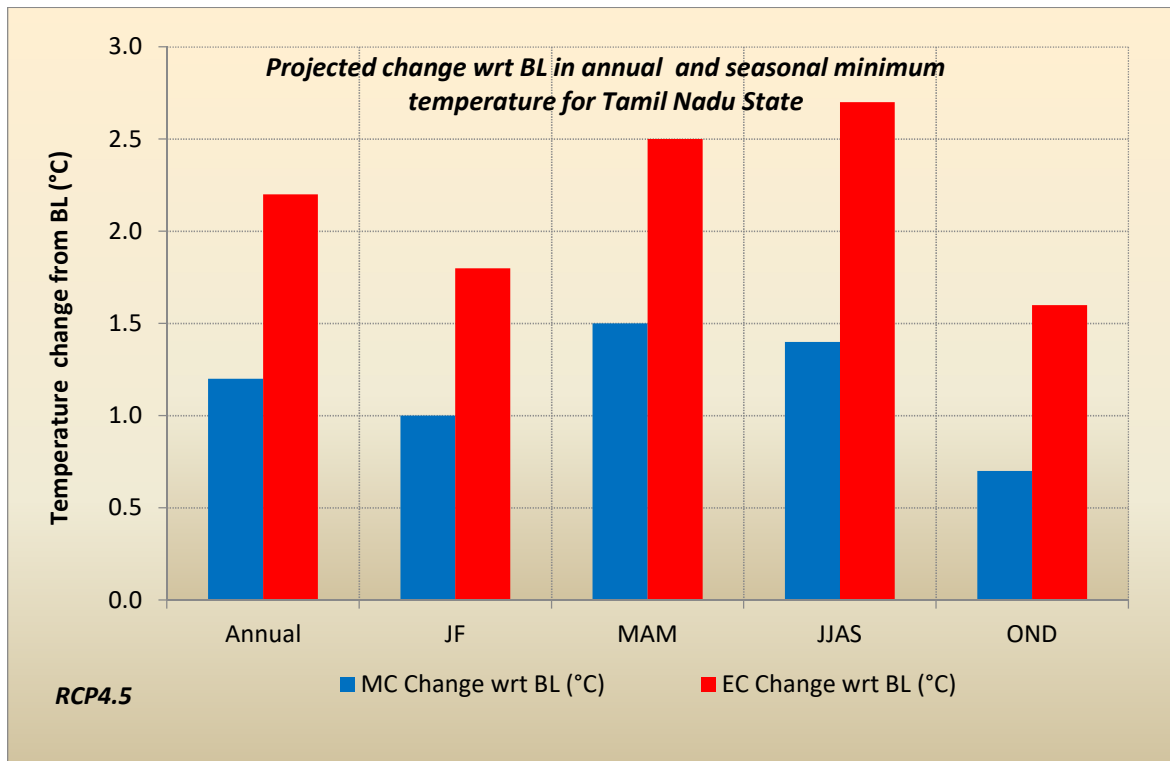


Figure 3.13 Projected change wrt baseline (BL) in annual and seasonal minimum temperature by mid-century (MC) and end of century (EC) under RCP4.5 (top) and RCP8.5 (bottom)

Source: www.climatevulnerability.in, 2018

3.3.2 Projected Precepitation

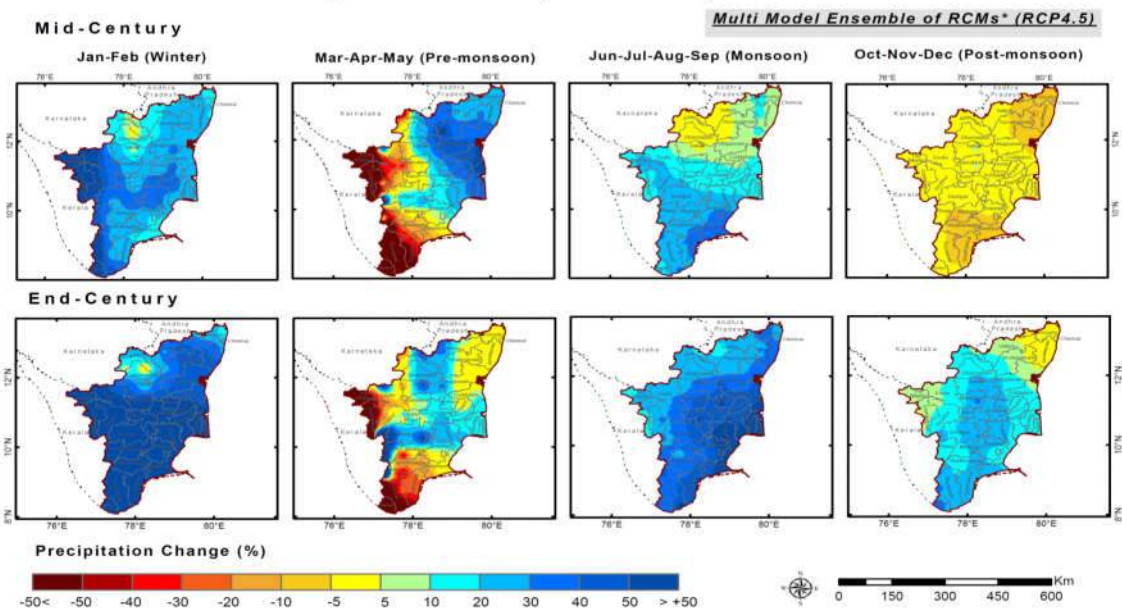
Average rainfall in Tamil Nadu State is projected by the MMM to increase marginally, by 4.4percentage towards mid-century and increase about 20.5 percentage towards end-century while for RCP8.5 scenario it is projected to increase marginally by 6.7% towards mid-century and 26.1% towards end-century for the State. Thus the percentage of the projected rainfall increase is low towards MC and EC for both the climate scenarios. In winter season (JF) highest rainfall increase is projected towards MC and EC for Tamil Nadu State for IPCC AR5 RCP4.5 scenario. In winter season (JF) rainfall decrease is projected while in monsoon season (JJAS) highest rainfall increase is projected towards Mid Century (MC) and End Century (EC) as compared to Baseline (BL) for Tamil Nadu State for RCP 8.5 scenario (Figure 3.14). Since currently, more than three quarters of the annual total rainfall amount is concentrated in the monsoon season, the projected increase in monsoonal rainfall accounts for the overall increase in annual rainfall. Regionally, too, there are differences, although consistent trends are more hardly discernible.

3.3.3 Projected Extreme Events

Gosain and Rao (2018) analysed the trends in Tamil nadu for selected extreme event indices based on MMM projections, although due to the poor RCM performance in replicating historical extreme events caution is required when interpreting these trends. While they find positive trends in certain temperature-related indices (such as Maximum of day time temperature (TXx), Maximum of night time temperature (TNx) and Minimum of day time temperature (TXn) and Minimum of night time temperature (TNn)) that indicate a warming up for both time periods and RCPs, these trends are statistically significant for limited geographical areas (districts) only. Moreover, the **percentage of warm days and warm nights** is projected to increase and **percentage of cool days and cool nights** is projected to decrease under all scenarios and time periods. Cold spell duration indicator is projected to decrease and warm spell duration indicator is projected to increase, too.

In terms of precipitation extreme Indices, none of the indices show significant trends for the majority of the districts of Tamil Nadu for both IPCC AR5 climate scenarios. An exception is the **CDD (consecutive dry days)** index, which shows a statistically significant positive trend for majority of the districts for RCP 4.5 scenario. **Annual total precipitation on wet days** and the **average precipitation on wet days**, moreover, are projected to increase, and so are **very wet days precipitation** and **extremely wet days precipitation**, pointing at further increases in rainfall intensity.

Projected Future Changes in Seasonal Precipitation for Mid-Century and End-Century
with respect to Baseline (1981 - 2010) for Tamil Nadu



Projected Future Changes in Seasonal Precipitation for Mid-Century and End-Century
with respect to Baseline (1981 - 2010) for Tamil Nadu

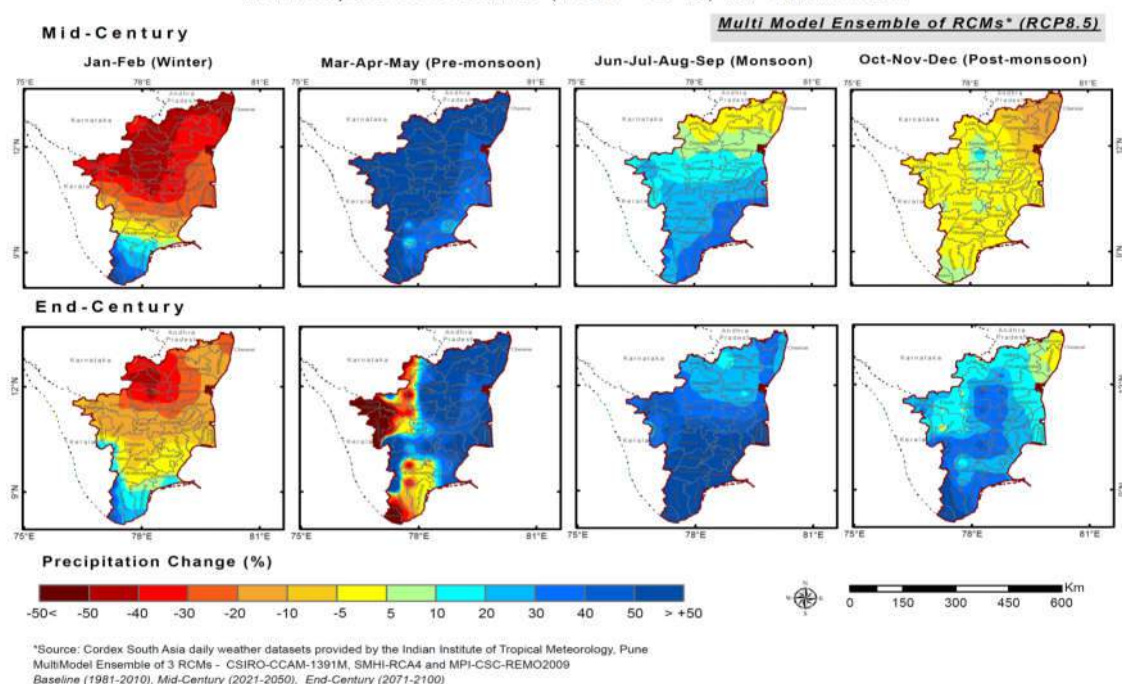


Figure 3.14 Projected spatial differences in seasonal precipitation changes for RCP4.5 (top) and RCP8.5 (bottom)

Source: www.climatevulnerability.in, 2018

CHAPTER 4: CLIMATE CHANGE RISK AND VULNERABILITY ASSESSMENT

4.1 VULNERABILITY

Climate change vulnerability is defined as the propensity to be adversely affected by climate change (IPCC 2014). It encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope with and adapt to future changes (IPCC 2014)³⁹. There are three key elements of vulnerability: (i) exposure (ii) sensitivity (iii) adaptive capacity.

On the other hand, risk is defined as the potential for consequence where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events (likelihood) multiplied by the impacts (or consequences) if these events occur. Risks result due to the interactions of vulnerability, exposure, and hazards (IPCC, 2014).

It is widely accepted that climate change may exacerbate far reaching consequences on ecosystems and pose developmental challenges (Ramachandran et al, 2016)⁴⁰. Therefore, it is very essential to have a detailed analysis of the likely impacts and vulnerability of climate change. This involves evaluation of hazards and vulnerability. Quantitative indexes are often used to express vulnerability (Roman et al., 2016)⁴¹. Vulnerability of an area is purely dependent on its natural settings, its climatic and the socio-economic conditions. It is very necessary to understand the interactions of climate change impacts on all the sectors with changes in exposure and vulnerability, as well as adaptation and mitigation actions affecting the same or a different sector, at regional or sub regional scales that vary across temporal and spatial scales (IPCC, 2014).

Tamil Nadu is one of the extreme-events prone States in India that faces more extremities of cyclones and drought recurrently. In view of this, the following are the climate change vulnerability studies across various sectors in Tamil Nadu.

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³⁹IPCC (2014) 'Summary for Policymakers', in Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Savolainen, J., Schlömer, S., von Stechow, C., Zwickel, T. and Minx, J.C. (Eds.): Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, NY, USA

⁴⁰A. Ramachandran; Dhanya Praveen; P. Radhapriya; S.K. Divya; K. Remya; K. Palanivelu, (2016) Vulnerability and adaptation assessment a way forward for sustainable sectoral development in the purview of climate variability and change: insights from the coast of Tamil Nadu, India, International Journal of Global Warming 10(1/2/3):307, DOI: 10.1504/IJGW.2016.077896

⁴¹Roman, C.E., Lynch, A.H. and Dominey-Howes, D. (2010) 'Uncovering the essence of the climate change adaptation problem – a case study of the tourism sector at Alpine Shire, Victoria, Australia', Tourism Planning & Development, Vol. 7, No. 3, pp.237–252.

4.2 SECTORAL VULNERABILITY & IMPACTS

In the following section vulnerability of each of the sectors is discussed i.e. Sustainable Agriculture, Water Resources, Forest & Biodiversity and Coastal Area Management. Vulnerability studies have not been conducted for the Energy and Sustainable Habitat sectors; hence only impacts are discussed for these sectors.

4.2.1 Climate Change Impacts and Vulnerability on Sustainable Agriculture

Climate change and agriculture are interrelated processes, both of which take place on a global scale. Climate change affects agriculture in a number of ways, including through changes in average temperatures, rainfall, and climate extremes (e.g., heat waves); changes in pests and diseases; changes in atmospheric carbon dioxide and ground-level ozone concentrations; changes in the nutritional quality of some foods, and changes in sea level.

Climate change is already affecting agriculture, with effects unevenly distributed across the world. In fact, studies on the Agricultural vulnerability of Tamil Nadu to Climate Change have shown that all districts in an agro climatic zone does not fall under the same category of vulnerability which exemplifies the need for the State to prioritize research and development issues and effective decision making through “Location-Performance-Vulnerability” based adaptation strategies (Varadhan and Kumar 2015)⁴².

The Current Agriculture Vulnerability for the Districts of Tamil Nadu has been assessed by GIZ and Integrated Natural Resource Management (INRM) and is shown in Figure 4.1.

It is clearly explained that Chennai district has shown very high vulnerability (There is no agriculture activity) which is located in the North Eastern zone of Tamil Nadu. Further, Ramanathapuram, Thoothukkudi, Virudhunagar, Dindigul, The Nilgiris, Sivaganga and Kanyakumari districts fall under high vulnerability category. The major contributing factors include food grains yield, irrigated area, net sown area, fertilizer consumption, milk and egg production, low livestock and poultry population.

4.2.1.1 Climate Change Impact on Crop Varieties in Tamil Nadu

The recent study simulated the crop yield under a possible climate change scenarios for the coastal areas of South India through the end of this century. The crop simulation model, the Decision Support System for Agrotechnology Transfer (DSSAT) 4.5, was used to understand the plausible impacts on the major crop yields of rice, groundnuts, and sugarcane under the RCP4.5 trajectory. The findings reveal that under the RCP 4.5 scenario there will be decreases in the major C3 and C4 crop yields in the study area as shown in Table 4.1. This would affect not only the local food security, but the livelihood security as well (Ramachandran et al 2017)⁴³.

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⁴²Varadan, R.J.; Kumar, P. Mapping agricultural vulnerability of Tamil Nadu, India to climate change:A dynamic approach to take forward the vulnerability assessment methodology. *Clim. Chang.* 2015, 129, 159–181

⁴³ A. Ramachandran¹ & A. Saleem Khan¹ & K. Palanivelu¹ & R. Prasannavenkatesh¹N. Jayanthi¹ (2017), Projection of climate change-induced sea-level rise for the coasts of Tamil Nadu and Puducherry, India using SimCLIM: a first step towards planning adaptation policies, *J Coast Conserv* (2017) 21:731–742 DOI 10.1007/s11852-017-0532-6

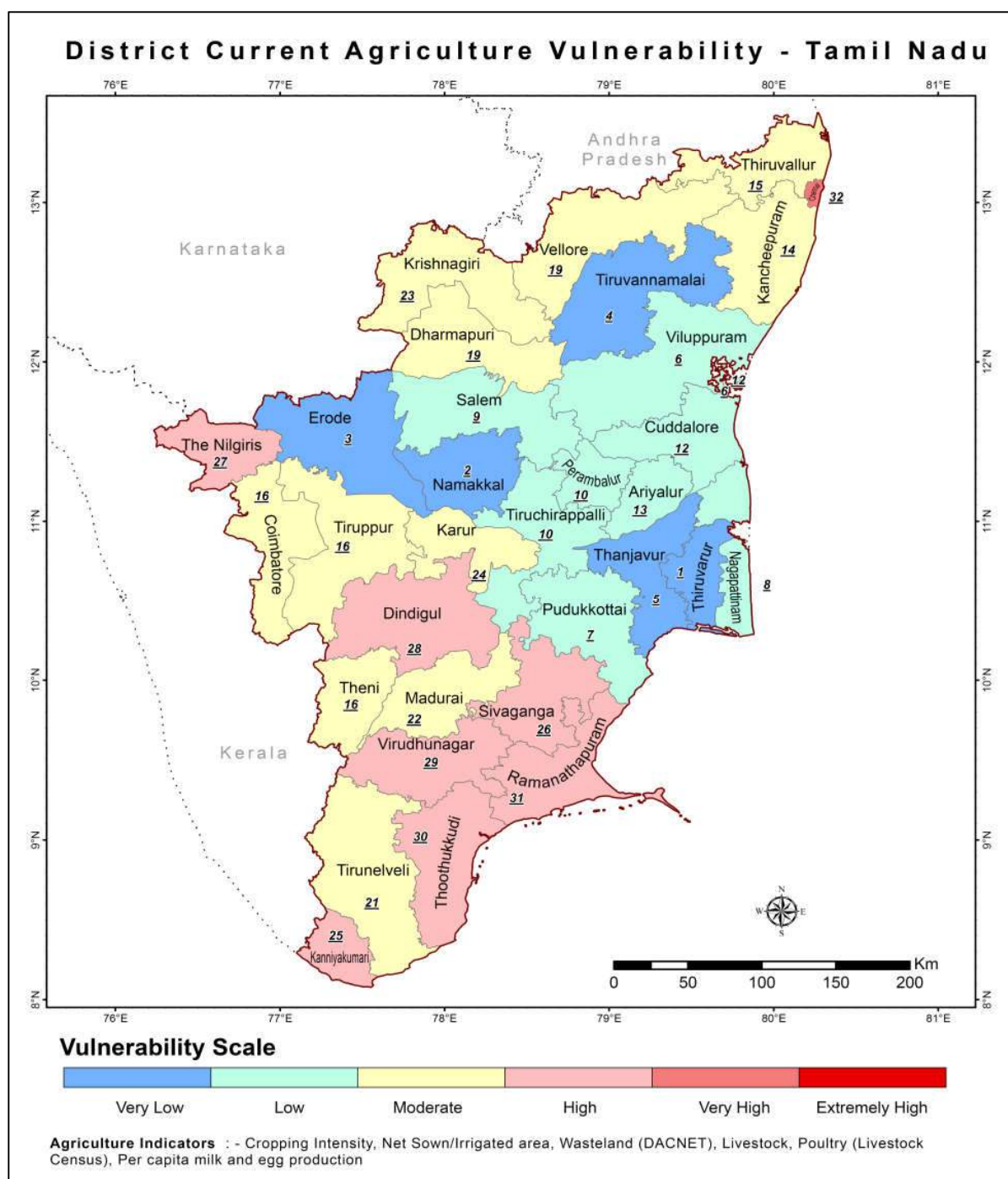


Figure 4.1 Agriculture Vulnerability map for districts of Tamil Nadu for current vulnerability

(Source: www.climatevulnerability.in 2018)

Table 4.1 Mean projected crop yield changes under control and CO₂ simulations

Projected Yield	Year	Control	CO ₂ (538 ppm)Rice
Rice	2010-2040	-8.8	-6.4
	2041-2070	-13.1	-4.7
	2071-2098	-18.7	-4.4
Groundnut	2010-2040	2.8	6.4
	2041-2070	-5.1	4.2
	2071-2098	-9.7	0.6
Sugarcane	2010-2040	-1.8	No Change
	2041-2070	-2.6	
	2071-2098	-2.8	

(Source: Ramachandran et al 2017)

Maize: The change in climate is expected to create both positive as well as negative impacts on maize cultivation. Impact of maize yield was studied for major maize growing districts of Tamil Nadu using INFOCROP model for climate change scenarios developed for 2020, 2050 and 2080 (Geethalakshmi, 2009)⁴⁴. Analysis projected a reduction in yield by 3.0, 9.3 and 18.3 percent by 2020, 2050 and 2080 respectively from the current yield levels (Figure 4.2).

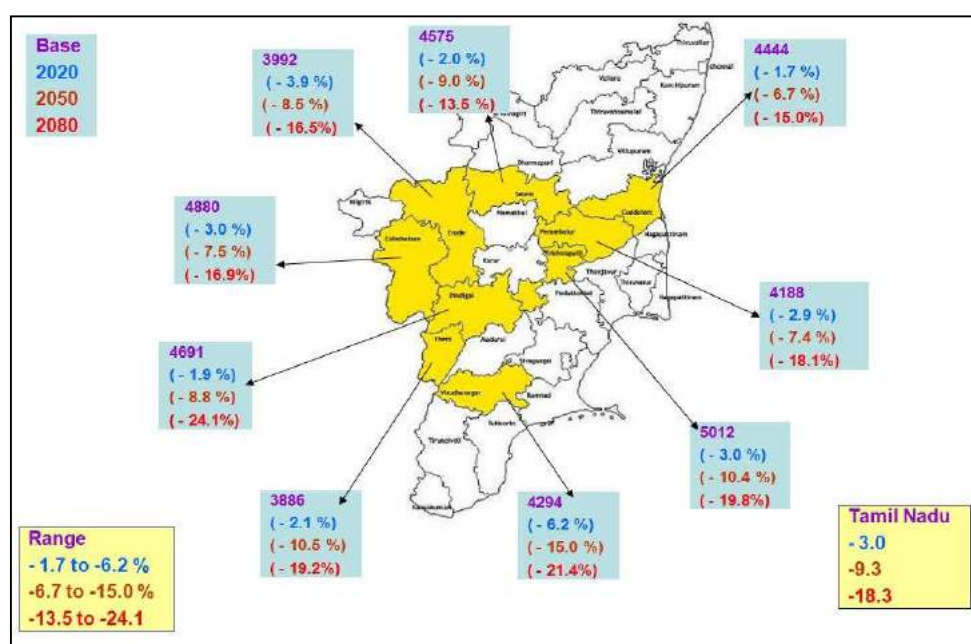


Figure 4.2 Impacts of changing climate on Maize production in Tamil Nadu

(Source: SonalliMcdermid et al 2016)

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⁴⁴V Geethalakshmi, T Ramesh, PalamuthirsolaiAzhagu, A Lakshmanan "Productivity and water usage of Rice as influenced by different cultivation of System, Madras Agricultural Journal, 96 (7-12), 349-352

<https://doi.org/10.1007/s00704-019-02901-0>

Future climate projections were created employing 29 global climate models (GCMs) and selected a model for representing the climate of Tamil Nadu as per the Agricultural Model Inter comparison and Improvement project (AgMIP) protocol and used for impact studies (SonaliMcDermid et al., 2016)⁴⁵. Under RCP 4.5 and RCP 8.5 scenarios, DSSAT predicted increase and decrease in maize yield with varying magnitude over Tamil Nadu. Overall, in most places of Tamil Nadu, negative impact of climate change on maize productivity during mid-century is expected. Forcing of CanESM2 (Hot/dry) for RCP 4.5 scenario with Decision Support System for Agrotechnology Transfer (DSSAT) showed a deviation in Maize productivity from (-) 50 to (+) 55 per cent over Tamil Nadu. Though, there is also positive deviation for CanESM2 (Hot/Dry), in most of places of Tamil Nadu except a very few areas, maize productivity is expected to get affected negatively. The rate of decrease is expected to be higher in many places under RCP 8.5 for CanESM2 (Hot/dry) compared to RCP4.5 scenario.

Sorghum: Similar study conducted for sorghum indicated declines in yields by 4.5, 11.2 and 18.7 percent respectively by 2020, 2050 and 2080 from the current yield levels if no management intervention is made. The yield reduction could be mainly due to a quality increase in night-time temperature (minimum temperature) when compared to the magnitude of increase in maximum temperature and variation in the expected rainfall (Figure 4.3).

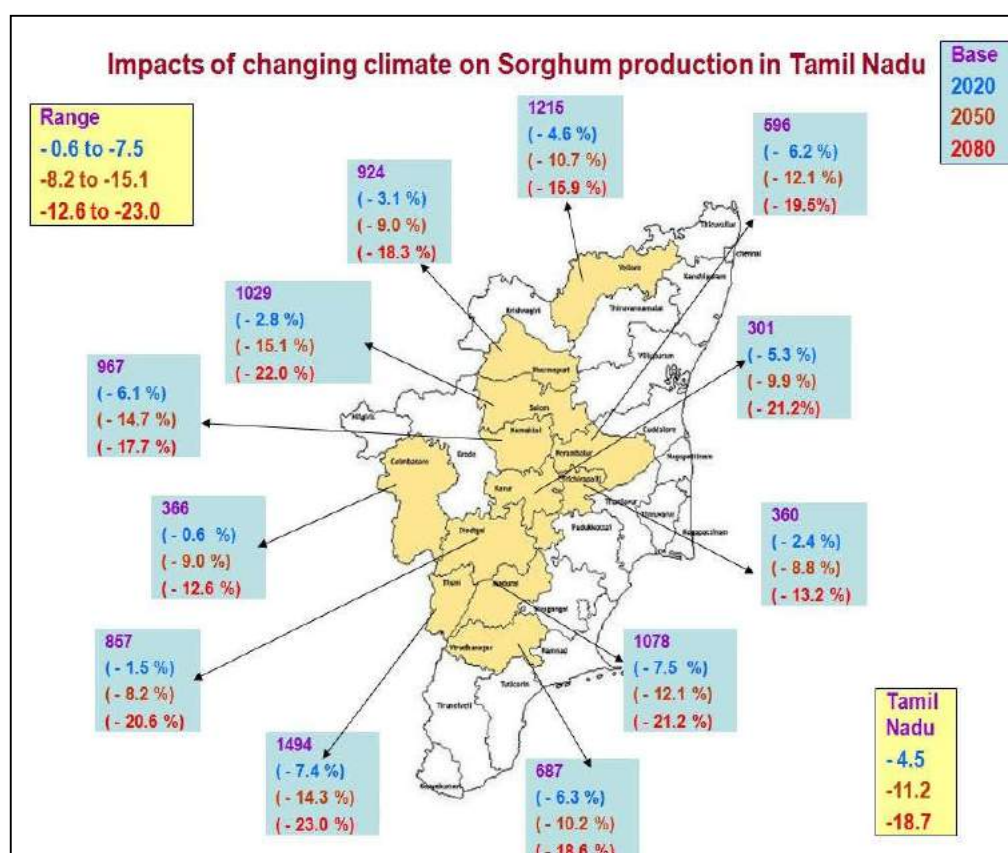


Figure 4. 3 Impacts of changing climate on sorghum production in Tamil Nadu

4.2.2 Climate Change Impact and Vulnerability to Water Resources

Figure 4.4 clearly shows the current and projected water resource vulnerability of Tamil Nadu districts.

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⁴⁵SonaliMcDermid, R. Gowtham, K. Bhuvaneswari, GeethalakshmiVellingiri, and LakshmananArunachalam, The impacts of climate change on Tamil Nadu rainfed maize production: a multi-model approach to identify sensitivities and uncertainties CURRENT SCIENCE, VOL. 110, NO. 7, 10 APRIL 2016

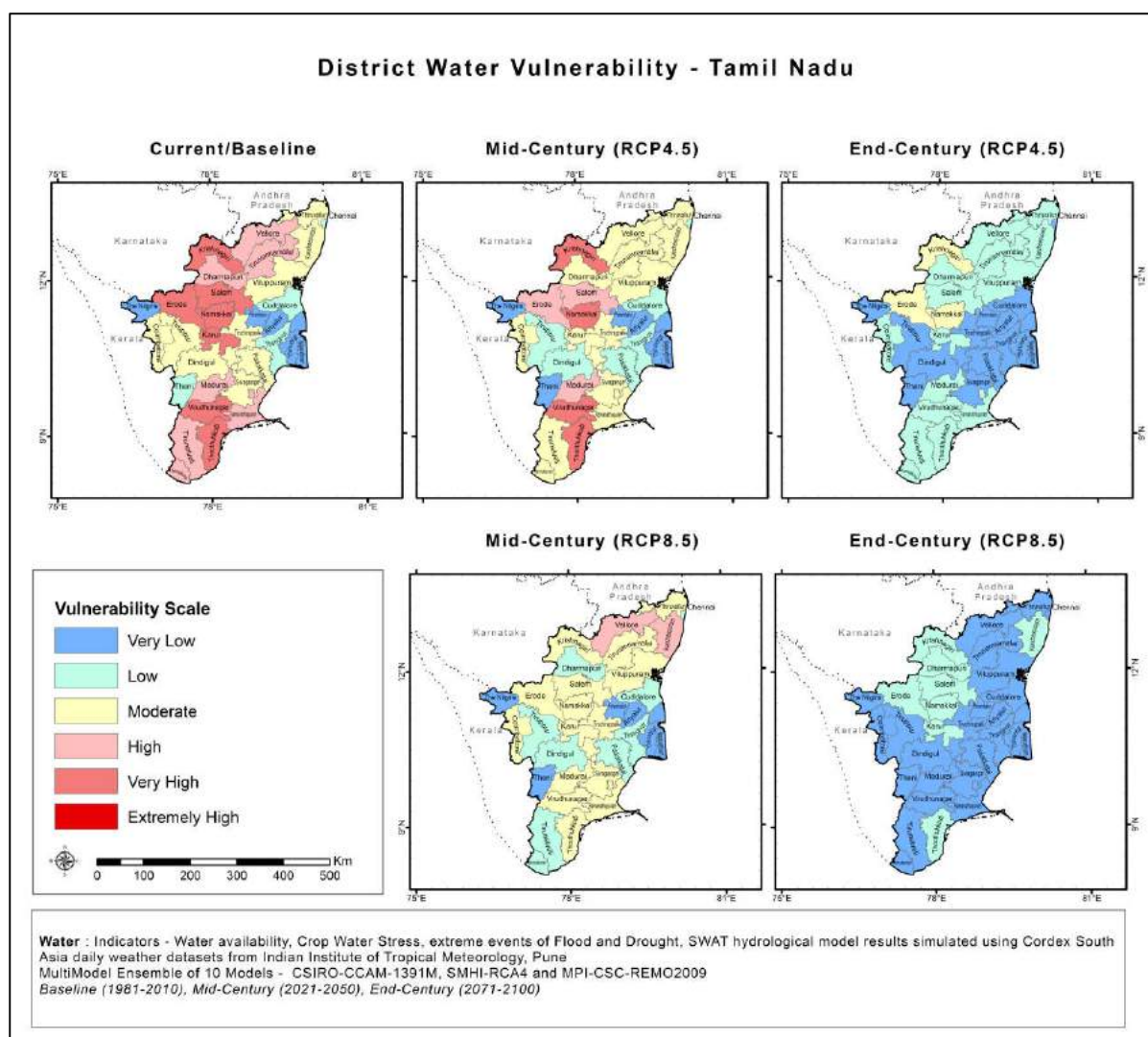


Figure 4.4 Water Resources Vulnerability for Tamil Nadu districts under RCP4.5& RCP8.5

(Source: www.climatevulnerability.in)

Current Water Vulnerability for Tamil Nadu

As per current water vulnerability, Erode, Krishnagiri, Namakkal, Thoothukkudi, Karur, Salem and Virudhunagar districts have shown very high vulnerability. The major contributing factors include higher drought frequency, lower surface water availability and high crop water stress. Further, Madurai, Kanniyakumari, Dharmapuri, Tirunelveli, Vellore, Tiruvannamalai and Ramanathapuram fall under high vulnerability category and nine districts namely, Tiruppur, Sivaganga, Viluppuram, Kancheepuram, Tiruchirappalli, Dindigul, Coimbatore, Pudukkottai and Thiruvallur fall under moderate vulnerability category.

Projected Water Vulnerability for Tamil Nadu

The overall water resources vulnerability of the districts is projected to decrease towards mid-and end century when compared to the current conditions for both emission scenarios. Districts vulnerability under RCP8.5 scenario is projected to be lower when compared to the RCP4.5 scenario.

RCP4.5, Mid-century: Vulnerability of thirteen districts is projected to decline under RCP4.5 mid-century scenario as compared to current vulnerability. District Karur is projected two folds decrease from current very high vulnerability to fall under moderate vulnerability category. 12 districts namely,

Dharmapuri, Dindigul, Erode, Kanniyakumari, Pudukkottai, Ramanathapuram, Salem, Theni, Tirunelveli, Tiruppur, Tiruvannamalai and Vellore are projected to fall under high, moderate, low and very low vulnerability from current vulnerability very high, high, moderate and low vulnerability category. The remaining 19 districts are projected to remain in the same vulnerability category as current vulnerability.

RCP4.5, End-century: Vulnerability of twenty-seven districts is projected to decline under RCP4.5 end-century scenario as compared to current vulnerability. 15 districts namely, Dharmapuri, Dindigul, Erode, Kanyakumari, Krishnagiri, Madurai, Namakkal, Pudukkottai, Ramanathapuram, Sivaganga, Tiruchirappalli, Tirunelveli, Tiruppur, Tiruvannamalai and Vellore are projected two folds decrease in vulnerability. 4 districts namely, Karur, Salem, Thoothukkudi and Virudhunagar are projected three folds decrease from current very high vulnerability to fall under low vulnerability category. Ariyalur, Nagapattinam, Perambalur, The Nilgiris and Thiruvavur districts are projected to remain in the same vulnerability category as current (very high to low) (Figure 4.4).

RCP8.5, Mid-century: Vulnerability of seventeen districts is projected to decline under RCP8.5 mid-century scenario when compared to current vulnerability. Ten districts namely, Dharmapuri, Erode, Kanniyakumari, Karur, Krishnagiri, Namakkal, Salem, Thoothukkudi, Tirunelveli and Virudhunagar are projected to have a two folds decrease in the vulnerability category. District Kancheepuram being an exception is expected to increase its vulnerability as crop water stress and drought frequency in north east monsoon is expected to increase while surface water availability is expected to decrease (moderate to high).

RCP8.5, End-century: Vulnerability of twenty-seven districts is projected to decline under RCP8.5 scenario towards end-century as compared to current vulnerability. District namely, Virudhunagar is projected the maximum decline from current very high vulnerability to fall under very low vulnerability category. 12 districts are projected three folds decrease in vulnerability, Erode, Karur, Krishnagiri, Namakkal, Salem and Thoothukkudi (very high to low vulnerability) while Kanniyakumari, Madurai, Ramanathapuram, Tirunelveli, Tiruvannamalai and Vellore (high to very low vulnerability).

4.2.3 Climate Change Impact and Vulnerability to Forest & Biodiversity

A drastic climatic change has severe impacts on various ecosystems especially forest ecosystem and its biodiversity. IPCC AR5 concluded that forest ecosystems could be extremely impacted by future climate change. Even with a temperature increase of 1-2 °C most ecosystems and landscapes will be impacted through changes in species composition, productivity and biodiversity (Leemans&Eickhout 2004).

It is likely that changing temperature and precipitation pattern will produce a strong direct impact on tropical forests. In addition, for forestry, the climate change-induced modifications of frequency and intensity of forest fires, outbreaks of insects and pathogens, and extreme events such as high winds, topsoil erosion may be more important than the direct impact of higher temperatures and elevated CO₂.

India, a country with rich biodiversity, has different forest types in different climatic zones, each with a unique floristic composition. The forests are mainly distributed in the Himalayas, Western Ghats, Eastern Ghats, and Vindhya ranges.

A study by Remya et al (2014) the Eastern Ghats receives both southwest and northeast monsoons. The mean annual precipitation is 800-960 mm and mean minimum and maximum temperatures are 17 and 33° C respectively. Many models were employed to study the climate change and its future impacts up to the end of this century. The results indicated that the maximum temperature will rise to 3.5 - 3.9° C more than that of present. Likewise, the annual rainfall projections have shown a decreased trend of -1 to -10 percent by the end of this century. They are also indications of increasing heavy rainfall events during northeast monsoon and slight decrease during southwest monsoon season. The vagaries in monsoon and the higher temperature have serious impacts on biodiversity conservation. Remarkable changes have already been noticed in deciduous and thorn forest. Currently the evergreen forests are also under stress due to changing climate. Model results shows

that there will be a reduction in the habitat suitability of evergreen species by the end of this century (Ramachandran 2019)⁴⁶.

Eastern Ghats spans 3 main agro climatic zones in Tamil Nadu. Jawadi, Elagiri, and part of Kalrayan fall under the North Eastern Agro-climatic Zone. Chitery, Shevroy Western Kalrayan, BodaimalaiKolli, and Pachamalai fall under the North Western Agro climatic zone. Semmalai, Ayyalur, Karandamalai, and Alagar Hill fall under the Southern Agro climatic zone. High-resolution regional climate change projections for EG using PRECIS indicates an increase in maximum temperature of about 1.2–1.4, 2.3–2.5, and 3.5–3.9 °C during the 2020s (2005–2035), 2050s (2035–2065), and 2080s (2065–2095), respectively, in relation to the baseline period (1970–2000). Minimum temperature was also projected to increase by 1.3–1.4, 2.3–2.7, and 3.3–3.5 °C respectively. Annual rainfall projections for the same periods indicate a general decrease of about 1–8, 1–10, and 1–10 percent, (Table 4.2; Figure 4.5) respectively (CCC&AR report 2013).

Table 4.2 Future climate projections for Eastern Ghats, Tamil Nadu, India

Climate Variability	2020s (2005–2035)	2050s (2035–2065)	2080s (2065–2095)
Maximum Temperature (°C)	1.2–1.4	2.3–2.5	3.5–3.9
Minimum Temperature (°C)	1.3–1.4	2.3–2.7	3.3–3.5
Rainfall (%)	-1– -8	-1– -10	-1– -10

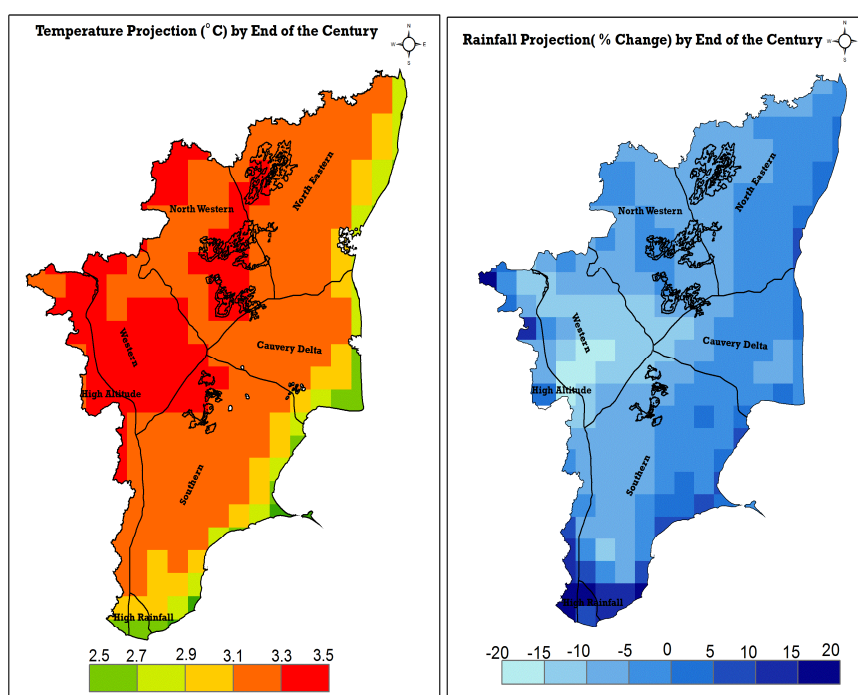


Figure 4.5 Temperature and rainfall projection by the end of the century at Eastern Ghats

Remya et al 2015 have demonstrated the changing climate through recent vagaries in the temperature and rainfall, and their impending impact on tropical ecosystems⁴⁷. Because of the long

⁴⁶Ramachandran 2019 Critical Analysis Of Forest Degradation In South Eastern Ghats, India: Evolving Suitable Restoration And Conservation Strategies, DSc, Thesis, Bharathiyar University

⁴⁷Remya K, Ramachandran A, jayakumar S 2015, Predicting the current and future suitable habitat distribution of *MyristicadactyloidesGaerin* using MaxEnt model in the Eastern Ghats, India, Ecological Engineering

lifespan of trees in forest ecosystems, they cannot adapt easily to major changes to the climate. Modelling the habitat suitability Maximum Entropy (using MaxEnt) of *Myristicadactyloides* for current and future climate change scenarios demonstrated that the habitat suitability of *M. dactyloides* will decline under the moderate climate change scenario for the years 2050 and 2070.

Similarly, modelling the habitat suitability distribution of semi-evergreen forest in the southern Eastern Ghats of India using the MaxEnt model based on moderate emission scenario, by Ramachandran, 2019, demonstrated the intricate relationship between changes in temperature and rainfall and habitat suitability as shown in Figure 4.6. This suggests the possibility of a reduction in the suitable habitat of semi-evergreen forest in the future. Compared to the present extent of 50700 ha, about 1800 ha might be suitable in 2050s and only 800ha in 2070s. This study also suggests the urgent need to have suitable adaptation strategies for conserving these forests.

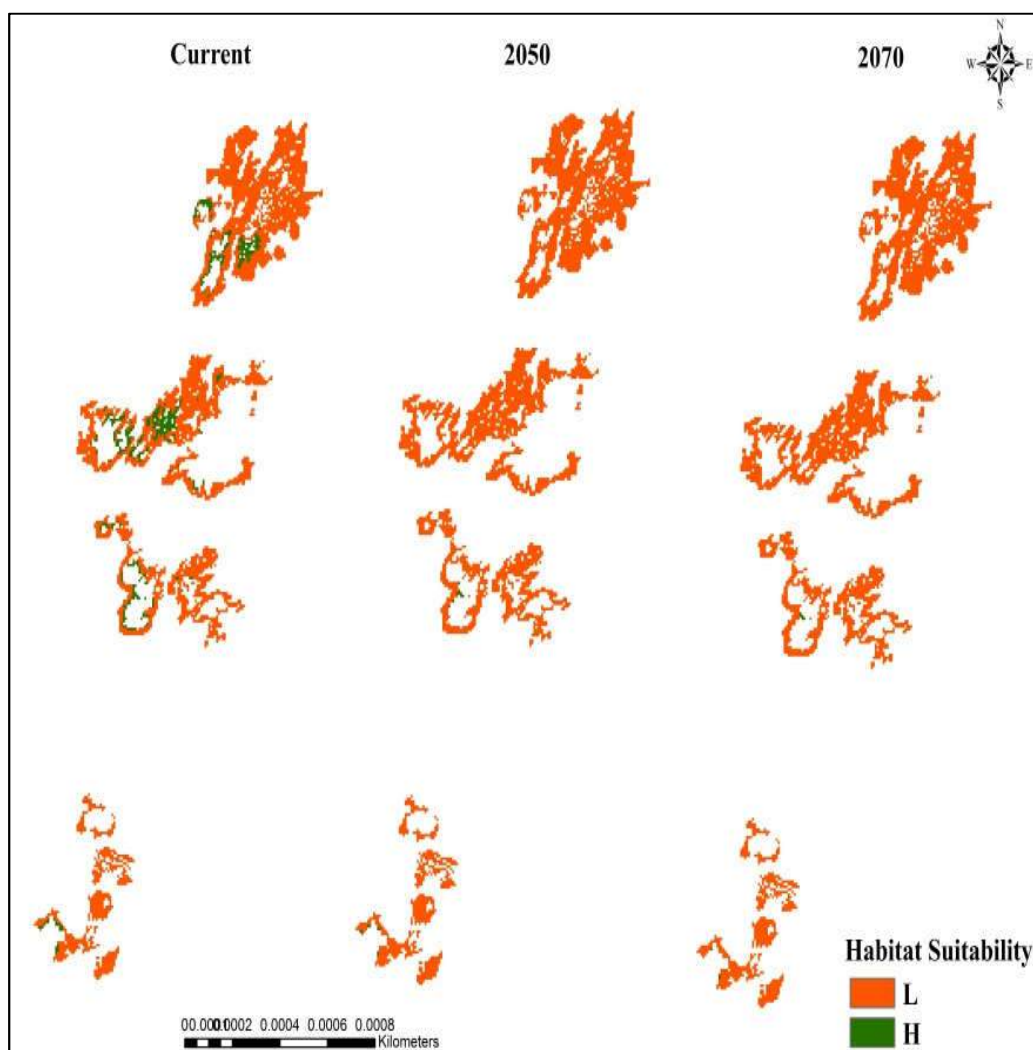


Figure 4.6 Habitat suitability distribution of Semi evergreen forest type

L: Low suitability; H: High Suitability (Source: Ramachandran 2019)

4.2.4 Climate Change Impact on Vulnerability in Coastal Ecosystem

Tamil Nadu has a 1076 km long coastline divided into 13 coastal districts (Thiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, Nagapattinam, Thiruvallur, Thanjavur, Pudukottai, Ramanathapuram, Thoothukudi, Thirunelveli, Kanyakumari) is more prone to multi- hazards than

other States and is frequented by hazards of various nature and different intensities⁴⁸. It has three major ports, seven Government captive ports, 16 non-major ports, fishing harbors and a variety of coastal industries such as nuclear and thermal power plants, refineries and fertilizers. The coast is also endowed with varied coastal habitats such as mangroves, corals, seaweeds, sea grass beds, salt marshes, mudflats and sand dunes⁴⁹. The coastal districts of Tamil Nadu are densely populated, that ranges from as low as 320 people per sq.km to more than 3000 people per sq.km. The low-lying East coast of India (comprising of Tamil Nadu and Puducherry) is more vulnerable than the West coast, is more prone to the occurrence of cyclones than the latter (Saxena et al. 2012). An added risk factor is that large parts of this coastal zone are low-lying with a gentle slope, resulting in wide inundation areas, thus increasing the vulnerability of the region (Ramachandran et al 2017)⁵⁰.

It is important to note that the historical record of cyclonic storms that crossed the coast of Tamil Nadu in the last three decades shows that an average of two cyclonic storms occurred in a decade. In November 2000, a severe cyclonic storm crossed the coast at Cuddalore at 110 kmph wind speed (IMD 2011; Khan 2013). Cyclone Nisha in 2008, cyclone Laila in 2010 and cyclone Thane in 2011 were the worst hit cyclones of Tamil Nadu coast along with cyclone Jal in 2010, cyclone Nilam in 2012 and cyclone Phailin in 2013, Flood at Chennai in 2015, Vardah cyclone in 2016, atheOckhi cyclone in 2017 and Gaja Cyclone in 2018.

In addition, Projection of climate change-induced sea-level rise for the coasts of Tamil Nadu accelerated rise in sea level due to changing climate poses a serious threat to coastal resources and coastal communities of Tamil Nadu. Sea level Rise (SLR) is one of the greatest climate change impacts faced by the low-lying coastal regions of the world including the coastal districts of Tamil Nadu (Ramachandran et al 2017), and therefore adaptation to the rising sea level is considered as the most appropriate response measure to face this global challenge. However, this requires a pragmatic approach that's locally suitable. SimCLIM climate modeling software has been used to project SLR for the Tamil Nadu coast in India for four periods of time slice namely 2025, 2050, 2075 and 2100 for Two RCP scenarios viz., RCP 4.5 and RCP 8.5 of IPCC AR5. It has been estimated that the projected average medium range of SLR for the chosen study area may range from 7.39 cm to 50.01 cm for RCP 4.5; 7.40 cm to 78.15 cm for RCP 8.5 for the time slices from 2025 to 2100. Table 4.3 & Table 4.4 show the Projections of Climate Change- induced SLR for the Coastal districts of Tamil Nadu based on IPCC AR5- RCP 4.5 and RCP8.5.

Further, a study by Ramachandran et al 2016, assessed that the most vulnerable coastal districts of Tamil Nadu with respect to climate variability. An index-based vulnerability assessment was done in Coastal Districts of Tamil Nadu choosing groundwater, agriculture, and fisheries sectors. Individual sectors' vulnerability levels vary widely across the districts due to the differences in its physical exposure, sensitivity and adaptive capacity. As shown in the Figure 4.7 Villupuram and Thanjavur districts exhibited very high vulnerability in the groundwater sector, while Ramanathapuram and Thoothukudi districts showed highest vulnerability in the agricultural sector, and Thoothukudi and Villupuram districts in the fisheries sector. From the overall composite vulnerability assessment, Thoothukudi and Villupuram districts required immediate attention as it falls under high to very high vulnerability category in all the three sectors among 13 coastal districts (Figure 4.7).

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⁴⁸NIDM (2015) Tamil Nadu: National Disaster Risk Reduction Portal. National institute of disaster management, New Delhi, India. Available at <http://nidm.gov.in/pdf/dp/TamilNadu.pdf> DoE 2015

⁴⁹ENVIS (2014) Coastal districts profiles of Tamil Nadu. Environmental information system (ENVIS), Department of Environment. Government of Tamil Nadu and SuganthiDevadason Marine Research institute, Tuticorin, India, p 151

⁵⁰A Ramachandran, AS Khan, K Palanivelu, R Prasannavenkatesh, 2017 Projection of climate change induced sea level rise for coast of Tamil Nadu and Pudhucherry in Simclim

Table 4.3 Projection of climate change-induced SLR for the coasts of Tamil Nadu using SimCLIM based on IPCC AR5-RCP 4.5

Year Range	2025			2050			2075			2100		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Districts												
Thiruvallur	04.94	07.37	12.64	13.20	19.75	33.95	23.22	34.79	59.87	33.25	49.84	85.80
Chennai	04.94	07.37	12.64	13.20	19.75	33.95	23.22	34.79	59.87	33.25	49.84	85.80
Kancheepuram	04.77	07.51	11.47	12.74	20.11	30.80	22.42	35.44	54.31	32.10	50.76	77.81
Villupuram	04.77	07.51	11.47	12.74	20.11	30.80	22.42	35.44	54.31	32.10	50.76	77.81
Cuddalore	04.74	07.54	12.98	12.64	20.19	34.86	22.24	33.57	61.47	31.84	50.95	88.09
Nagapattinam	04.74	07.40	12.25	12.64	19.82	32.90	22.24	34.92	58.02	31.84	50.02	83.14
Thiruvarur	04.74	07.40	12.25	12.64	19.82	32.90	22.24	34.92	58.02	31.84	50.02	83.14
Thanjavur	04.74	07.40	12.25	12.64	19.82	32.90	22.24	34.92	58.02	31.84	50.02	83.14
Pudukkottai	04.81	07.40	12.32	12.85	19.82	33.09	22.60	34.92	58.35	32.36	50.02	83.62
Ramanathapuram	04.51	07.27	11.55	12.03	19.46	31.00	21.16	34.28	54.67	30.29	49.10	78.33
Tuticorin	04.55	07.10	11.57	12.13	19.02	31.05	21.34	33.51	54.74	30.55	47.99	78.44
Thirunelveli	04.53	07.00	11.70	12.09	18.73	31.41	21.26	32.99	55.39	30.44	47.25	79.37
Kanyakumari	04.94	07.67	10.89	13.18	20.55	29.24	23.20	36.21	51.55	33.21	51.87	73.86
Average	04.74	07.39	11.97	12.66	19.81	32.14	22.28	34.78	56.68	31.90	50.01	81.23

(Source: Ramachandran et al 2017)

Table 4.4 Projection of climate change-induced SLR for the coasts of Tamil Nadu using SimCLIM based on IPCC AR5-RCP 8.5

Year Range	2025			2050			2075			2100		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Districts												
Thiruvallur	04.94	07.38	12.65	14.97	22.42	38.58	30.31	45.48	78.36	51.85	77.88	134.29
Chennai	04.94	07.38	12.65	14.97	22.42	38.58	30.31	45.48	78.36	51.85	77.88	134.29
Kancheepuram	04.77	07.51	11.48	14.45	22.84	34.99	29.26	46.32	71.06	50.05	79.33	121.77
Villupuram	04.77	07.51	11.48	14.45	22.84	34.99	29.26	46.32	71.06	50.05	79.33	121.77
Cuddalore	04.74	07.54	12.99	14.34	22.92	39.61	29.02	46.49	80.45	49.65	79.62	137.88
Nagapattinam	04.74	07.40	12.26	14.34	22.51	37.38	29.02	45.65	75.92	49.65	78.17	130.11
Thiruvarur	04.74	07.40	12.26	14.34	22.51	37.38	29.02	45.65	75.92	49.65	78.17	130.11
Thanjavur	04.74	07.40	12.26	14.34	22.51	37.38	29.02	45.65	75.92	49.65	78.17	130.11
Pudukkottai	04.81	07.40	12.33	14.57	22.51	37.60	29.50	45.65	76.36	50.46	78.17	130.87
Ramanathapuram	04.51	07.27	11.56	13.64	22.09	35.22	27.60	44.80	71.53	47.21	76.72	122.58
Tuticorin	04.55	07.10	11.57	13.75	21.59	35.27	27.84	43.79	71.63	47.62	74.98	122.75
Thirunelveli	04.53	07.00	11.71	13.71	21.26	35.69	27.74	43.11	72.48	47.45	73.82	124.20
Kanyakumari	04.94	07.67	10.90	14.95	23.34	33.22	30.27	47.34	67.44	51.79	81.07	115.56
Average	04.74	07.40	11.98	14.36	22.50	36.52	29.08	45.63	74.17	49.74	78.15	127.12

(Source: Ramachandran et al 2017)

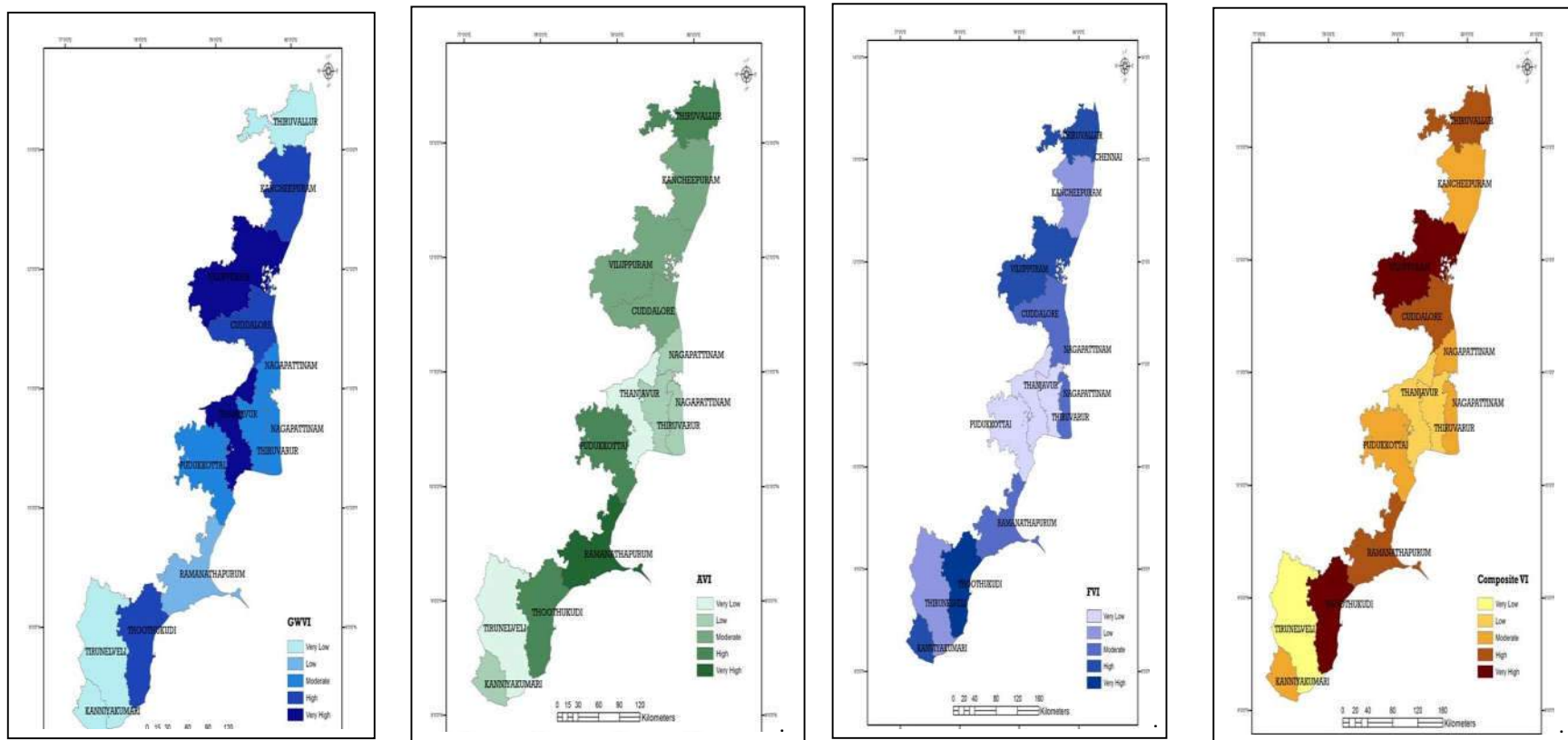


Figure 4.7 Vulnerability of Water, Agriculture, Fisheries and composite vulnerability index of climate variability in the coastal Districts of Tamil Nadu

(Source Ramachandran et al 2016)

4.2.5 Impacts of Climate Change on Energy Sector

Energy production and use accounts for substantial portions of the total GHG emissions and is regarded as the major driver behind the human induced climate change. The impact of climate change in undermining prosperity and hampering sectoral growth is known, but on the other hand the energy sector is equally impacted. Though the power sector is also closely associated with the causes for global warming, the phenomenon of Climate Change itself can impact the electric power sector in many ways. The impact of climate change on the sector and vice-versa is outlined in Table 4.5:

Table 4.5 Impacts of climate change on Energy sector and vice-versa

Impact of Energy Sector on Climate Change	Impact of Climate Change on Energy sector
Supply sector	- Projected increase in temperature coupled with the likelihood of water scarcity might impact the power generation of the units and enhance the existing energy demand supply gap of the State and increase dependency on unscheduled power procurement leading to financial bleeding of Distribution Companies(DISCOM). It creates stress for the capacity of generation and grid networks. - Increase in water temperature are likely to reduce electricity generation efficiency, especially where water availability is also affected. Such a scenario has impact on thermal power generation. - Changes in precipitation patterns and surface water discharges, as well as an increasing frequency and/or intensity of droughts, may adversely impact hydropower generation and reduce water availability for cooling purposes to thermal and nuclear power plants. - Extreme weather events, such as stronger and/ or more frequent storms, can reduce the supply and potentially the quality of fuel (coal, oil, gas), reduce the input of energy (e.g., water, wind, sun, biomass), damage generation and grid infrastructure, reduce output, and affect security of supply. - Rapid changes in cloud cover or wind speed (which may occur even in the absence of climate change) can affect the stability of those grids with a sizeable input of renewable energy, and longer-term changes in these and precipitation patterns can affect the viability of a range of renewable energy systems. - Sea level rise can affect energy infrastructure in general and limit areas appropriate for the location of power plants and grids. This scenario may impact the power plants located or planned close to coastal areas in Tamil Nadu.
Demand Sector	Increase in temperature has a dichotomous relation with increase in energy demand to meet up the cooling load.

4.2.6 Climate Change Impacts on Sustainable Habitat Sector

Impacts under Sustainable Habitat have been categorized into Housing, Drinking Water, Urban Development, Health and Sanitation, Waste Management, Transport, Energy, Pollution and Greening of Urban Spaces. The impact of climate change on the sectors outlined in Table 4.6 and 4.7.

Table 4.6 Impact of Climate Change on Sustainable Habitat sector

Sector	Impact
Housing	- Increased number of floods due to erratic rainfall pattern and extreme natural events like Tsunami (coastal regions) which has an adverse effect on the State's urban infrastructures - As the State has become more urban, the need for housing has expanded rapidly but the housing market has not been able to keep up with this space, creating a stock demand-supply mismatch - Thrust on infrastructural development with increase in population - With the increase in migration rate, growth of urban slums creates acute shortage of housing stock in urban regions, Rural-urban influx is one of the major impacts of the climate change in this sector - Increasing land and real estate prices have pushed people to occupy marginal lands in and around cities - In most cities, a significant share of the population lives in slums or in similar precarious settlements, which are characterized by substandard housing and inadequate access to clean water and sanitation. This exposes the public to health hazards and significant environmental threats - The construction of 13.91 lakh houses results in the increase in carbon footprints and creates a major impact on climate change
Drinking Water	- More and more extraction can lead to scarcity, rising population results in increase in demand of household water - Inequitable distribution of water - Full coverage remains a difficult to achieve factor with the increasing demand - Change in rainfall pattern is a threat to the sustainability of water use in the urban regions as it leads to reduction of water availability and quality from surface and groundwater sources
Urban Development	- Climate extreme events affects the development planning and delays the project implementation - Floods result in sinking of land due to water logging, making the land unsuitable for further development - Increase in storm events and high intensity flood also interrupts the transport and communication, energy and water supply system in urban areas due to breakdown of power transmission lines, water pipelines and road infrastructures - Unregulated developments gives rise to environmental degradation and congestion
Health and Sanitation	- Floods leading to contamination of water resources and supply system, resulting in increased occurrence of water borne diseases - Interference in public health services and infrastructure - Flooding affects the septic tank causing blockages or system damage
Waste Management	- Increase in urban population concentration results in generation of solid waste which affects the environment as well as the public health - Contamination of the groundwater sources - Uncontrolled emission of methane by decomposition of waste - Increased incidence of vector-borne diseases
Transport	- Increased intensity of flood and natural events like Tsunami affects road infrastructure that causes major disruption in transportation system. - Increase in vehicular population means increase in vehicular emission which adds to the pollution - Increasing population concentration and vehicular population results in traffic congestion of the State resulting in more emissions of Carbon monoxide (CO) and Hydrocarbons (HC)
Energy	Increase in urban population and rise in temperature results in more demand for energy and its consumption leading to a, continuous stress on the energy supply system of the State, and also results in waste generation which implies increase in GHG emission
Pollution	- Unregulated constructions resulting in increase in suspended particulate matter in the air - Removal of green cover increases the local temperature - Urban sprawl leads to more and more emissions affecting the air quality - Increase in vehicular emission adds to air pollution
Greening of urban spaces	Unplanned and unsustainable urbanisation causes mass removal of green cover which leads to increase in air temperatures, difference in temperature between urban and rural areas (heat island effect)

4.3 COMPOSITE VULNERABILITY INDEX

The vulnerability analysis has been based on Composite Vulnerability Index (CVI) using multivariate analysis for current and projected climate (under RCP4.5 and RCP8.5 climate scenario towards mid-century and end-century). The IPCC working definition of vulnerability as a function of exposure, sensitivity, and adaptive capacity has been used and all 63 identified indicators have been categorised into adaptive capacity, sensitivity and exposure (Figure 4.8). Accordingly, five sectoral vulnerability indices for social, economic, climate, water resources and agriculture have also been generated. The indices would facilitate the identification of districts, which are vulnerable to climate change and need special attention towards adaptation.

4.3.1 Current Composite Vulnerability Index

With respect to the present climate, 5 districts, namely Ramanathapuram, Vellore, Viluppuram, Krishnagiri and Nagapattinam, fall under very high vulnerability category followed by the 6 districts, Dharmapuri, Thoothukkudi, Ariyalur, Cuddalore, Virudhunagar and Sivaganga, under high vulnerability; 13 districts, namely Karur, Thanjavur, Pudukkottai, Salem, Tiruvannamalai, Dindigul, Tirunelveli, Perambalur, Thiruvavur, Kancheepuram, Thiruvallur, Tiruchirappalli and Madurai, under moderate vulnerability; 5 districts, Erode, Namakkal, The Nilgiris, Theni and Kanniyakumari, under low vulnerability and 3 districts, Coimbatore, Tiruppur and Chennai, under very low vulnerability category (Figure 4.9).

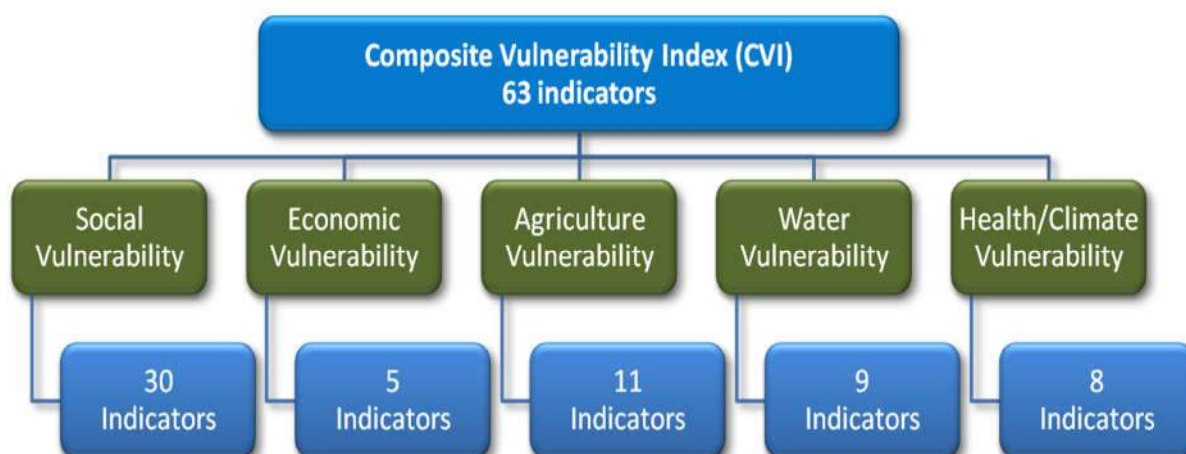


Figure 4.8 Flowchart for Construction of Composite Vulnerability Index

(Source: www.climatevulnerability.in)

4.3.2 Projected Vulnerability Profile

The overall Composite Vulnerability (CV) of the Tamil Nadu districts is projected to decrease towards the mid-century and end-century as compared to the baseline for both the IPCC AR5 climate scenarios. District vulnerability is likely to decrease further under RCP4.5 scenario as compared to RCP8.5 scenario towards both mid and end-century. Districts towards mid-century are relatively more vulnerable than end-century for both the climate scenarios (Figure 4.9).

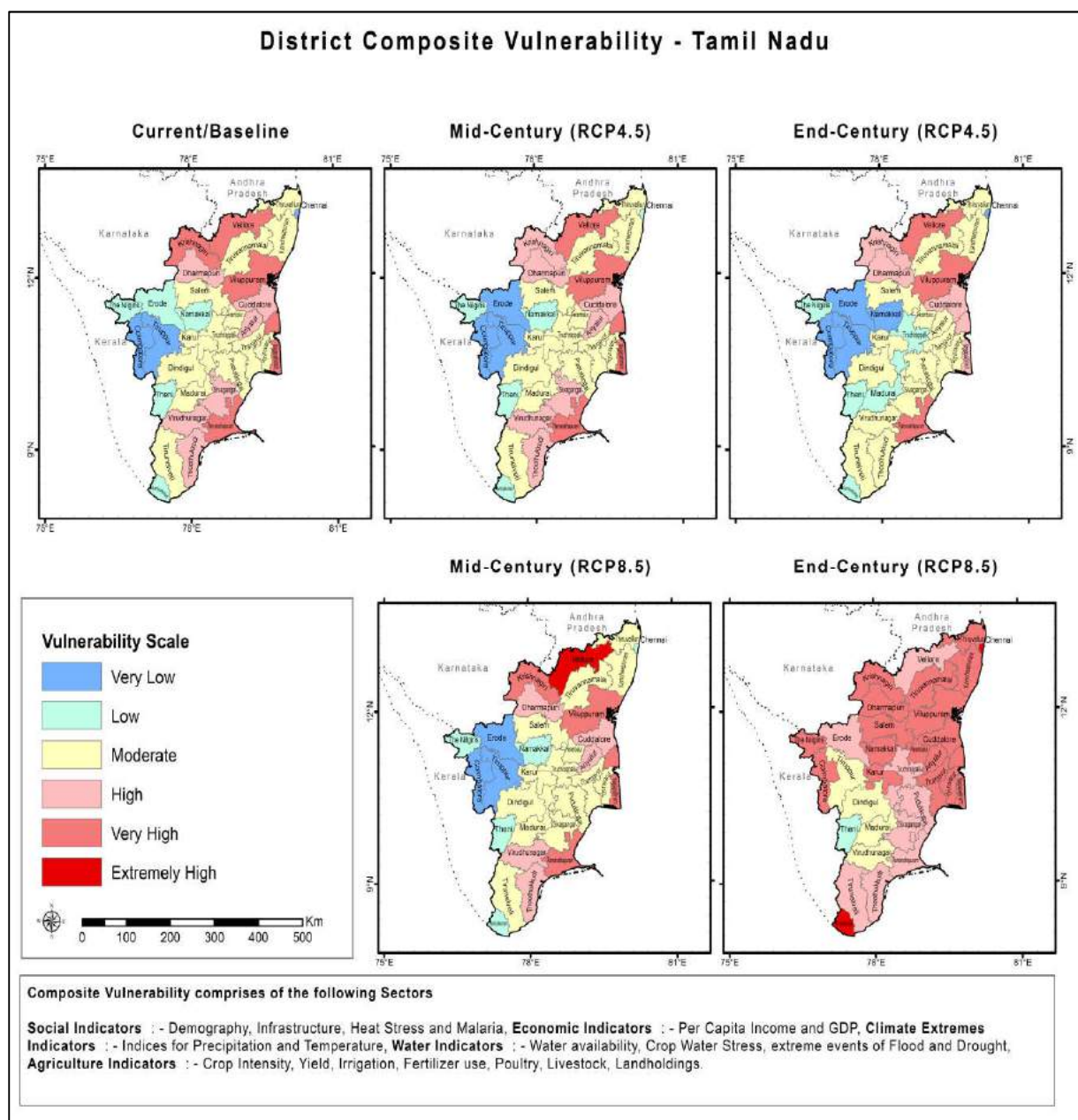


Figure 4.9 Composite Vulnerability Index for Tamil Nadu Districts for Current, Mid and End Century

(Source: www.climatevulnerability.in 2018)

- The overall climate extremes vulnerability of the districts is projected to increase towards mid-and end-century when compared to the current conditions for both the emission scenarios. Districts vulnerability under RCP8.5 scenario is projected to be higher as compared to RCP4.5 scenario towards both mid and end-century. The projected increase in vulnerability towards end-century is higher than that of mid-century for both the emission scenarios for the districts.
- The overall water resources vulnerability of the districts is projected to decrease towards mid-and end-century as compared to the current conditions for both emission scenarios. Districts vulnerability under RCP8.5 scenario is projected to be lower when compared to RCP4.5 scenario. Districts towards mid-century are relatively more vulnerable than end-century for both the climate scenarios.
- Composite Vulnerability (CV) improves towards the mid-century and end-century when compared to the current conditions as exposure to drought weeks in south west and north east monsoon season, exposure to consecutive dry days and sensitivity to crop water stress in south west monsoon season is projected to decrease while adaptive capacity to seasonal surface water availability, ground water availability in south west monsoon season, rainfall and rainy days are projected to increase.

RCP4.5, Mid-century: District Chennai's vulnerability is projected to increase towards mid-century. It moves to low vulnerability category from current very low vulnerability category. Vulnerability of two districts namely, Erode (low to very low category) and Krishnagiri (very high to high category) are projected to decline when compared to the current vulnerability as water resource vulnerability is projected to decline for these districts.

Vulnerability category of rest of the 29 districts is projected to remain unchanged and is projected to have same current vulnerability category as baseline. 9 districts namely, Coimbatore, Madurai, Thiruvallur, Kancheepuram, Tirunelveli, Cuddalore, Virudhunagar, Thoothukkudi and Nagapattinam are projected to marginally increase their vulnerability as their index values are projected to increase implying increase in degree of vulnerability.

RCP4.5, End-century: Vulnerability of ten districts is projected to decline under RCP4.5 scenario towards end-century as compared to current vulnerability. These districts are Krishnagiri and Nagapattinam (very high to high), Ariyalur, Sivaganga, Thoothukkudi and Virudhunagar (high to moderate), Madurai and Tiruchirappalli (moderate to low) and Erode and Namakkal (low to very low vulnerability category). This is so because exposure to drought weeks in south west and north east monsoon season, exposure to consecutive dry days and sensitivity to seasonal crop water is projected to decrease while adaptive capacity to seasonal surface water availability, rainfall and rainy days are projected to increase.

RCP8.5, Mid-century: Two districts are projected to move to higher vulnerability category from current lower vulnerability category towards mid-century. Chennai is projected to move to low from current very low vulnerability and district Vellore which has very high current vulnerability is projected to exacerbate further and fall under extremely high vulnerability category. This is mainly due to projected decrease in exposure to rainfall and rainydays and sensitivity to heat stress.

RCP8.5, End-century: Vulnerability of ten districts is projected to decline under RCP8.5 scenario towards end-century as compared to current vulnerability as water resource vulnerability is projected to decline for these districts. These districts are Ariyalur, Cuddalore, Erode, Madurai, Namakkal, Sivaganga, The Nilgiris, Thoothukkudi, Tiruchirappalli and Virudhunagar.

Table 4.7 Districts current and projected composite vulnerability along with disaggregated subcomponents for Tamil Nadu

Composite Vulnerability Index (CVI)						
			RCP4.5		RCP8.5	
Districts	BL Rank	BL	MC	EC	MC	EC
Coimbatore	1	VL	VL	VL	VL	VL
Tiruppur	2	VL	VL	VL	VL	VL
Chennai	3	VL	L	VL	L	VL
Erode	4	L	VL	VL	VL	VL
Namakkal	5	L	L	VL	L	VL
The Nilgiris	6	L	L	L	L	VL
Theni	7	L	L	L	L	L
Kanniyakumari	8	L	L	L	L	L
Madurai	9	M	M	L	M	L
Tiruchirappalli	10	M	M	L	M	L
Thiruvallur	11	M	M	M	M	M
Kancheepuram	12	M	M	M	M	M
Thiruvarur	13	M	M	M	M	M
Perambalur	14	M	M	M	M	M
Tirunelveli	15	M	M	M	M	M
Dindigul	16	M	M	M	M	M
Pudukkottai	17	M	M	M	M	M
Salem	17	M	M	M	M	M
Tiruvannamalai	17	M	M	M	M	M
Thanjavur	20	M	M	M	M	M
Karur	21	M	M	M	M	M
Sivaganga	22	H	H	M	M	M
Cuddalore	23	H	H	H	H	M
Virudhunagar	23	H	H	M	H	M
Ariyalur	25	H	H	M	H	M
Thoothukkudi	26	H	H	M	H	M
Dharmapuri	27	H	H	H	H	H
Nagapattinam	28	VH	VH	H	VH	VH
Krishnagiri	29	VH	H	H	VH	VH
Viluppuram	30	VH	VH	VH	VH	VH
Vellore	31	VH	VH	VH	EH	VH
Ramanathapuram	32	VH	VH	VH	VH	VH

SOURCE: WWW.CLIMATEVULNERABILITY.IN

4.4 STOCKTAKING ON VULNERABILITY REDUCTION SINCE EARLIER VERSION OF TNSAPCC

State has been implementing various climate change interventions since the development of earlier version of TNSAPCC (2014), which has reduced the vulnerability of the State to an extent. Therefore, a comparative analysis has been done using Thirty-four indicators (list of indicators is in Annex 4.B) for which data was available at the district level were collected for computation of the index using Principal Component Analysis (PCA) method. It is a multivariate computer model that assigns weight based on the hidden pattern of data without bias. This includes following steps:

- Identification of indicators (in this case indicators where sectoral investments made have been chosen for relevance, as well as climate linked hazards and exposures).
- Normalization of indicators has been done.
- In PCA method, Eigen values have been computed and vector multiplications have been done to determine the weights category wise.
- As per AR5 Vulnerability is a function of sensitivity and adaptive capacity $V = f(\text{sensitivity, adaptive capacity})$ and risk is a function of hazard, exposure and vulnerability $R(h, e, v)$.

Concisely, the data shows the change in vulnerability as well as the change in risk over the last five years. The indicators have been enlisted in the Table 4.8, which are hazard/ exposure/ sensitivity/adaptive capacity linked in nature.

Table 4.8 Indicators for the computation of the combined vulnerability index

Indicators	Interpretation with respect to risk and hazard due to their exposure, sensitivity and adaptive capacity
Projected increase in temp in °C by 2050	higher temperature means higher risk of drought hazard, water scarcity and yield loss in the agriculture sector
Projected increase in precipitation in % by 2050	higher precipitation means higher risk of flood hazard yield loss due to submergence of the exposed
Sex Ratio (2011)	A better sex ratio ensures gender equity and division of work and greater ability to cope with risks
Urban population growth decadal	Higher exposed urban population affects the capacity of the exposed to cope with hazards and they will have less ability to cope with the risk due to resource congestion
Decadal growth in population	Higher the growth, higher the exposure and higher the vulnerability
Gap in work participation rate (1991-2001) and (2001-2011)	Higher the gap, higher the risk
Poverty (2014-15)	While poverty is multi-dimensional, larger the exposure by the poor population have less ability to cope with risk
Literacy rate (2011)	Higher the literacy of the exposed population the better ability to cope with the risk due to climate change
% of Forest area to Geographical area (2011)	Positive change in forest area helps in carbon sequestration and reduction in local climate variability

Indicators	Interpretation with respect to risk and hazard due to their exposure, sensitivity and adaptive capacity
Share of agriculture workers (2011)	Agricultural workers especially with monoculture of paddy, have the least diversification and having low value addition are sensitive to climate variability adversely
Cropping Intensity (2011-12)	Positive change in cropping intensity shows instances of diversification, availability of residual moisture, irrigation and lesser vulnerability
Livestock Population (2012)	The food habits of livestock population in the region is likely to enhance methane emission due to enteric fermentation and has adverse relationship with climate sensitivity
Electricity access% to total House Hold (2011)	People having better access to electricity have better adaptive capacity
Access to toilets (2011)	Access to toilets will reduce open defecation, reduce water pollution, reduce disease burden and improve adaptive capacity
Share of HH using firewood for cooking (2011)	People using firewood for cooking would affect forest biomass, increase indoor air pollution, pulmonary diseases and affect adaptive capacity in the long run
Share of HH using crop residue for cooking (2011)	same as above
Share of HH using electricity for cooking (2011)	Usage of electricity for cooking will enhance adaptive capacity
Access to Mobile Phone Only % (2011)	Access to mobile phones will help in dissemination of information like early warning system, pest and disease, market information, etc. and would improve the adaptive capacity
Households having access to banking services (2011)	Households having access to banking will help in improving their livelihood and improved adaptive capacity
Road density (2011)	Better road density is linked to reduction in congestion, livelihood options and thus enhances adaptive capacity

4.4.1 Climate Vulnerability of Tamil Nadu Base Line 2011 To 2017

The Risk and Vulnerability Index for baseline 2011-12 and 2017 have been presented in Figure 4.10, 4.11, 4.12 and 4.13. Table 4.9 and 4.10 show the changes in the risk and vulnerability spatially in last five-year period since the TNSAPCC was implemented. It shows that rapidly urbanized districts to have high risk and vulnerability. The high exposure both in terms of habitation and infrastructure puts these districts at higher risk. In the case of Chennai, the vulnerability has remained the same in last five years while the risk profile has increased. In the case for Ariyalur, it is a bit anomalous. It has moved to the top in the list of vulnerable districts in 2017, from a much better position in 2011. This could be due to temperature increase of the area. Krishnagiri which tops the vulnerability has a relatively high risk profile. Viluppuram continues to be in high risk and vulnerability due to high urbanization and sensitivity. Likewise, coastal districts like Kanyakumari, the vulnerability has increased. The green cover rich Nilgiris has been shown as moderately vulnerable. Vellore, Ramanathapuram continues to be in the high risk and vulnerable.

Tamil Nadu Vulnerability Index 2011

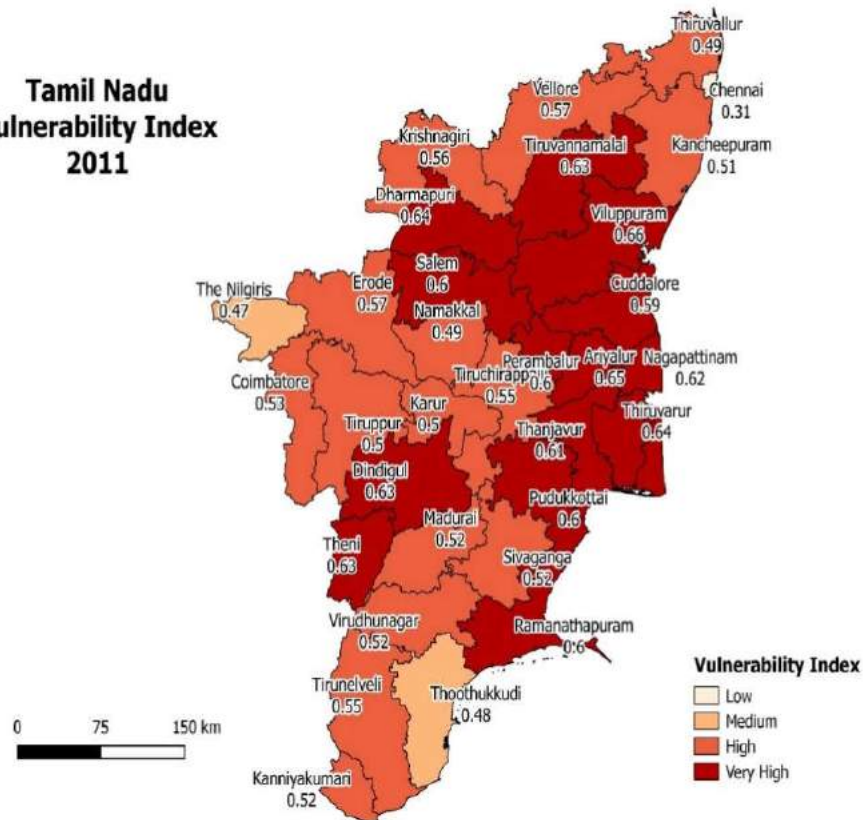


Figure 4.10 Baseline Vulnerability and Risk Index, 2011

Tamil Nadu Vulnerability Index 2017

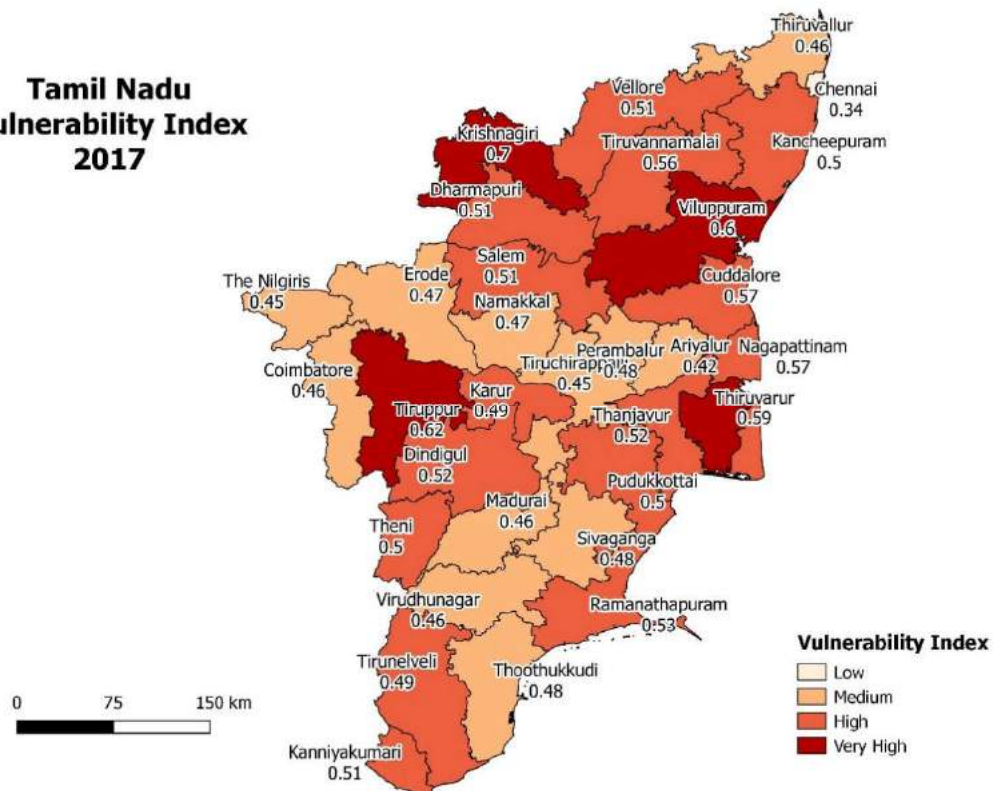


Figure 4.11 Vulnerability and Risk Index, 2017

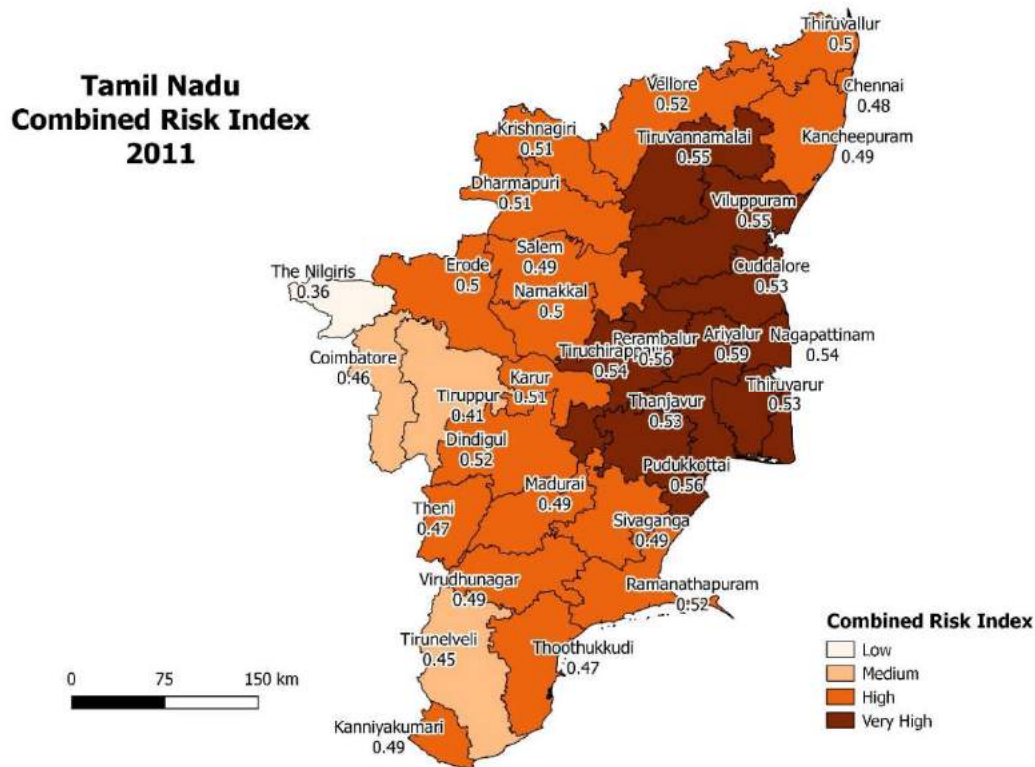


Figure 4.12 Baseline Risk Index, 2011

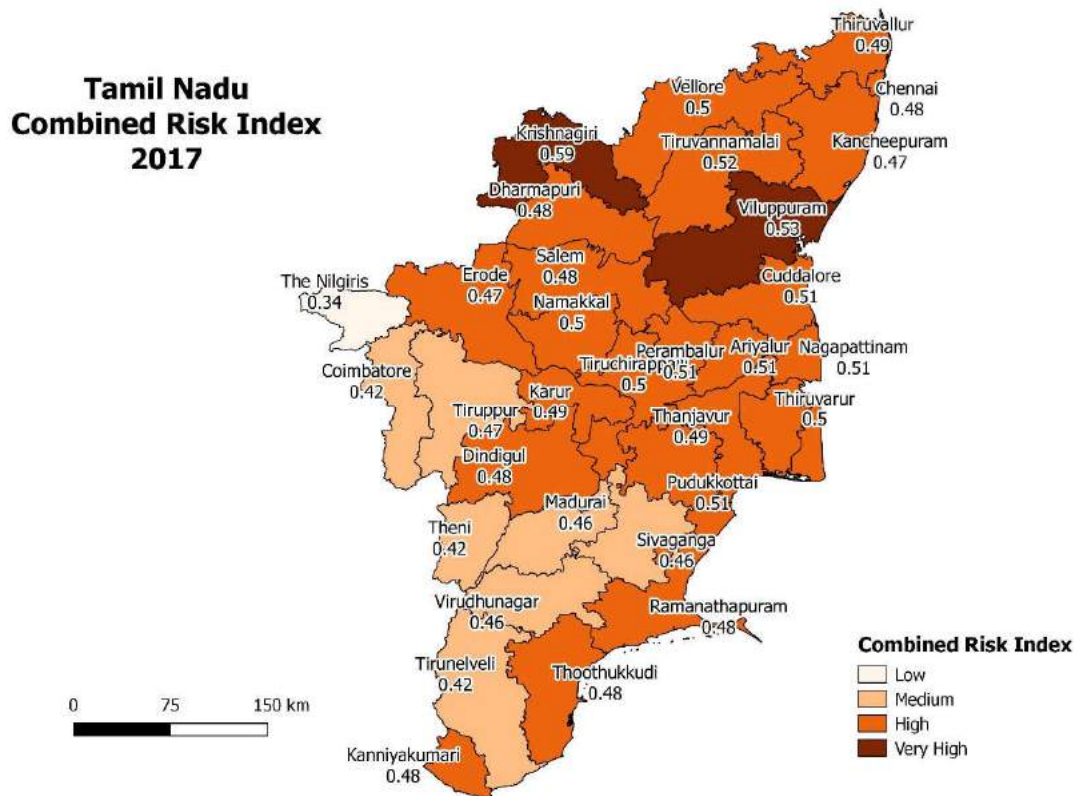


Figure 4.13 Risk Index, 2017

Table 4.9 Spatial spread of risk and vulnerability in Tamil Nadu, 2017

Districts	Hazard Index	Exposure Index	Composite Vulnerability Index	Combined Risk Index	Composite Vulnerability Rank (2017)	Combined Risk Rank (2017)
Ariyalur	0.627	0.470	0.423	0.506	31	8
Chennai	0.657	0.456	0.341	0.484	32	16
Coimbatore	0.336	0.465	0.461	0.421	28	30
Cuddalore	0.600	0.376	0.567	0.515	6	4
Dharmapuri	0.538	0.378	0.513	0.476	12	22
Dindigul	0.434	0.472	0.524	0.477	9	21
Erode	0.450	0.488	0.472	0.470	23	24
Kancheepuram	0.640	0.276	0.497	0.471	17	23
Kanyakumari	0.384	0.541	0.513	0.479	11	19
Karur	0.560	0.413	0.490	0.488	19	14
Krishnagiri	0.600	0.474	0.697	0.590	1	1
Madurai	0.529	0.401	0.463	0.464	27	26
Nagapattinam	0.532	0.427	0.568	0.509	5	7
Namakkal	0.573	0.470	0.468	0.504	24	10
Perambalur	0.654	0.400	0.479	0.511	22	6
Pudukkottai	0.567	0.474	0.503	0.514	15	5
Ramanathapuram	0.498	0.413	0.527	0.479	8	18
Salem	0.549	0.395	0.505	0.483	14	17
Sivaganga	0.482	0.423	0.481	0.462	20	27
Thanjavur	0.510	0.443	0.521	0.491	10	13
The Nilgiris	0.142	0.444	0.449	0.345	30	32
Theni	0.246	0.521	0.502	0.423	16	29
Thiruvallur	0.715	0.281	0.464	0.487	25	15
Thiruvarur	0.548	0.377	0.588	0.504	4	9
Thoothukkudi	0.482	0.471	0.479	0.477	21	20
Tiruchirappalli	0.600	0.436	0.451	0.496	29	11
Tirunelveli	0.296	0.461	0.493	0.416	18	31
Tiruppur	0.321	0.459	0.623	0.467	2	25
Tiruvannamalai	0.638	0.369	0.560	0.523	7	3
Vellore	0.559	0.417	0.509	0.495	13	12
Viluppuram	0.597	0.392	0.604	0.531	3	2
Virudhunagar	0.533	0.382	0.464	0.460	26	28

Table 4.10 Spatial Change in Risk and Vulnerability in Tamil Nadu

Districts	Composite Vulnerability Rank (2011)	Composite Vulnerability Rank (2017)	Combined Risk Rank (2011)	Combined Risk Rank (2017)
Ariyalur	2	31	1	8
Chennai	32	32	26	16
Coimbatore	20	28	29	30
Cuddalore	14	6	10	4
Dharmapuri	4	12	15	22
Dindigul	5	9	13	21
Erode	15	23	19	24
Kancheepuram	25	17	25	23
Kanyakumari	24	11	24	19
Karur	26	19	16	14
Krishnagiri	17	1	14	1
Madurai	22	27	21	26
Nagapattinam	8	5	6	7
Namakkal	28	24	18	10
Perambalur	13	22	3	6
Pudukkottai	11	15	2	5
Ramanathapuram	10	8	11	18
Salem	12	14	23	17
Sivaganga	21	20	20	27
Thanjavur	9	10	9	13
The Nilgiris	31	30	32	32
Theni	6	16	27	29
Thiruvallur	29	25	17	15
Thiruvarur	3	4	8	9
Thoothukkudi	30	21	28	20
Tiruchirappalli	19	29	7	11
Tirunelveli	18	18	30	31
Tiruppur	27	2	31	25
Tiruvannamalai	7	7	5	3
Vellore	16	13	12	12
Viluppuram	1	3	4	2
Virudhunagar	23	26	22	28

CHAPTER 5: CLIMATE CHANGE STRATEGY - ADAPTATION

Adaptation in human systems is defined by the IPCC as “the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities”.⁴²

In the light of the observed and anticipated changes and vulnerability information, adaptation to the consequences of climate change constitutes the cornerstone of the State’s action on climate change.

In line with the sectoral and vulnerability information presented throughout the chapters 2 to 4, the following sectors have been selected as the key adaptation areas for Tamil Nadu: **Agriculture, Water, Forests and Biodiversity, and Coastal Area Management**. The fifth sector/ mission (on **strategic knowledge for climate change**) is cross-cutting.

The rest of this chapter presents a sector-wise account of progress vis-à-vis TNSAPCC targets and related implementation challenges. In addition to sectors covered in TNSAPCC, new sectoral plans on climate-related **Disaster Management** and **Health and Sanitation** are introduced (sections 5.6 and 5.7, respectively, which accordingly are organized slightly differently from the rest of the chapter). Based on extensive consultations with relevant stakeholders, communities, civil society and concerned departments, for each sector, a set of forward-looking possible actions for enhanced adaptation is proposed in this chapter.⁴³ Although the chapter is adaptation-centric, many of the actions contained will equally yield significant mitigation benefits.

5.1 SUSTAINABLE AGRICULTURE

5.1.1 Stocktaking

5.1.1.1 Progress Mapping (IN LAST 5 YEARS)

Activities in Agriculture and allied sector are implemented by various government departments such as Department of Agriculture, Department of Horticulture, Agriculture Engineering Department, Department of Agriculture Marketing, Department of Water Resources, Tamil Nadu Water Supply and Drainage Board, Department of Fisheries, Department of Animal Husbandry, Research institutions like Tamil Nadu Agriculture University and Tamil Nadu Fisheries University. A total of 8 broad strategies were proposed for Agriculture and allied sector in the TNSAPCC, under which 40 sub-activities were taken up. 35 of these activities were adaptation, 2 were mitigation and remaining 3 activities were for both adaptation and mitigation. Total amount proposed for Agriculture and allied sector for 2012-17 was INR 23,093.14 Crore. Out of this budget, an amount of INR 3,073.45 Crore was allocated for adaptation activities, INR 1,413.32 Crore was allocated for mitigation activities and INR 155.22 Crore was allocated for activities with both adaptation and mitigation components. The detailed physical achievements and financial allocations under this sector for 2012-17 (under TNSAPCC) as part of stock taking exercise has been given in **Annexure 33** and **Annexure 33** respectively.

5.1.1.2 Key Issues and Challenges

This section deals with the major issues and challenges faced by the sector concerning Climate Change and its impacts. The issues and challenges have been broadly divided into technical, institutional/regulatory, financial and socio- economic.

⁴²https://www.ipcc.ch/site/assets/uploads/2018/11/sr15_glossary.pdf

⁴³ The prioritisation of actions proposed and prioritized in this chapter is explained in more detail in chapter 7.

Table 5.1 Key issues and Challenges of Agriculture and Allied Sector

Area	Issues/Challenges
Technical	• Small farm holdings, highly vulnerable to changing climate • More than 48 percent of the area under dryland depending on highly varying rainfall for crop production. In these areas crop production is limited to only one season from September end to December. • Labor shortage during peak seasons for planting and harvesting • Lack of storage facilities • Stagnation in yield levels even with high input application
Institutional/ Regulatory	• Indiscriminate use of fertilizers and pesticides increases the cost of cultivation as well as pollution levels • Pollution in water bodies due to mixing up of industrial effluents which affects human and animal health • Low level of technology adoption resulting in poor crop yields • Political instability also hinders the smooth functioning of the sector.
Financial	• Lack of Minimum Support Price (MSP) for most of the crops that leads to uncertainty in income of the farmers • Lack of procurement at MSP at farm gate level • All the farmers in a particular location cultivate the same crop that results in surplus of crop in the market leading to reduction in market price. • Failure of market competition, decreasing farmer's income, lack of marketing channel for surplus of marketable agriculture and horticulture crops.
Socio-Economic	• Erratic monsoon and increased frequency of extreme weather events such as cyclone and drought disrupted the life of the farming community. For example, cyclone Gaja hit Thanjavur and Nagapattinam Districts and uprooted more than 45 lakh coconut trees. • As major water sources of Tamil Nadu lie in the neighboring States, Interstate water sharing conflict create greater problem and uncertainty. Example: Cauvery water release for cultivation is becoming highly uncertain which is the source of irrigation in almost 14 districts of Tamil Nadu.

5.1.1.3 Gap/Barrier Analysis

After understanding the operational and financial progress of the activities under various strategies in TNSAPCC (5.1.1.1 and Table 5.2) the following analysis was put forth for the gaps and barriers to more complete TNSAPCC strategy implementation (Table 5.2)

Table 5.2 Gap/ Barrier analysis of Agriculture and Allied Sector

Sl.No.	Strategy	Progress	Gap/Barrier
1	Research and development to improve the productivity of crops: crop season, water conservation, varietal development for major crops	- Breeding and testing of varieties tolerant to various climatic stress is in progress - Developing and evaluating crop genotypes (rice, millets, pulses, oilseeds, fodder horticulture and forest trees) of short duration with high yield potential suitable for different soil conditions is in progress - Developed newer formulations of microbial inoculants and seed treatment methods for productivity enhancement of millets - Identified pre-sowing seed management techniques for small millets - Development of organic technologies for cropping systems is in progress - For improving the maize productivity, cultivation packages such as seed quality improvement, crop geometry to suit mechanical weeding, nutrient management were standardized	- More funds needs to be allocated for undertaking research and development activities for crop improvement as well as for standardizing cultivation practices. - There should be strong research and development activities to develop policies backed with evidences related to climate change in the State of Tamil Nadu - With the increase in the population, the requirement or demand of all crops has increased tremendously. The improved production practices should be quickly adopted by the farmers in Tamil Nadu. - Measures to popularize the identified technologies and cultivars should be strengthened for better adoption
2	Mitigating effect of extreme weather events: Climate profiling of agronomic practices and popularizing with extension strategies	- Cultivars suitable to withstand the climate vagaries have been identified - Standardized water harvesting techniques - Measures identified to improve soil health sustainability - Contingency plan developed for all the crops to manage extreme weather condition - Climate proofing of watersheds to manage the drought was implemented - Integrated Farming Systems was popularized as an alternative income to farm families - Department of Agriculture in Tamil Nadu has established network of seed banks, food banks and cold storage to ensure supply of inputs at times of contingencies - TNAU is providing market intelligence - Integrated voice message on weather based agro advisories, market demand & price forecasting to farming community regularly - Climate Change knowledge Management cell has been established with DST support to warn and train farmers and officials regarding extreme events - With central and State Government support, crop insurance programme has been popularized	- Other non-farm activities such as labour in the banian factory, other industries should be explored for risk protection mechanisms in the event of extreme weather situations - Weather based crop insurance need to be popularized - Farmer producer organizations should be promoted to enhance farm profits - Market intelligence should be popularized among the farming community

Sl.No.		Strategy	Progress	Gap/Barrier
3		Improving ground water recharge and countering sea water intrusion	- Recharging the aquifers using the abandoned open wells and defunct bore wells is done as part of watershed programme supported by NABARD - Sub-surface dykes were constructed - Excess flood water at upper reaches is being diverted to water deficit areas by the WRO of PWD - Activities on deep ploughing to break sub surface hard pan to increase infiltration efficiency and improve ground water quality and check sea water incursion is being carried out with funding support from Department of Agriculture and Agricultural Engineering in all the districts of Tamil Nadu	Building the capacity of the extension persons to popularize the technologies for managing extreme weather events, soil salinity management and use of salt tolerant varieties
4		Soil conservation strategies	- Department of Agriculture, Public Works Department and Agricultural Engineering Department are promoting minimum/no tillage during fallow period, compartmental bunding, contour farming, deep ploughing, mulching for all crops besides conducting awareness programmes and training. - Efforts are also made to bring the fallow land and degraded land back to cultivation - PKVY and DoA together promote organic farming including horticultural crops	Mechanization to suit small farm holders should be identified and popularized to resolve the scarcity of labour
5.		Water conservation strategies	- Presently the micro irrigation scheme is implemented through Tamil Nadu Horticultural Development Agency in the name of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) scheme with the involvement of Dept. of Agriculture, Horticulture and Agri. Engineering. - Research activities on conjunctive use of Irrigation water is in progress at TNAU - IAMWARM and PMKSY schemes are strengthening existing water harvesting structures and repairing and replacing the shutters in the irrigation tanks and drainage channels - Creation of additional farm ponds through State fund is in progress	Alternate and less water requiring crops with drought resistant and heat tolerant should be promoted during Kharif season to increase production levels.

Sl.No.	Strategy	Progress	Gap/Barrier
6	Promotion of Inland Fishing and Brackish water aquaculture	- New breeds for inland fisheries to be developed by Tamil Nadu Dr. Jayalalitha's Fisheries University (TNJFU) - Fish culture in pens and cages, establishment of hatcheries are done - Government Fish Seed Farms/ Hatchery has been renovated to increase fish seed production for fish farming and improving inland fisheries for tank and its command areas through IAMWARM project - Culture of Sea bass is encouraged - Advocating Culture of Special Pathogen free <i>Litopenaeus vannamei</i> to increase per hectare production	Institutional linkages should be strengthened for better technology transfer
7	Animal husbandry and dairy development	- Promoting breeding with indigenous varieties to improve resilience to climate change - Grazing area for increasing the fodder in the villages have been increased - Village ponds have been renovated to harvest more rainwater for animal; drinking purpose - Veterinary University has been entrusted with responsibility of disease surveillance and developing forecasting of disease outbreaks for short- and long- term timeframe - Capacity building programmes are organized to manage dairy effectively and profitably for the farm women as well as land less farm laborers.	Alternate agro based livelihood options such as livestock rearing, honeybee rearing, goatery, mushroom production should be promoted among the farming community as alternate sources of income

5.1.2 Sector Planning

5.1.2.1 National and State-level Targets and their Linkages

As set out in chapter 1, TNSAPCC 2.0 intends to link the sectors of TNSAPCC 2.0 to NDC and SDG commitments to synergies with the goals of NDCs under the Paris Agreement, though the targets under NDCs are National targets. It also contributes towards achieving other development goals including Sustainable Development Goals (SDGs).

One of the focus areas of the Adaptation Component of the Indian Nationally Determined Contribution (NDC) is the agricultural sector. India is already engaging in climate action, focusing on mitigation and adaptation strategies. Efforts are being made to identify agriculture sector-specific barriers & challenges and plans are being made to remove the barriers for ensuring the food security involving both Central and State Government.

The 5.3 illustrates Tamil Nadu's overarching targets of relevance to Sustainable Agriculture and their linkages with agreed targets at the national and international level.

Table 5.3: State-level targets of relevance to Sustainable agriculture and their linkages to national and international goals. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform.

	SDG-related			NDC-related
International targets	SDG2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	SDG6: Ensure availability and sustainable management of water and sanitation for all	SDG 12: Ensure sustainable consumption and production patterns	
National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined ⁴⁴ .			For better adaptation to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture
State-level targets 2030	Proportion of population (marginalized and vulnerable) with access to food grains at subsidized prices: target value to be defined	Capacity of sewage water treated (MLD): 100%		

5.1.2.2 Proposed activities from 2021-30 Under Agriculture and Allied Sector

Based on extensive stakeholders and line ministry consultations and stated in the sectoral and vulnerability information of chapters 1- 4, the total number of 51 activities are proposed for a long-term implementation (2021-30) in the State out of which 35 activities are to be continued from TNSAPCC and 16 activities are newly proposed by the different bodies in the State during the TNSAPCC 2.0. The total amount required for the implementation of the proposed activities in agriculture and allied sectors is approximately INR 71,731.94 Crore. Out of this, INR 48,031.94 Crore has been allocated for adaptation (45 activities), INR 20,900 Crore has been allocated for mitigation (3 activities) and INR 2,800 Crore for combined activities of adaptation and mitigation (3 activities). Out of these 51 proposed activities, 7 are related to capacity building, 30 are investment projects, 2 are policy-oriented activities and 12 are research-based activities. The detailed description of the proposed activities for 2021-2030 and budget allocation along with implementing departments has been given in **Annexure 3B** and **Annexure 3C** respectively.

⁴⁴ The NIF is available under <http://www.mospi.gov.in/national-indicator-framework>

5.1.2.3 Priority Adaptation Actions

Given the limited resources available and the experience of TNSAPCC implementation, all the proposed activities for 2021-30 were ranked based on a multi-criteria scorecard method which is described in detail in section 7.3.

Based on the method of prioritization, the first five high priority activities under **Sustainable Agriculture Sector** for 2021-30 are listed in Table 5.4

Table 5.4 Priority activities for Agriculture and Allied Sector

Priority Activity	Implementing Authority	Proposed Budget in INR Crore for 2021-30
Extension strategies to popularize climate resilient management practices to mitigate extreme weather events (ART and MLT)	KVK/ DoA	600
Increase the use of Micro Irrigation technology Viz., Drip, Sprinkler, Rain gun, Mobile Sprinkler in dry land, Garden land and Horticultural farming system	DoA/ AED/ DoH	20000
Creation of additional farm ponds to capture the runoff water and utilize the harvested water during critical stages of crop growth and to recharge the aquifers to improve the quality of irrigation water	DoWR/ AED	2000
Strengthening and popularizing the existing crop insurance programme	DoA	3350
Intensify disease surveillance and develop forecasting of disease outbreaks for short- and long-term time frames	DoAH	20
Promote breeding with indigenous varieties to improve resilience to climate change	DoAH	10

5.2. WATER RESOURCES

5.2.1 STOCKTAKING

5.2.1.1 Progress Mapping (In Last 5 Years)

Activities in the Water sector are carried out by various government bodies like the Department of Water Resources, Public Works Department, Department of Agriculture, Department of Horticulture, Agriculture Engineering Department, Department of Agriculture Marketing, Department of Fisheries, Department of Animal Husbandry, Technical Institutions like Tamil Nadu Agriculture University and capacity building institutions like Irrigation Management Training Institute in the State. A total of 5 broad strategies were proposed for Water sector in the TNSAPCC, under which 25 sub-activities were taken up. 19 of these activities were primarily adaptation-related, 5 were mitigation-focused and the remaining one activity was both for adaptation and mitigation. The total amount proposed for the water sector for 2012-17 was INR12,626 Crore. Compared to this proposed total, an amount of INR 34,352.89 Crore was actually allocated for adaptation activities, INR 322.50 Crore was allocated for mitigation activities and INR 10.56 Crore was allocated for activities with both adaptation and mitigation components. The detailed physical achievements and financial allocations under this sector for 2012-17 (under TNSAPCC) as part of stock taking exercise has been given in **Annexure 33** and **Annexure 33** respectively.

5.2.1.2 Key Issues and Challenges

Rapid industrialization and urbanization in Tamil Nadu are responsible for the huge increase in the demand for water. The inefficient management of this resource has led to deterioration in water quality, posing new challenges for water management and conservation. The hydrological cycle has altered most of the river basins due to land use change, inter-basin transfers, irrigation and drainage. This section deals with the major issues and challenges faced by the sector in the State concerning Climate Change and its impacts. The issues have been listed below:

a. Gap between demand and supply of water

The total water potential of the State including cross border contribution from Andhra Pradesh, Karnataka and Kerala is 1775.60TMC (47,680 MCM). This also includes ground water potential of about 20,649 MCM. The sectoral demand for water in 2011 was 49,773 MCM, which is about 2000 MCM more than the potential availability. The demand is projected to increase up to 48,766 MCM and 55,919 MCM in 2020 and 2045 respectively. The gap between supply and demand by 2020 is expected to be 5,211 MCM (11percent) and it is likely to grow up to 17 percent by 2050, if there is no intervention. Therefore, all possible measures must be taken to reduce the gap. Table 5. 5. shows the total sectoral demand of water resources of the State and Table 5.6 shows the supply/demand and gap percentage in 2001 and 2050.

Table 5.5 Total sectoral demand (MCM)

Sector/Year		2011	2020	2045
1	Domestic	2248	2608	3908
2	Irrigation	38032	38032	38302
3	Livestock	965	965	965
4	Industrial & Power	3884	5318	10774
5	Eco & Environmental Recreation & Minimum flow needs	519	1843	1970
	Sub Total	45,648	48,766	55,919
6	Add for existing 45 percent overall irrigation efficiency instead of 60 percent adopted in calculating irrigation for Cauvery basin	4125	4125	-
	Grand Total	49,773	52,891	55,919

Table 5.6 Supply/demand and gap percent in 2001 and 2050

Sl.No.	Supply	2001	2050
1	Total water resource	46,540	46,540
2	Agricultural demand	49,978	49,978
	Total demand	54,395	57,725
3	Gap	7,855	11,185
4	Gap percentage	16.88	24.05

b. Over exploitation of Groundwater

As per the available data, up to 80 percent of the total available ground water has been used. This has led to the decline in ground water table in most of the blocks. According to the estimates for 2009, out of 385+1 blocks, 138+1 (Chennai District) are over exploited, 33 are critical, 67 are semi-critical and in 11 blocks the quality is bad (Table 5.7).

Table 5.7 Over-exploitation of groundwater in Tamil Nadu

S. of No	Year of Assessment	Total Number of Blocks	Categorization of Blocks		
			Dark	Grey	White
1	January 1980	377	80 (21 %)	113 (30 %)	184 (49 %)
2	January 1992	384	89 (23 %)	86 (22 %)	209 (55 %)
3	January 1997	384	97 (25 %)	88 (23 %)	199 (52 %)
4	January 2009	385+1	183 (48 %)	67 (17 %)	136 (35 %)
5	January 2017	385	183 (48 %)	67 (17 %)	136 (5%)

c. Frequent Droughts

Tamil Nadu, a coastal State in south India, is also prone to droughts. The climate of the State ranges from dry sub humid to semiarid. An assessment of droughts in Tamil Nadu from 1977 to 1991 reveals recurrent drinking water shortages in major parts of the State and Chennai city. The worst drought years in the past 32 years were identified as 1980, 1982, 1983, 1987, 1989, 2002, 2003, 2004, 2006 and 2009. The drought of 1980 destroyed the ground nut crop over 1,00,000 hectares in the districts of Chengalpattu and Vellore. According to a study of rain pattern in peninsular India by the Indian Council of Agricultural Research (ICAR), the frequency of deficit rainfall and resultant drought is once in every three years in entire Tamil Nadu.

- Under moderate climate change emission scenario increase in drought conditions is likely to be in the districts of Krishnagiri, Kanniyakumari, Nilgiris, Perambalur, Salem, Tirunelveli and Vellore towards mid- century. Drought conditions are likely to improve for these districts towards end-century.
- Projected drought condition is likely to decrease under high emission scenario in most of the districts towards mid- and end-century.

d. Frequent Flood

Tamil Nadu generally receives copious rains during the Northeast monsoon. Heavy downpour within a short duration results in severe flood, causing great risk of damage to life and property of the people and to the States assets like irrigation infrastructure, roads, etc. Every year the most vulnerable coastal districts such as Cuddalore, Nagapattinam, Thanjavur and Thiruvavarur are prone to floods. Urban flooding is another significant problem in Tamil Nadu. The city of Chennai (capital) and its suburban areas are worst affected by flood because of improper drainage, encroachment of water bodies and waterways. In the last three decades, Chennai metropolitan area has experienced heavy floods during the years 1976, 1985, 1996, 1998, 2005, 2007 and 2008. The 2015 flooding was caused by torrential rain over four weeks in October and early November which was compounded by the more seasonal monsoon storms that hit the region in late November.

- The magnitude of peak discharge is projected to increase towards end-century scenario when compared to the mid-century scenario. Projected peak discharge is higher under high emission scenario. Manifold increase in peak discharge is likely for the districts of Dindigul, Kanniyakumari, Madurai, Tiruppur and Virudhunagar.
- Districts of Dindigul, Pudukkottai, Ramanathapuram, Sivaganga, Virudhunagar and Tiruppur are projected to have a higher increase in 75 percent and 90 percent dependable flow when compared to the other districts. Districts of Chennai, Thiruvallur, Vellore and Dharmapuri are projected to have decrease in low flows.
- Magnitude of high flows is projected to increase manifold. Many dams/reservoirs are likely to experience an increase in the peak flow by 10 to 40 percent towards end-century for both scenarios. This may call for additional risk management strategy.

e. Low Water Use Efficiency

The overall efficiency in surface irrigation like canals and tanks is only 40 percent whereas in well irrigation it is 70 percent. Researchers opine that this level of overall efficiency can be increased to 50 to 60 percent in surface irrigation and to 85 percent in well irrigation. If the overall efficiency were increased in phases from 40 percent to 50 percent and 60 percent, this would annually save about 3,000 MCM for every 10 percent increase in efficiency. Tamil Nadu has taken up several initiatives for tank rehabilitation in physical terms and have also taken up institutional reforms to improve efficiency in water use.

f. Cyclones

Northeast monsoon season (October – December) rains are received only based on the formation of cyclones in the Bay of Bengal or Indian Ocean. Floods are also caused by severe cyclonic storms. Often, the area of low pressure is formed as depression zone and subsequently they develop as cyclones that result in heavy rain. In Tamil Nadu, severe cyclonic storm occurred during north east monsoon period. In the last decade the cyclones such as “Nisha” (2008), “Jal” (2010), “Thane” (2011), “Nada” (2016), “Vardah” (2016), “Okhi” (2017) and the recent “Gaja” (2018) caused heavy damages to the lives and properties of the people. Normally these cyclonic storms lead to heavy rains e.g. Orathanadu in Thanjavur district recorded 660 mm of rainfall within a period of 24 hours during cyclone Nisha (2008). It is important to have provisions to channelize and store this water so that it can be used in the lean period.

g. Migration

Due to erratic rainfall and inflation of agricultural inputs, many agricultural lands were left as fallow or converted for other uses and agricultural laborers migrated to urban areas in search of jobs to sustain their life. The stream of people moving to large urban centers with hope of better fortune increases each year and this trend has led to large number of people, especially the poor, settling and living in floodplains in and around urban areas. These areas lie outside the formal city limits (peri-urban areas) so they are unplanned and unregulated. They have been ignored during urban planning systems, so they continually lack adequate drainage systems, water supply and sanitation facilities. This causes stress on the water sources and also increases the pollution levels. The

capital city of Chennai and other city corporations in the State are experiencing such stress. The competition between rural and urban demands for scarce water resources sometimes exacerbates the water shortage. Management of urban water demand necessitates a need to transfer ground water from peri-urban and rural areas and this leads to the water table level decline in those areas, affecting the sustainability of the sources.

5.2.2 GAP/Barrier Analysis

After an overall understanding of the operational and financial progress of the activities under various strategies in TNSAPCC the following analysis was put forth for the gaps and barriers of the sector in the State. (Table 5.8)

Table 5.8 Gap/ Barrier Analysis of Water Sector

Sl. No.	Activity	Progress	Gap/ Barrier
1	Interlinking of Rivers, and Construction of Mini Reservoirs to enhance availability of water to deficit region from the surplus region	Initiatives for interlinking of rivers in the southern region of Tamil Nadu has been taken up Significant progress has been made in the construction of mini reservoirs to store the excess water.	Plans should be made for possible inter-linkage of north and west Tamil Nadu rivers The water ways that carry excess water should be cleaned so that proper flow of water can be ensured
2	Construction of Water harvesting structures	Significant activities on construction of water harvesting structures have been made	Remote sensing and GIS information could be used for locating points for construction such structures and this needs to be done for effective inflow of excess rainwater
3	Restoration of tanks and traditional water bodies	Through State funds restoration of tanks and traditional water bodies are being done	Tamil Nadu is famous for system and non-system tanks. However, over a period, with lots of encroachments the purpose of these tanks have been defeated. This should be rectified
4	Water quality monitoring	Water quality monitoring is regularly done by TNPCB, Surface and Ground Water Board (PWD)	Sensitization for the people and public has to be done to avoid pollution of water bodies. Dyeing industry, leather industry, Paper mills and sugar industry are letting effluents directly into rivers without treating. Hence, there is need for treatment plants to reduce Pollution load.
5.	Research and development activities for increasing water productivity	Taken up by TNAU and PWD institutions	Research should be strengthened to increase the area under irrigated agriculture with available water. Micro irrigation should be a system of irrigation and all systems of irrigation should be evaluated for increasing water use efficiency at field level. From dam gate to farm gate, the conveyance loss should be

Sl. No.	Activity	Progress	Gap/ Barrier
			reduced by finding effective ways and means.
6.	Strengthening infrastructure to manage disaster	Indian meteorological Department and Disaster Management Authority is providing fore-warnings	Weather forecast accuracy should be improved to precisely forewarn the extreme weather events. Preparedness should be created by building the capacity of people to face extreme weather events. Infrastructure facilities such as coastal wave protection wall, bio- shields and drainage channels should be created and properly maintained.
7.	Policy related Interventions	Water Use Policy for the State is in existence	Evidence based Water Use Policy backed with scientific data should be made for the benefit of all the sectors who share water in the State.

5.2.3: SECTOR PLANNING – STRATEGIES FOR WATER RESOURCES

5.2.3.1 National and State-level targets and their linkages

Water availability in Tamil Nadu is rapidly changing in response to urbanization, population growth and food security concerns. Climate change is adding additional complexity to the existing situation. Climate change impacts have direct consequences on water security. Effective State-driven climate change adaptation should reflect the importance of water management by reducing vulnerability and building climate resilience. Water sector activities in Tamil Nadu have been planned in a manner to meet NDC commitments. Table 5.9 lists Tamil Nadu's overarching targets of relevance to Water Resources and illustrates their linkages with agreed targets at the national and international level.

Table 5.9 State-level targets of relevance to Water Resources and their linkages to national and international goals. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform.

	SDG-related	NDC-related
International targets	SDG6: Clean Water and Sanitation: Ensure Availability and sustainable management of water and sanitation for all	
National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined ⁴⁵ .	To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly water resources ⁴⁶
State-level i.e. targets 2030	100% Capacity of sewage water treated (MLD)	
Other targets and planned initiatives	- All the households in urban as well as rural villages are connected with water lines in the State of Tamil Nadu. - Water meters are fixed for calculating the water usage and accordingly water charges are levied	

⁴⁵ The NIF is available under <http://www.mospi.gov.in/national-indicator-framework>

⁴⁶ Additional water related initiatives mentioned in the NDC document as adaptation strategies include the Pradhan Mantri Krishi Sinchayee Yojana scheme to promote efficient irrigation practices, the Neeranchal watershed development programme and others

	• Safe drinking water is provided to all the people in urban as well as in rural areas • The State of Tamil Nadu is giving utmost importance to sanitation and hygiene • Under the smart city programme, for the main cities underground drainage (UGD) systems have been laid and connection have been given to all the households • Regular monitoring of water quality and identification of point sources of pollution is done • In the Cauvery sub-basin (Kalingarayan basin), baby canal has been constructed to separate the polluted water. • Industries that are not following the pollution treatment processes are not given license for further running • Selection of irrigation projects and under taking activities for efficiency improvement –NWM • IAMWARM project supports drip and sprinkle irrigation which increases the water use efficiency to more than 60 percent Setting of up of basin management organizations under the auspices of DoWR and CWC	

5.2.3.2 Proposed Activities from 2021-30 under Water Sector

Based on sectoral and vulnerability information presented in Chapters 2-4, totally 10 activities have been proposed for long-term implementation (2021-30) in the State wherein all activities that have been newly proposed by different bodies in the State and none of them to be continued through the TNSAPCC. The total financial amount proposed for SAPCC2.0 implementation in the water sector is approximately INR 19,041.84 Crore. Out of this INR 18,441.84 Crore has been allocated for adaptation (9activities) and INR 600 Crore for both adaptation and mitigation (one activity). Out of the 10 proposed activities 9 are investment projects and 1 is related to capacity building. The detailed description of the proposed activities for 2021-2030 and budget allocation along with implementing departments has been given in **Annexure 33** and **Annexure 33** respectively.

5.2.3.3 Priority Adaptation Actions

Given the limited resources and the experience of partial SAPCC implementation, all the proposed activities for 2021-30 were ranked based on a method which is described in detail in section 7.3.

Based on this method of prioritisation, the first five high priority activities under **Water Resources sector** for 2021-30 are listed in Table 5.10:

Table 5.10 Priority activities in Water Sector

PRIORITY ACTIVITY	PRIORITYACTIVITY	Proposed Budget for 2021 -30 in INR Crore
Climate change adaptation programme in Cauvery Delta	PWD/ TNAU	1560
Irrigated Agriculture Modernisation and Water-Bodies Restoration and Management (IAMWARM) Project	DoA/DoH/AED/Agri-Marketing Board/DoAH/ Dept.of Fisheries/ TNAU/ WRD/PWD	2820
Capacity building to various stakeholder including Officials, Irrigation engineers, field level staff on maintenance of irrigation system and increasing the water use efficiency	TNAU	20
Cauvery Modernisation Scheme Under the Accelerated Irrigation Benefits Programme (AIBP)	PWD	11420
Increasing water use efficiency	WRD/ DoA	600

5.3. FOREST & BIODIVERSITY

5.3.1 Stocktaking

5.3.1.1 Progress Mapping (In Last 5 Years)

Forest sector activities are carried out by various government bodies such as the Department of Forest, Department of Environment, Department of Agriculture, Department of Horticulture, Biodiversity Authority of Tamil Nadu and knowledge institutions like Forest College and Tamil Nadu Agriculture University in the State. A total of 8 broad strategies were proposed for Forest sector in the TNSAPCC, under which 42 sub-activities were taken up. 31 of these activities were adaptation-related, 5 focused primarily on mitigation and 6 covered both adaptation and mitigation. The total amount proposed for the forest sector for 2012-17 was INR 1528 Crore. Compared to this proposed budget, an amount of INR 766.78 Crore was actually allocated for adaptation activities, INR 202.35 Crore was allocated for mitigation activities and INR 471.84 Crore was allocated for activities with both adaptation and mitigation components. The detailed physical achievements and financial allocations under this sector for 2012-17 (under TNSAPCC) as part of stocktaking exercise has been given in **Annexure 33** and **Annexure 33** respectively.

5.3.1.2 Key Issues and Challenges

This section deals with the major issues and challenges faced by the sector in the State concerning Climate Change and its impacts. The issues have been listed below:

a. Degradation of Habitats

Due to the initial emphasis given to development related issues, the degradation of forest habitat has occurred. In this context several projects have come up in forest lands. The number of migratory corridors have been affected, leading to fragmentation of the habitat especially, for the elephants that later became the main reason behind human-wildlife conflict in Tamil Nadu. The other reasons include grazing, forest fires, invasion of exotic species, encroachments, quarrying and mining, destruction of the coral reefs and estuarine environments, over exploitation/ unscientific harvesting of Minor Forest Products etc.

Conservation of forests is to be promoted in areas where water is available (Western and Eastern Ghats are some examples) and no commercial exploitation is to be allowed. These areas are to be protected from poachers, encroachers and fodder- starved cattle etc. Activities like raising green fodder bank inside the Reserved Forest areas, providing salt licks to meet the micronutrient requirements of the elephants, creation of water holes, construction of check dams and percolation ponds to meet the water demand in summer seasons have been undertaken.

Active maintenance of physical barriers (elephant proof trench, electric fence, etc.), active guarding of crops and more importantly reducing habitat fragment at ion and stopping the degradation of habitat quality can all help in reducing human wildlife conflict. Providing adequate and immediate compensation can also help affected families. Eco-centrism is therefore life-centred, nature-centred where nature includes both human and non-humans.

Government of India initiated the project tiger as an ecosystem-based approach and declared 15 tiger- reserves in different habitats across the country, for the protection of prey-species and rehabilitation of degraded habitats. Other conservation efforts include the establishment of many Biosphere Reserves, National Parks, Sanctuaries Reserve forests and other protected areas. Elephants and other wild animals normally stray into human habitations in search of food and water. Personnel need to be kept ready to chase the animals back to their migratory routes.

b. Encroachment of Forest Lands

Encroachment in forest areas is mostly for cultivation purposes and for the construction of hut and houses. An extent of the 15129.863 ha. Forest area is under encroachment in the State as on 31.03.2019. Out of this, about 11103.876 ha is in Reserve Forest and remaining 4025.987 ha is in Reserve Land notified under section (4) of Tamil Nadu Forest Act 1882.

c. Forest Fires

Fires occur at regular intervals annually during summer months, extending from January to June and if south west monsoons fail, the fire hazards extend up-to September. Majority of the Forest Divisions including National Parks and Sanctuaries in Tamil Nadu are prone to fire hazards. In the natural forests, the outer slopes up-to elevation of 350 m are the worst affected by fire, because of topography and grazing interests. The problem gets compounded, in areas like Tirunelveli district, which are prone to high velocity winds. Most of the forest fires are ground fires and after effects of such fires are generally invasion of invasive species like Lantana which leads to retrogression and a change in the original vegetation over a period of time.

d. Natural Disasters

In Tamil Nadu the coastal areas at the south of Nagapattinam are most vulnerable to high storm surges. In these locations, the beaches and coastal lands are gently sloping and therefore suffer deeper incursion of seawater. Protective mangrove cover is decreasing at an alarming rate due to the increase in shrimp farming and other industrial activities. (ENVIS Centre, Department of Environment, 2006). Landslides are very common in the Nilgiri Range, characterized by a lateritic cap which is very sensitive to mass movements.

e. Threats to the Sacred Groves

The threats vary from one region to the other and even from one grove to the other like disappearance of the traditional belief systems, which were fundamental to the concept of sacred groves, rapid urbanization and developmental interventions including commercial forestry, encroachments, invasion of exotic weeds such as Eupatorium, Lantana and Prosopis and increasing livestock grazing and fuel wood collection.

f. Human-Animal Conflict

The problem of human-wildlife conflicts poses a severe threat to wild life conservation. In Tamil Nadu, the most commonly involved wild animals in the human- wildlife conflicts that cause damage to humans and their property, are elephants, tigers, leopards, wild boars, bison, bonnet macaques and marsh crocodiles.

g. Illicit removal of Firewood, Bamboo, Minor Forest Produce (MFP) and Timber

In 1977, fuel coupe workings were stopped in Tamil Nadu through a Government order. Further, harvests of green bamboo were also given up. This was the beginning of a new era in the State when conservation forestry took over production forestry. Yet, pressure on forests by way of over grazing, encroachment, and illicit felling (mainly for fuel wood and small timber) have increased manifold necessitating strong protection measures (both preventive and detective) with people's co-operation. The 1988 National Forest Policy has laid great emphasis on maintenance of environmental stability through preservation, restoration of ecological balance that has been adversely disturbed by serious depletion of the forest.

h. Illegal Trade in Flora and Fauna

It is recognized that the illegal trade in flora and fauna is next in size only to the trade in narcotics and may equal to that of ornaments. The State is facing smuggling problem with respect to sandal, red sanders and medicinal plants. Chennai port is recognized port for trade including CITES.

i. Depleting NTFP

NTFP contributes to about 20 percent to 40 percent of the annual income of forest dwellers who are mostly disadvantaged and land less communities with a dominant tribal population. It provides them with critical subsistence during lean seasons, particularly for primitive tribal groups such as hunter gatherers and the landless. Most of the NTFPs are collected and used/sold by women and has a strong linkage to women's financial empowerment in the forest-fringe areas.

Depleting resource base is either because of diversion of forest land for non- forest use, or due to unsustainable harvesting practices that has been the major ecological challenge in the NTFP sector with growing and visible impacts of climate change on crop production. On the other hand, poor research & development focus, inadequate post-harvesting practices, insufficient funds & infrastructure, and unorganized nature of the trade have made it financially vulnerable, particularly for the primary collectors whereas the differential and sometimes contradictory tax & transit regimes in the States have adversely affected not only the trade but even the production of NTFPs.

j. Meeting Fuel wood Demand

Trees outside Forests (TOF) are estimated to contribute 41 percent of the total fuel wood supply. The industrial demand for timber, poles and pulp wood is primarily met from imports, captive plantations, plantations taken up by the forest department, and farm forestry plantation taken-up by farmers. There is no production of timber and poles from natural forest to meet the industrial demand. However, the supply chain of fuel wood is complex.

The total demand for fuel wood under various scenarios was expected to vary between 15.17 to 18.14 million cu.m. by year 2013 according to the study. Household sector, which contributed to 84.5 percent of the total fuel wood demand, continues to dominate with contribution ranging between 70 and 80 percent. Thus, it was important to address fuel wood supply through plantation outside forest etc. The Wood Balance Study for Tamil Nadu (2009) assessed the total demand for wood in Tamil Nadu for the year 2008 as 28.5 million cu.m. of which fuel wood constituted 82 percent of the total demand. Households and industries demand accounts for 77 and 16 percent of the total demand for wood.

5.3.1.3 Gap/Barrier Analysis

After an overall understanding of the operational and financial progress of the activities under various strategies in TNSAPCC (5.3.1.1) the following analysis was arrived at in extensive consultations with stakeholders and line departments for the gaps and barriers of the sector in the State. (Table 5.11)

Table 5.11 Gap/ Barrier Analysis of Forest Sector

Sl.No.	Strategy	Progress	Gap/Barrier
1	Increasing the forest cover, both inside and outside notified forest areas through afforestation programmes as well as restoration of degraded forests	- Good progress has been made in Participatory Forest Management or Joint Forest Management through the NTFP scheme - TAFCON and TANTEA has promoted Industrial and Energy Plantation under public private partnership mode - Under NICRA and other climate change adaptation programmes Climate Resilient Agro and Farm Forestry is being promoted in vulnerable regions of Tamil Nadu	Though lot of progress has been made to increase the forest cover, still activities needs to be continued to further increase greenery in various agro-ecosystems
		IFGTB and Forest College and Research Institute, Mettupalayam are undertaking	Collection, conservation and documentation of genetic

Sl.No.	Strategy	Progress	Gap/Barrier
2	Enhancing Biodiversity Conservation efforts: In situ / ex situ (both inside the Protected Area as well as in other Reserved Forests)	conservation of genetic resources by screening and preserving existing wild germplasm for developing climate resilient varieties • Constant efforts are taken under TBGP for biodiversity conservation • Good progress has been made in establishment of fodder banks	resources in bio reserves needs to be documented for developing climate resilient varieties • Special focus needs to be given for the establishment of biodiversity corridors / species garden
3	Coastal & marine biodiversity conservation	• Good efforts are being taken for conservation of Mangroves	• Conducting regular assessment & monitoring of Coral reef as indicator species needs to be done • Coral rehabilitation measures should be taken up • Alternative livelihood for reef associated fishery dependent people needs to be identified
4	Creation of Biodiversity Registers	• Good progress has been made to identify, conserve and protect the Biodiversity heritage sites	• Mapping of floral and faunal biodiversity at a high spatial resolution on GIS is needed
5	Lower strata diversification	• Suitable fodder crops grown under different crops have been identified and Identified germplasms have been screened for its suitability to different ecosystems • Seed multiplication of forage crops have been done	• Large scale field testing of different forest species for lower strata diversification in different agro-climatic zones needs to be done
6	Management of Forest fires and alien invasive species	• Large number of people were trained through various capacity building programmes on managing the Alien Invasive Species	• Programmes for removal of Lantana and Prosopis from dry forest • Programmes for phased removal of wattle from Shola ecosystem in the hills • Awareness creation and capacity building on forest fire

Sl.No.	Strategy	Progress	Gap/Barrier
			control as well as escaping from the forest fires
7	Research & capacity building on impact of climate change on forest & biodiversity & ecosystem services	Identified climate resilient plants through Intensification of research on forest plant diversity, conservation and utilization of various germplasms	- Estimating mitigation potential of forests in Tamil Nadu - Valuation of bio-resource sin Coasts; Wetland; Forest ecosystems - Research on impact of climate change on coral reefs and associated biodiversity
8	Awareness generation and capacity building on climate change for integrating Climate Change in governance	Created awareness impact on forest to rural poor, farmers, farm laborers and people live in forest fringes by training, field visits, and field demonstrations on climate change on climate change	- Capacity building through seminars and trainings for scientists and researchers to meet the challenges of climate change - Special programme for Gulf of Mannar Biosphere Reserve– to build the capacity of the stakeholders

5.3.2 Sector Planning – Forest and Biodiversity

5.3.2.1: National and State-Level Targets and their Linkages

Tamil Nadu's overarching targets of relevance to Forest, Ecosystems and Biodiversity and illustrates their linkages with agreed targets at the national and international level is depicted in Table 5.12.

Table 5.12: State-level targets of relevance to Forests, Ecosystems and Biodiversity and their linkages to national and international goals. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform.

	SDG-related				NDC-related
International targets	SDG 15: Protect, restore and promote sustainable use of terrestrial <u>ecosystems</u> , sustainably manage forests, combat <u>desertification</u> , and halt and reverse <u>land degradation</u> and halt <u>biodiversity</u> loss.	SDG 13: Take urgent action to combat <u>climate change</u> and its impact by regulating <u>emissions</u> and promoting development in <u>renewable energy</u>	SDG 6: : Clean Water and Sanitation: Ensure Availability and sustainable management of water and sanitation for all	SDG 12: Ensure sustainable consumption and production patterns	
National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined. ⁴⁷				To create an additional carbon sink of 2.5 to 3 billion tonnes of CO ₂ e through additional forest and tree cover by 2030
State-level i.e. Tamil Nadu-specific targets	- Increasing existing forest cover (21.76%) to 33 % by 2030 ⁴⁸ 800 sq. km extension of water bodies - Maintaining the existing mountain forest cover: 67.7% - Increase in per capita income of mountain dwellers to INR 1350 Crores	- Number of Districts in the State with Disaster Management authority to implement disaster risk reductions strategies: 35 - Proportion of State Government that adopt and implement local disaster risk reduction strategies in line with National Disaster Risk reduction strategies: 100	Capacity of sewage water treated (MLD): 100%		
Additional State-level targets and planned initiatives	Additionally minimum 20 percent of the degraded forest will be rehabilitated by 2030		Out of 1175 wetlands in Tamil Nadu, the prioritised 47 wetlands may be restored by 2030	By 2030, programmes will be implemented to achieve the sustainable natural resource management and efficient utilization of natural resources, leading to a reduction in the "ecosystem footprint" ^{49,50}	

⁴⁷ The NIF is available under <http://www.mospi.gov.in/national-indicator-framework>

⁴⁸ https://cms.tn.gov.in/sites/default/files/documents/forest_policy_2018.pdf

⁴⁹ Forest survey of India Information Serious, Vol (1). No. (3). 2019, Ministry of Environment, Forest and climate change.

⁵⁰ ENVIS newsletter on state environment, vol (7), No.(4). 2011 supported by Ministry of Environment, Forest and climate change.

5.3.2.2 Proposed Activities from 2021-30 under Forest Sector

In the forestry sector, adaptation and mitigation go together hand in hand. In terms of adaptation, capacity development to forest dependent communities on sustained harvest of NTFPs in order to reduce the pressure on forests, biodiversity conservation, wild life protection would come as major component activities. As far as mitigation is concerned activities such as increasing the forest cover, Management of Forest fires and elimination of alien invasive species, etc will be taken up. Identified activities for the forest sector by the Government of Tamil Nadu are given below

Major Mitigation Options:

- Increasing the forest cover, both inside and outside notified forest areas through afforestation programmes as well as restoration of degraded forests
- Enhancing Biodiversity Conservation
- Management of Forest fires and alien invasive species
- Research component in Forestry sector

Major Adaptation Options:

- Livelihood enhancement of the forest dependent people
- Wildlife protection
- Lower strata diversification.
- Capacity building on climate change for integrating CC in forest ecosystem governance

In total, 37 activities are proposed for a long-term implementation (2021-30) in the State, out of which 7 activities are to be continued from the previous action plan and rest of the 30 activities are newly proposed by different bodies in the State. The total amount proposed for the Forest sector is approximately INR 2834.44 Crore. Out of this, INR 1976.48 Crore has been allocated for adaptation which consists of 24 activities, INR 396 Crore has been allocated for mitigation which consists of 6 activities and INR 461.96 Crore for both adaptation and mitigation which consists of 7 activities. Out of these 37 proposed activities, 9 are related to capacity building, 19 are investment projects, one is policy –oriented activity and Eight are research-based activities. The detailed description of proposed activities for 2021-2030 and budget allocation along with implementing departments has been given in **Annexure 33** and **Annexure 33** respectively.

5.3.2.3 Priority Adaptation Actions

All the proposed activities for 2021-30 were ranked based on the method described in section 7.3. Based on this method of prioritisation, the first five high priority activities under **Forest & Biodiversity** for 2021-30 are listed in Table 5.13.

Table 5.13 Priority activities in Forest Sector

PRIORITYACTIVITY	IMPLEMENTINGAUTHORITY	PROPOSED BUDGET for 2021- 30 in Crore
Valuation of bio resources in Forest ecosystem	Department of Environment (DoE)	20
Increase the forest cover through massive afforestation programme in degraded forest lands of Tamil Nadu	Tamil Nadu Forest Department (TNFD)	200
Integrated development of wildlife habitats	TNFD	200
Eco restoration and conservation of Pallikaranai Marshland	TNFD/ DoE	400
Project tiger	TNFD/ DoE	116.8
Water conservation and canopy improvement	TNFD/ DoE	222.54

5.4. COASTAL AREA MANAGEMENT

5.4.1 STOCKTAKING

5.4.1.1 Progress Mapping (In Last 5 Years)

Activities on Coastal Area Management is carried out by various government bodies and knowledge institutions in the State. A total of 6 broad strategies were proposed for Coastal Area Management in the TNSAPCC, under which 35 sub-activities were taken up. 27 of these activities were adaptation-related, 7 were mitigation-focused and the remaining one activity related to both adaptation and mitigation. The total amount proposed for Coastal area management for 2012-17 was INR 4420 Crore. Compared to this proposed total, an amount of INR 3,055.79 Crore was actually allocated for adaptation activities, INR 28.16 Crore was allocated for mitigation activities and INR 2.56 Crore was allocated for activities with both adaptation and mitigation components.

Department of Environment (DoE), Department of Fisheries (DoF), Tamil Nadu Forest Department (TNFD) Chennai River Restoration Trust (CRRT), Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), Tamil Nadu Maritime Board, Tamil Nadu State Disaster Management Agency (TNSDMA), Gulf of Mannar Biosphere Reserve Trust (GoMBRT) are the main actors for policy and decision making as well as execution of activities for conservation and protection of coastal resources of the State. Broad activities implemented in the State in order to adapt to the coastal impact of climate change are the following: Integrated Coastal Zone Management Plan (ICZMP), establishment of Climate Change Cell, institutional strengthening, Comprehensive Disaster Management Plan, installation of Early Warning System and Disaster Warning Announcements System, Flood Protection Plan, indigenous species plantation for coastal protection, sewerage monitoring in coastal regions, construction of physical structures are the major coastal activities in the State. The knowledge institutions like Suganthi Devadasan Marine Research Institute (SDMRI), M.S. Swaminathan Research Foundation (MSSRF), Institute for Ocean Management (IOM), Anna University, National Institute of Ocean Technology (NIOT), National Centre for Coastal Research (NCCR) and National Centre for Sustainable Coastal Management (NCSCM) have equally responded to the alarming issue of coastal zone management by conducting research studies on vulnerability of coastal resources to climate change and their subsequent monitoring. Coastal vulnerability mapping, coastal health monitoring, deployment of Artificial Reef Modules in Gulf of Mannar, Coral and seagrass rehabilitation, training and capacity building programmes, baseline surveys and biodiversity database management constitute an array of activities that were carried out. The detailed physical achievements and financial allocations under this sector for 2012- 17 (under TNSAPCC) as part of stocktaking exercise have been given in **Annexure 33** and **Annexure 33** respectively.

5.4.1.2 Key Issues and Challenges

This section (Table 5.14) deals with the major issues and challenges faced by the sector in the State concerning Climate Change and its impacts. The categories have been broadly divided into technical, financial and socio-political.

Table 5.14 Key Issues and Challenges of Coastal Area Management

Sector	Issues/Challenges
Technical	- Commercial fishing - Domestic and Industrial pollution - Unsustainable coastal tourism - Coastal Habitat destruction - Sea water intrusion
Financial	- Activity-wise funding is not available for specified strategies - Absence of a separate coastal area management body, for fund channelization and management

Socio-political	• Depletion of fish-catch, resulting in lower incomes for fishermen • Increased number of economic activities in coastal belts by local communities and commercial projects

5.4.1.3 Gap/Barrier Analysis

After an overall understanding of the operational and financial progress of the activities under various strategies in TNSAPCC (5.4.1.1) the following analysis was put forth by main stakeholders for the gaps and barriers of the sector in the State. Gaps/ barriers were mainly identified in the areas of institution, finance and regulation/ policy. (Table 5.15).

Table 5.15 Gap/ Barrier Analysis of Coastal Area Management Sector

Area	Gap/Barrier
Institutional	• A core department on Coastal Area Management that works solely on Coastal management related issues is required.
Financial	• Budget and Funding of projects needs to be more broad based by dovetailing different departments rather than through Department of Environment or Department of Forest which restricts budget for coastal and associated ecosystems. • Ecosystem-based funding needs to be mobilized
Regulatory/Policy	• There is need for focused conservation and management programmes for each ecosystem in CRZ (CZMP), Forest Policy or environment policy 2017

5.4.2 SECTOR PLANNING – COASTAL AREA MANAGEMENT

5.4.2.1 National and State-level targets and their Linkages

Table 5.16 highlights the Tamil Nadu's overarching targets of relevance to the Coastal Area Management sector and illustrates their linkages with agreed targets at the National and International level.

Table 5.16: State-level targets of relevance to Coastal Zone Management and their linkages to National and International goals. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform.

	SDG-related	NDC-related		
International targets	SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development			
National targets/ indicators		To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation	To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to	To create an additional carbon sink of 2.5 to 3 billion tones of CO ₂ equivalent through additional forest and tree cover

		and moderation.	climate change, particularly ... coastal areas	by2030.
State-level targets (2030)	• 5600 hectares area under mangrove cover • 42 % live coral cover of the total coral area under Tamil Nadu • Increase in the extent of protected areas (WLS,NP,BR &CR) to 11218 sq. km • 100 associated fishing implements- FRP Boats Assistance • 900 Associated Fishing Implements – Ice Boxes • Compliance of International Law- Tamil Nadu Marine Fishing Regulation Act • 61 Days under Fishing Ban Period- International Compliance of International Law			

5.4.2.2 Proposed Activities From 2021-30 Under Coastal Area Management

A total number of 38 activities are proposed for a long-term implementation (2021-30) in the State out of which 3 activities are to be continued from the previous action plan and rest of the 35 activities are newly proposed by different bodies in the State. The activities that are to be continued include artificial reef deployment, strengthening of rainwater harvesting structures and fishing community livelihood enhancement. New activities range from Gulf of Mannar protection, coastal zone management, Biodiversity and ecosystem conservation and eco-restoration to solid waste management in coastal areas, training and capacity building programmes, disaster management, eco-tourism etc.. These proposed activities cover policy actions, research and development, investment projects and capacity building and are expected to be aided under Central and State schemes as well as external assistance. Protection of Koswari and Appa Islands from erosion in Gulf of Mannar and Tropical Dry Evergreen Forest (TDEF) tree plantation with water management and livelihood enhancement is to be implemented under GCF funds and other projects are to be funded through NABARD, NADP, Coastal Disaster Risk Reduction Project, ICZMP, MGNREGS amongst other funding sources.

The total amount proposed for coastal area management is approximately INR 4776.10 Crore. Out of this INR 4681.75 Crore has been allocated for adaptation (27 activities), INR 83.34 Crore has been allocated for mitigation (7 activities) and INR 11.01 Crore for both adaptation and mitigation (four activities). Out of the thirty-eight proposed activities, seven are related to capacity building, twenty-seven are investment projects, three are pilot projects and one is policy oriented. The detailed description of proposed activities for 2021- 2030 and budget allocation along with implementing departments has been given in **Annexure 33** and **Annexure 33** respectively.

5.4.2.3 Priority Adaptation Actions

All the proposed activities for 2021-30 were ranked based on a method which is described in detail in section 7.3.

Based on the method of prioritisation, the first five high priority activities under **Coastal Area Management** for 2021-30 are listed in Table 5.17.

Table 5.17 Priority activities of Coastal Area Management Sector

Priority Activity	Implementing Authority	Proposed Budget 2021-30 in INR Crore
Integrated Coastal Zone Management	Department of Environment (DoE)	306.08
Integration of TDEF tree plantation with water management and livelihood enhancement	DoE	80
Assessment of microplastics in coastal areas, estuaries and lakes in Tamil Nadu,	DoE	0.812
Shore Protection in Coastal ranges	Department of Fisheries (DoF)	63.74
Disaster Management Risk Project	SDMA	77.94
Shoreline Management	GoMBRT	16
Conservation Management	GoMBRT	19.16
Coastal Livelihood Management	GoMBRT	12
Eco-tourism	GoMBRT	18.3

5.5. STRATEGIC KNOWLEDGE MANAGEMENT FOR CLIMATE CHANGE

The Government of Tamil Nadu has responded efficiently to the increasing impact of climate change by undertaking sectoral research and has generated a good inventory of knowledge in partnership with several national and State-level institutions in the State. The State consists of vulnerable zones both in inland and coastal habitats where the unprecedented change in temperature and rainfall patterns results in droughts, cyclones and sea level rise that causes heavy losses. These are also the regions which are predicted to be vulnerable in the coming years and it is imperative to have a well-equipped decision-making system. The State government through the respective sectoral departments has developed a knowledge portal that will support strategic decision making in order to adapt to the consequences of climate change and ensure security of the residing population through food security, economic stability and environmental sustainability.

The relevant sectors (covered in sections 5.1 to 6.2) identified in Tamil Nadu are: Sustainable Agriculture, Water resources, Forest & Biodiversity, Coastal Area Management, Energy Efficiency, Renewable Energy & Solar Mission and Sustainable Habitat. In this regard, key stakeholders in all the vulnerable sectors are engaged. The main stakeholders to enhance the knowledge base in their areas and the knowledge partners are the following:

The **Centre for Climate Change and Disaster Management (CCC&DM) Anna University** is the first Centre in India functioning exclusively for climate change research activities. Research works in CCC&DM includes developing regional climate scenario, sectoral impact and vulnerability assessments and framing adaptation strategies using IPCC scenarios. Initially regional climate scenarios for the whole country were developed with the help of Hadley Centre, UK Met Office. CCC&DM undertakes various research activities pertaining to management of natural resources such as agriculture, coastal, forest & biodiversity, and water and evolving adaptation strategies to cope with changing climate and its extremities. Government of Tamil Nadu has recognized CCC&DM, Anna University as the Nodal Agency for Tamil Nadu State Action Plan on Climate Change (TNSAPCC)'s Knowledge Management Sector.

M.S.Swaminathan Research Foundation (MSSRF) is an integral part of Knowledge Management in the State, which is involved in various research activities such as Biodiversity, Biotechnology, Eco-technology, Food Security, Coastal system research, Information Education Communication, Climate change and GIS. MSSRF emphasizes on a participatory research with vulnerable communities, particularly in rural India, in order to enhance their capacity to cope with climate change induced calamities. The organization also focuses on Coastal Systems Research integrated with Farming System Research along with research on Mangrove wetlands, for livelihood provision to coastal communities as well as to achieve sustainable management of coastal resources. Several studies have been conducted on Plant Genetic Resources management, which comprises of their integrated conservation and cultivation, promotion of sustainable consumption and protection of farmers rights and Traditional Knowledge related to biodiversity to facilitate access and benefit sharing.

Suganthi Devadason Marine Research Institute (SDMRI) is also an eminent research organisation, involved in conservation and management of Coastal and Marine Ecosystem, Environmental protection and monitoring, Climate Change and Coastal biodiversity, Resource utilization and value addition, awareness and Capacity building, Underwater research and monitoring in reef and sea grass ecosystems. There has been extensive research work conducted by SDMRI in Gulf of Mannar along with the Gulf of Mannar Biosphere Reserve Trust (GoMBRT).

Development of Humane Action (DHAN) Foundation is a development institution working on various vulnerable sectors in Tamil Nadu through conducting an array of demonstration projects, training and capacity building programmes. Some prominent works are Coastal conservation and livelihood programmes. It works extensively on restoration of livelihoods in climate disaster affected areas and rainfed farming development in order to enhance agro-production during times of rainfall fluctuations. They also work at Panchayat level to disseminate knowledge to grass root level and increase their adaptive capacity against climate change phenomena.

Along with the Research institutes, all the **line departments** are taking steps for enhancement of knowledge acquisition and dissemination to all sections of the society for better adaptability to climate change. In line of that, departments are involved in conducting capacity building and training programs under each strategy or objectives of a given project.

5.5.1 Stocktaking

5.5.1.1 Progress Mapping (In Last 5 Years)

Strategic knowledge management sector is the core area of the State, which is contributed by several departments, institutions and private organisations. Centre for Climate Change and Disaster Management (CCC&DM) Anna University, M.S. Swaminathan Research Foundation (MSSRF), Suganthi Devadason Marine Research Institute (SDMRI), Gulf of Mannar Biosphere Reserve Trust (GoMBRT), Development of Humane Action (DHAN) Foundation along with the line departments of vulnerable sectors. Under the National Mission of Strategic Knowledge on Climate Change, the State has established the State Climate Change Data Bank, State Climate Change Knowledge Portal (www.tnsccc.in) and Climate Change Knowledge Management Cell. Several training programmes and awareness campaigns are conducted by SDMRI, DHAN Foundation, GoMBRT, CCC&DM focusing on different kinds of stakeholders, especially on rainfed farming, climate resilient agriculture in coastal regions, climate proof urban development, micro-irrigation systems, conservation and management of coral reefs, sea grass beds and mangroves. Capacity building Programme on Climate Change Adaptation under CCA-RAI Programme of GIZ is a major knowledge development project taken up by DoE in collaboration with CCC&DM.

A total of 9 broad strategies were taken up for Strategic knowledge management sector in the TNSAPCC. All these activities were adaption-related. The total amount proposed for Strategic knowledgemanagementsectorfor2012-17 was INR49 Crore. Out of this budget, an amount of INR 28.94 Crore was actually allocated towards the planned adaptation activities. The detailed physical achievements and financial allocations under this sector for 2012-17 (under TNSAPCC) as part of this stocktaking exercise have been given in **Annexure 63** and **Annexure 73** respectively.

5.5.1.2 Key Issues and Challenges

This section (Table 5.18) deals with the major issues and challenges faced by the sector in the State concerning Climate Change and its impacts. The issues and challenges identified by the main stakeholders/ line departments have been broadly divided into technical, financial and socio-political ones.

Table 5.18 Key Issues and Challenges for Strategic Knowledge Management Sector

Sector	Issue/Challenge
Technical	- Financial support in the Long-term for knowledge management related climate change issues is a challenge - Number of stakeholder consultations and capacity building is minimum - Considerable efforts on data sharing on knowledge management from all sectors in the State is required
Financial	- Lack of funding for Knowledge management - Lack of identification of funding sources for Knowledge management in the State
Socio-political	Lack of Dissemination of knowledge at all levels of the society

5.5.1.3 Gap/Barrier Analysis

After an overall understanding of the operational and financial progress of the activities under various strategies in TNSAPCC (section 5.5.1.1), the following analysis was put forth for the gaps and barriers of the sector in the State. Gaps/ barriers were mainly identified in the areas of institution, finance and regulation/ policy. (Table 5.19)

Table 5.19 Gap/ Barrier Analysis of Strategic Knowledge management Sector

Area	Gap/ Barrier
Institutional	- Strengthening of a unified knowledge management body at CCC& DM Anna University - Lack of coordination between sectoral departments on exchange and dissemination of knowledge and regular up-dation
Financial	- Activity-wise research fund allocation for the sector was minimum - The activities/strategies are components of a larger project, therefore, allocation of funds is not provided clearly - Meager allocation of appropriate funds from State and Central Government for Knowledge Management activities
Regulatory/Policy	- Lack of strong policies for implementation of knowledge management system in any concerned sector - The present policy does not implement Knowledge management at grass root level

5.5.2 Sector Planning – Strategic Knowledge on Climate Change

5.5.2.1 National and State-level targets and their linkages

Table 5.20 State-level targets of relevance to Strategic Knowledge of Climate Change and their linkages to national and international goals. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform.

	SDG-related	NDC-related
International targets	SDG13: Take urgent action to combat climate change and its impacts	
National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined. ⁵¹	To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.
State-level targets 2030	35 Number of Districts in the State with Disaster Management authority to implement disaster risk reductions strategies 100% Proportion of State Government that adopt and implement local disaster risk reduction strategies in line with National Disaster Risk reduction strategies	

⁵¹The NIF is available under <http://www.mospi.gov.in/national-indicator-framework>

	SDG-related	NDC-related
	Strengthening of Systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions in the State (Climate Change Mitigation- Capacity building and Awareness, Pollution Abatement- Capacity Building and Awareness, Disaster Management Mitigation- Capacity Building and Early Warning/ Disaster Warning announcement system.	

Table 5.20 illustrates the key initiatives of the State towards achieving the various SDG and NDC commitments that are linked to the Strategic Knowledge Management sector.

5.5.2.2 Proposed Activities from 2021-30 under Strategic Knowledge Management Sector

Collectively 12 activities are proposed for the knowledge management sector to be achieved for a over the period of 2021-30. Out of these, 2 activities, namely the establishment or strengthening of the State Climate Change Cell under the NMSKCC and training of agri-business stakeholders by Agriculture Marketing Board will be progressed from the activities provided in the TNSAPCC. In addition, new activities are proposed in line with strengthening the knowledge base in the State and the respective sectors such as the establishment of a State-level campaign on climate literacy, establishment of a climate studio at Anna University, training to various stakeholders directly or indirectly dependent on coastal resources and vulnerable to impacts of climate change, ecosystem-based climate proofed watershed and agro- advisory services to farmers using Network for Information on Climate (Ex)change (NICE) platform. Other than trainings, many studies are also proposed in line with conservation and protection of coral reefs, impacts of post-bleaching stressors on coral recovery and introduction of new crops under horticulture. The activities are funded through Central and State-based schemes, respective departments and private funding body like NMSA, PMKSY, MIDH, NABARD, GIZ amongst other sources.

A total number of 12 activities are proposed for long-term implementation (2021-30) in the State, out of which 2 activities is to be continued from TNSAPCC and 11 activities are newly proposed by different bodies in the State. The total amount proposed for this sector is approximately INR 280.87 Crore. Out of this INR 178.96 Crore has been allocated for adaptation which consists of 9 activities, INR 98.46 Crore has been allocated for mitigation which consists of 1 activity and INR 3.45 Crore for both adaptation and mitigation which consists of 2 activities. Out of these 12 proposed activities, 5 are related to capacity building, 3 are investment projects, 1 is pilot project, 1 is policy-oriented activity and 2 are research-based activities. The detailed description of proposed activities for 2021- 2030 and budget allocation along with implementing departments has been given in **Annexure 33** and **Annexure 33** respectively.

5.5.2.3 Priority Adaptation Actions

All the proposed activities for 2021-30 were ranked based on a method which is described in detail in section 7.3.

Based on this method of prioritisation, the first five high priority activities under **Strategic Knowledge Management for Climate Change** for 2021-30 are listed below in Table 5.21:

Table 5.21 Priority activities in Strategic Knowledge Management Sector

Priority Activity	Implementing Authority	Proposed Budget for 2021-30 in INR Crore
MIDH - NHM: increasing the productivity of Horticultural crops through Hi- Tech practices	DoH	0.26
Ecosystem based Climate proofing watershed in Nammiyampattu and Kanamalai panchayat of Jawadhu hills of Tiruvannamalai district Tamil Nadu	DHAN Foundation	3.19
Create an enabling institutional framework for developing and disseminating strategic knowledge on climate change.	DoE/Anna University	4.6
Studies on the impacts of coral-competing sponges on coral community structure and associated biodiversity in the reef areas of Gulf of Mannar, South eastern India	SDMRI	0.54
Studies on the status of Post- bleaching Stressors that affect the Recovery of Corals in Tuticorin group of islands, Gulf of Mannar	SDMRI	0.15
Agro-advisory to farmers using NICE platform to adapt Climate Change in Telangana and Tamil Nadu	DHAN Foundation and District Administration Tiruvannamalai	0.71

5.6 DISASTER MANAGEMENT AND MITIGATION

5.6.1 RATIONALE FOR INCLUSION OF DISASTER MANAGEMENT AND MITIGATION

Tamil Nadu is a State known for its multi-hazard vulnerability, the major natural hazards are being cyclonic storms, urban and rural floods and periodic droughts. Some parts of the State also witness landslides, sea erosion, and sea water incursion. With a coastline of 1076 kms (which is about 15 percent of the Indian coastline), the State is exposed to the peril of Tsunami, high tide lines and continuous erosion. Therefore, it is not surprising that the State has witnessed natural disasters of severe intensity since the beginning of the century. To name a few, the 2004 tsunami, the 2015 floods, 2016-17 droughts and the Ockhi cyclone have caused extensive damages in the State.

The disaster risk assessment and management form a baseline for future work on loss and damage. The study area of loss and damage in the State is still under progress which forms an integral part of climate change scenario.

The table 5.22 lists and categorises disaster occurrence in the State. Out of the different types of disasters listed, climate –related disasters are drought, thunder, storm surge, sea erosion, sea water incursion, lightning, flash floods, floods, cyclones and forest fires. Further, landslide could also be triggered by high-intensity rainfall and hence fall under the ‘Water and Climate related Risks’ category.

Table 5.22 Risk Identification of Disasters in Tamil Nadu

Water and Climate related	Geophysical related	Chemical and industrial	Accidents related	Biological related
Drought Thunderstorm surge Sea erosion Sea water incursion Lightning Flash floods Floods Cyclone Forest fires	Earthquake Tsunami Landslide/debris flows/mudslides	Industrial fires Gas and Chemical leakages Oil spills	Electrical fires Urban and Village fires Building collapses Festival/Fair/Temple stampeded Road Rail and Air based accidents/ boat capsizing Fire accidents	Epidemics Pest attacks Food poisoning Water contamination Cattle epidemics

Water and Climate related Disasters



Multi-Hazard Vulnerability in Tamil Nadu

- Drought: Low rain fall with erratic behavior of monsoon-vulnerable to drought during June to September months.
- Affects agriculture and drinking water sectors.
- Coastal disaster: Problems ranging from pollution, siltation, coastal erosion, flooding, saltwater intrusion, storm surges and cyclones. Tsunami of 2004 had a devastating impact.
- Sea Erosion: Sea erosion impacts livelihood of fishermen, adversely affects housing, road infrastructure and groundwater.
- Sea Water Incursion: Sea level rise, changing monsoon behavior and increased groundwater demand influence saltwater intrusion. It leads to reduction in drinking water (potable and usable), irrigation, agricultural lands unfit for cultivation. Impacting small and marginal farmers.
- Cyclone/ Heavy Rainfall: 8 percent of Tamil Nadu is affected by 5-6 cyclones/year (2-3 severe). Cyclones are severe in East coast during October-December. Extreme weather events like extreme heavy rains affect carrying capacity of rivers and drainage system. Cyclonic storms damage power infrastructure, loss of lives, damages to housing and agricultural properties.

- Flood: Annual flooding, including flash floods, floods due to cloudbursts, monsoon floods, cyclonic floods- resulting in temporary homeless people and crop damage. Coastline experiences heavy flooding during depression.
- Storm Surge: Storm surge from 3 meters to 11 meters in Coast of Tamil Nadu are major threat to fishing community, damaging livelihood support, small & marginal farmers as agricultural lands become unfit for cultivation.
- Heat Wave: Occur between March and June. Extreme temperatures and resultant atmospheric conditions affect people by causing physiological stress.

According to the State Disaster Management Perspective Plan (2018-2030), the vulnerable areas of Tamil Nadu have been assessed against each type of water and climate related disasters given in Table 5.23.

Table 5.23 Vulnerable areas of Tamil Nadu

Disaster	Vulnerable Areas
Droughts	Districts like Dharmapuri, Madurai, Coimbatore, Ramanthapuram, Salem, Tiruchirapalli, Thirunelveli, Kanyakumari, Sivagangai and Pattukkottai in Thanjavur District.
Cyclones	Cyclonic activities on the east coast are more severe than the west
Sea Erosions	Districts like Kanyakumari, Thirunelveli, parts of Tuticorin, Ramanathapuram, Pudukkottai, Thanjavur, Thiruvarur, Nagapattinam, Cuddalore, Villupuram, Kancheepuram, Chennai and Thiruvallur.
Sea Water Incursion	Coastal districts of the State.
Floods	Districts of Chennai, Kancheepuram, Thiruvallur, Cuddalore, Thanjavur, Thiruvarur, Nagapattinam, Pudukottai and Thoothukudi.
Storm Surge	Southern parts of Thanjavur, Kanyakumari, Thirunelveli, Ramanathapuram, Pudukottai and Thoothukudi.
Heat Wave	Vellore, Thiruvannamalai, Krishnagiri, Dharmapuri, Salem, Namakkal, Tiruppur, Coimbatore, Erode, Karur, Tiruchirapalli, Ariyalur, Perambalur, Sivagangai, Virudhunagar, Theni, Dindigul and Madurai.
Forest fires	Six districts namely Chennai, Coimbatore, Dindigul, Kancheepuram, Madurai and Thiruvallur are under the 'very high risk' category, Cuddalore, Namakkal, Thanjavur, Tuticorin, Tiruchirapalli, Thirunelveli, Tiruppur, Vellore and Virudhunagar in the 'high risk' category.

5.6.2 Sector Planning: Disaster Management and Mitigation

5.6.2.1 National and State-level Targets

Table 5.24 highlights the key initiatives of the State towards achieving the various SDG and NDC commitments that are linked to Disaster Management sector.

	SDG-related		NDC-related
International targets	SDG13: Take urgent action to combat climate change and its impacts	SDG11: Make cities and human settlements inclusive, safe, resilient and sustainable Reduced loss and damage from disasters (11.5))	

National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined. ⁵²		Strategy 6- ~~%~~ for better adaptation to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly ... health and disaster management.
State-level targets (2030)	• 35 Number of Districts in the State with Disaster Management authority to implement disaster risk reductions strategies • 100% Proportion of State Government that adopt and implement local disaster risk reduction strategies in line with National Disaster Risk reduction strategies • Strengthening of Systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions in the State (Climate Change Mitigation- Capacity building and Awareness, Pollution Abatement- Capacity Building and Awareness, Disaster Management Mitigation- Capacity Building and Early Warning/ Disaster Warning announcement system.	• Tree cover achieved outside forest area (State Specific): 23692 Sq. km	

5.6.2.2 Proposed Activities From 2021-2030

A total of 49 primarily adaptation-related activities, in line with the Sendai framework, are proposed for Disaster Risk Reduction Measures. To ensure maximum synergy with the existing State-level planning initiatives and implementation, the corresponding Disaster Risk Reduction Measures have been identified in the State Disaster Management Perspective Plan 2018-2030⁵¹. For additional detail including the identification of responsible departments, timelines and financing schemes, the reader is directed to refer to the aforementioned document.

⁵² The NIF is available under <http://www.mospi.gov.in/national-indicator-framework>

⁵¹ Available at: <https://tnsdma.tn.gov.in/app/webroot/img/document/SDMP-29-08.pdf>

Table 5.25 Priority activities in Disaster Management and Mitigation

S. No.	Proposed Activity
1.1	Hazard Vulnerability Risk Assessment (Systems approach)
1.2	Digital Risk Mapping in Public domain
1.3	Storm Surge model for coastal areas
1.4	Digital Elevation Model for areas of Very High & High Vulnerability
1.5	State Database on Emergency Management
1.6	Big data analytics to strengthen multi hazard disaster risk assessment
1.7	ICT Based Disaster Knowledge and information transfer system
1.8	Strengthening of Post Disaster Disease Surveillance Systems
2.1	Strengthening Incidence Response System
2.2	Strengthening of TNDRF
2.3	Strengthening Emergency Medical Response, Emergency Support Functions
2.4	Strengthening Inter-departmental Zonal Teams
2.5	Strengthening Disaster Response Guards and First Responders
2.6	Capacity building of multisectoral departments, TNDRF, Disaster Response Guards and First Responders etc.
2.7	Prepare and update multi-hazard disaster preparedness, response, relief and recovery SOPs.
2.8	Strengthen inter sectoral, inter-departmental coordination besides strengthening co-ordination with Central Agencies
2.9	Quinquennial Updating of Safety standards for Buildings (Educational, Hospitals & Multi-storeyed etc.) National Building Code 2016
2.10	New land use regulations for protecting ecologically sensitive areas.
3.1	Creation of State Disaster Mitigation Fund
3.2	Comprehensive flood risk reduction in highly vulnerable rural districts
3.3	Mainstreaming of disaster risk concerns into developmental plans
3.4	Risk transfer with special focus on at-risk population such as farmers, women and weaker section
3.5	Climate smart land and water management for sustainable Agriculture
3.6	New cropping strategies to overcome impacts of Climate Change
3.7	Restoration and protection of river ecosystems and ecologically fragile areas (based on Systems approach)
3.8	Bio Shields for Protection against Heat Wave, Lightning, Gale Wind

S. No.	Proposed Activity
3.9	Deliver climate resilient hydraulic infrastructure to reduce risk of flood and sea water incursion in delta areas.
3.10	Livelihood support with special focus on the poor in Vulnerable Areas
3.11	Integrated Development of Vulnerable Areas
4. 1	Multi-hazard Alert, Response and Tracking system (TNSMART)
4.2	Real time forecasting and spatial decision support system for major river basins
4.3	End to End Early Warning Systems
4.4	Strengthening MPES and Shelter Management
4.5	Enhance Public Private co-operation in Response, Recovery, and Build Back Measures
4.6	Strengthen community based disaster reduction strategies during all phases of disaster
4.7	Strengthen Information Management and risk Communication systems
4.8	Enhance Public Private co-operation in Response, Recovery, and Build Back Measures
4.9	Strengthen the resilience of critical infrastructure and basic social services
4.10	Strengthen Non-structural measures to reduce the risks due to Man- made and Natural Disasters.
4.11	Build the capacity to manage CBRN and other man-made disasters.
4.12	Equip multi-sectoral agencies with the State of art machinery and robotics to strengthen response and recovery efforts.
4.13	Multihazard disaster resistant housing (Green Housing) for the poor
4.14	Comprehensive river training measures for risk reduction of floods
4.15	Integrated Watershed Management for risk reduction of drought and enhance resilience to climate change with special focus on Vulnerable areas
4.16	Restoration and protection of river ecosystems and ecologically fragile areas such as Creek, Mangroves, Marshlands etc.
4.17	Deliver climate resilient hydraulic infrastructure to reduce risk of flood & sea water incursion in delta areas.
4.18	Irrigated Agriculture Modernisation
4.19	Sustainable Mission for Dry land Farming
4.20	Enhancing storage capacities of water bodies

5.7 HEALTH

5.7.1 Rationale for Inclusion of Health and Sanitation

Good health is an essential component for wellbeing of people. A healthy populace can contribute productively to the overall economic growth of the country. Tamil Nadu is contributing in building a healthy society by making quality medical facilities available and reachable to the people and by focusing on preventive health care. The Vision Tamil Nadu 2023 aims to ensure access to safe sanitation including open defecation free and garbage free environment. The State also aims to achieve SDG Goal 3 which ensures healthy lives and promote well-being for all at all ages. The State is not only bestowing with “State of the Art” health care services but also focuses on making available excellent human resources and infrastructure. The State has achieved appreciable success in preventing communicable diseases like polio, leprosy and tuberculosis. At the same time, as set out in chapters 2 and 4, the health sector is particularly vulnerable to climate change impacts.

Tamil Nadu has undertaken various initiatives such as Tamil Nadu Medical Services Corporation (TNMSC), Tamil Nadu State AIDS Control Society (TNSACS), Transplant Authority of Tamil Nadu (TRANSTAN) and various schemes at the State level such as Dr.Muthulakshmi Reddy Maternity Benefit Scheme with enhanced assistance, Chief Minister’s Comprehensive Health Insurance Scheme, Menstrual Hygiene Programme, Birth Companion Programme, Amma Baby Care Kit, Amma Arogya Thittam, Amma Whole Body Check-up, Amma Magaperu Sanjeevi.

5.7.2 Sector Planning: Health and Sanitation

5.7.2.1 State and National-level targets and their linkages

Table 5.26 State and National level targets and their linkages

	SDG-related	NDC-related
International targets	SDG 3: Ensure healthy lives and promote well-being for all at all ages	
National targets/ indicators	National-indicators have been defined in the National Indicator Framework (NIF) developed by the Ministry of Statistics and Programme Implementation, but no national-level targets other than the international Sustainable Development goals and the associated targets have been defined. ⁵²	Strategy 6- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly ... <i>health and disaster management.</i>
State-level targets 2030	•95 Percentage of women aged 15 - 49 years who received antenatal care, four times or more (Period 5 years/1 year) •Reducing the infant mortality rate to 10 deaths per 1000 live •1.0 HIV Prevalence (Number of HIV positive among tested per 10000 Population) 8000 number of deaths due to road accidents	

Table 5.28: illustrated State-level targets of relevance to Health and sanitation and their linkages to National and international goals. SDG-related targets stem from the Planning, Development and Special Initiatives Department’s SDG Monitoring Platform.

⁵² The NIF is available under <http://www.mospi.gov.in/national-indicator-framework>

Table 5.27 Key Issues and Challenges of Gender Sector

Area	Issues/Challenges
Policy & Regulatory	Gender is a sector, which is not included in the Nationally Determined contribution of the country. The State therefore needs to work towards fixing targets for development in Gender equality
Socio economic/Cultural	- Women appraisal and inclusivity in the societal development is negligible - Presence of rural and urban Inequality in the State - Women are responsible for the care of economy (Family, young, Children and elders) of the State at the household level and the climate risks like water stree, disaster responses tend to become an additional burden.
Environmental	Women along with children and aged people are the most vulnerable to natural hazards owing to their physical strength and characteristics

5.7.2.2 Proposed Activities

A total of 7 loosely adaptation-related activities are proposed for medium-term implementation in the health sector. To ensure maximum synergies with existing state-level planning initiatives and implementation, these correspond to those put forth under the “Tamil Nadu – Vision 2023”⁵³ planning exercise. For additional details including the identification of responsible departments, timelines and financing schemes, the reader is referred to the aforementioned document. In addition, it is envisioned to develop an additional set of adaptation-focused health sector activities for the period 2021-2030. Additional climate-change specific health sector actions are expected to derive during the preparation of heat wave action plan of the Commissionerate of Revenue Administration and Disaster Management.⁵⁴

Table 5.28: Priority activities in Gender Sectors

S.No.	Proposed Activity
1	Increase the capacity of primary and secondary healthcare network by improving the infrastructure of hospitals such as bed strength, laboratory, radiology facilities and diet provision and ensuring that a referral centre is available within a maximum distance of five kilometers from every sub-centre.
2	15 new medical colleges attached to district hospitals will be established.
3	17 medical colleges attached to hospitals will be upgraded to international standard.
4	Creation of two med. Cities in South and Western Tamil Nadu to serve the medical tourism industry by investment in hospital and education facilities, logistics and hospitality services.
5	Trauma, ambulatory, disaster management care and diagnostic services to be improved and neutralized.
6	Electronic medical records management and hospital management system will be implemented in all districts and Taluk hospitals.
7	Ensuring 100 percent availability of drugs at all locations.

⁵³Available at: <http://www.tn.gov.in/dear/Health.pdf>

⁵⁴Commissionerate of Revenue Administration and Disaster Management, 2019, available at: <https://tnsdma.tn.gov.in/app/webroot/img/document/heatWaveAction2019.pdf>

CHAPTER 6: CLIMATE CHANGE STRATEGY – MITIGATION

Climate change mitigation encompasses “human interventions to reduce emissions or enhance the sinks of greenhouse gases”⁵⁵ and is urgently required to meet the climate goals such as those under the Paris Agreement. While the previous chapter centered on adaptation strategies, several of the proposed strategies and activities imply substantial mitigation co-benefits. This chapter, in turn, focuses on mitigation strategies, which due to their intertwined nature may also yield important adaptation co-benefits.

Mitigation strategy as planned in the State involves pushing for higher share of renewable energy in the State especially hydro, solar and biomass-based including energy from waste. The State is also strengthening the State Designated Agency (SDA) to implement the comprehensive energy efficiency plan for the State. It also has integrated several energy and waste management solutions in Smart City Plan and AMRUT to mitigate the emissions. Sectoral plans under agriculture, forestry and water sector have investments that are likely to have several mitigation co-benefits.

Mitigation strategies in Tamil Nadu are focused on two areas, in line with the following national missions:

- Enhanced Energy Efficiency and solar mission (6.1)
- The waste sector, the transport sector, and the buildings/ residential sector, grouped under the “Sustainable Habitat” mission (6.2)

6.1. ENHANCED ENERGY EFFICIENCY AND SOLAR MISSION

6.1.1 Stocktaking

6.1.1.1 Progress Mapping (In Last 5 Years)

Activities of Enhanced Energy Efficiency and Solar Mission are carried out by various government bodies like TANGEDCO, Electrical Inspectorate and TEDA. A total of three broad strategies were proposed for Energy sector in the TNSAPCC, under which 27 sub-activities (mitigation related) were proposed. The total amount proposed for this sector for 2012-17 was INR 155,438 Crore. Compared to this proposed budget, an amount of INR 32,719.22 Crore was actually allocated for mitigation activities. The detailed physical achievements and financial allocations under this sector for 2012-17 (under TNSAPCC) as part of stock taking exercise has been given in **Annexure 36** and **Annexure 37** respectively.

6.1.1.2 Key Issues and Challenges

This section (Table 6.1) deals with the major issues and challenges faced by the sector in the State concerning Climate Change and its impacts. The issues and challenges have been broadly categorised into technical, institutional and regulatory, financial, socio-political and sensitisation.

⁵⁵https://www.ipcc.ch/site/assets/uploads/2018/11/sr15_glossary.pdf

Table 6.1 Key Issues and Challenges of Energy Sector

Area	Issue/Challenge
Technical (including infrastructural)	There is lack of technical knowledge and information on the benefits of modern energy management systems and sector specific new technologies launched globally. Cost associated with adoption of first of its kind technologies in the industrial sector is relatively more and the challenge to prove the operational suitability of a technology with the prevailing operating conditions in the industry. The industries fail to capture the value of cost-effective energy savings that can be achieved by these systems. There can be unrecognized energy benefits and environmental and societal benefits associated with improving energy efficiency. If these benefits are omitted from consideration, there can be under procurement of industrial energy efficiency resources.
Institutional and Regulatory	There is a shortage of adequately trained personnel in the field of energy efficiency (energy audits and end-user maintenance) at all levels of management and administration in the Government and Private sector.
Financial	Financing of projects continues to be a challenge. Banks and Financial institutions should be suitably appraised about energy efficiency projects and their risks and benefits. Special category of loan appraisers for such projects may be trained who will fast track based on the projected energy savings that especially those that are cost effective.
Socio-Political	There is need for continuous monitoring and audit of energy conservation awareness programmes and pass legislations that incentivize good practices of energy efficiency. The Government should improve among general public on energy conservation in particular about the New technologies and schemes of Bureau of Energy efficiency like Standards & Labeling (S& L) of appliances that would need fast adoption.
Sensitisation	There is need for awareness among General Public on the importance of energy conservation as there is limited knowledge on new technologies and schemes on Energy Efficiency. There is a need for creation of Awareness among students through various activities and inclusion of chapters on Energy Efficiency and Conservation.

6.1.1.3 Gap/Barrier Analysis

Barriers hindering the implementation of actions proposed under TNSAPCC were analysed in extensive consultations with key stakeholders. In sum, there is a need for creation of infrastructural, institutional, policy and financial enabling conditions for institutionalizing the action further proposed after revision of TNSAPCC. (Table 6.2)

Table 6.2 Gap/ Barrier analysis of Energy Sector

Area	Gap/Barrier
Institutional and Policy	• Future projections of Demand in the State are high and upgrading of transmission infrastructure would be a major challenge without causing a breakdown of the existing facilities. • State Power utilities during the Purchase of power from Renewable energy assets in Tamil Nadu must take into account the financial feasibility and their viability. • The State Energy regulators must consider during policy formulation, introduction of taxes or any such other regulatory mechanisms like “wind banking” to ensure that their growth is not affected.
Finance	The power generating units must receive guaranteed payments for the loans taken by them from the State utilities. It is only then the financial viability is taken care.

6.1.2 Sector Planning: Energy Efficiency and Solar Energy

6.1.2.1 National and State-Level Targets and their Linkages

Table 6.3 lists Tamil Nadu's overarching targets (and achievements) of relevance to **Enhanced Energy Efficiency & Conservation** and the **Solar Mission** and illustrates their linkages with agreed targets at the national and international level.

Table 6.3 NDC and SDG Commitments and Key State Level Initiatives to comply with national pledges. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform.

	SDG-related		NDC-related	
International targets	SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all	SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		
National targets/ indicators			Reduce the emission intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.—	Achieve about 40%- of cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030
State-level targets 2030	41 % Renewable Purchase Obligation (RPO) achieved 10% Reduction of aggregate Technical and Commercial loss	Share of Manufacturing in GSDP (%): 30.32 Renewable share in the total installed capacity: 44.61% Number of Internet subscribers: 100%		
Key state-level Achievements	A High-Power Committee has been constituted under the Chairmanship of Chief Secretary with 8 working groups under the Chairmanship of Secretaries to Government in order to plan, implement, monitor and review the SDG in Tamil Nadu. The working group on "Innovation, Industrialization and Sustainable Development" under the Chairmanship of the Principal Secretary to Government, Industries department is tasked with Goals pertaining to Energy.		The State has harnessed around 13,000 MU of wind energy and 2,905 MU of solar energy during 2017-18. By way of harnessing the Green Energy, the State has reduced use of hard coal and thus reduced about 5,406 Million tonnes of Carbon emission.	A massive addition of power to the tune of 13,287 MW has been added to the grid since 2011 upto 31.03.2018 by commissioning of new power stations in State and Central sectors, through medium- and long-term power purchase agreements and through renewable energy. On the Green Energy initiative, Tamil Nadu is a leader in Renewable Energy sector among all States and has a total installed capacity of 11,113 MW as on 31.03.18 against 10,480 MW on 31.05.2017.

a) **Situational Analysis- VISION 2023 PERSPECTIVE**

The sub sectors that were covered as part of Vision 2023 are Power Generation, Transmission and Distribution Systems (through Renewable and Non-Renewable sources). The total investment in the energy sector is estimated at Rs 4,50,000 Crore.⁵⁶

The investment target for the six broad groups of infrastructure sectors are listed in Table 6.4.

Table 6.4 Investment target for energy sector till 2023

	Capacity (MW)	Amount (Rs in Crore)
Total Investment		450,000
New thermal generation capacity	20,000	110,000
Incremental renewable capacity	10,000	80,000
- Including solar power	5,000	
Transmission and Distribution		200,000
LNG terminal, gas grid and smart grid	5 MTPA, 10 cities	60,000

Some facets of the strategies for energy sector along with summary of investments is given in Table 6.5.

Table 6.5 Summary of Investments in energy sector till 2023

Projects	Rs in Crore
Ultra-Mega Power Projects	50,000
Case 2 bidding	60,000
Wind power	25,000
Solar power	55,000
LNG terminal	20,000
Gas Grid	20,000
Transmission and Distribution	200,000
Investment in Smart Grid	20,000
Total	450,000

⁵⁶TN Vision 2023 Document, Government of Tamil Nadu

Table 6.6 indicates the projected demand for the State by 2050 on the basis of different Clean Energy Compound Annual Growth Rates (CAGR) figures in a Business As Usual (BAU) scenario. In this projection it is assumed that both peak power demand and annual energy demand will grow at the same CAGR every year. It may be noted that the demand growth at such high CAGR figures will have to be supported by a huge increase in generating capacity.⁵⁹

Table 6.6 Projected Demand Forecast on constant CAGR basis

(Calculated from the base year figures of 13,489 MW and 93,465 MU for 2013-14)

Annual Growth rate (%CAGR)	Year 2030		Year 2040		Year 2050	
	Peak Demand (MW)	Annual Energy (MU)	Peak Demand (MW)	Annual Energy (MU)	Peak Demand (MW)	Annual Energy (MU)
4%	25,224	174,780	37,400	259,130	55,360	383,574
6%	34,270	237,434	61,370	425,208	109,900	761,480
8%	46,212	320,200	99,820	691,641	215,420	1,492,465
10%	61,980	429,470	160,764	1,113,932	2215,420	2,889,254

There are some challenges arising due to the huge increase in demand particularly for a resource constrained and densely populated state. The State has added 23,000 MW in the 66 years since independence while the actual requirement is around 400,000 MW assuming a CAGR of 10%. It is still a matter of challenge that even a CAGR of 6% allows for an addition of 88,000 MW which needs to be met from the additional power capacity that continues to be challenge considering that the State does not have coal reserve or it has fully utilized its power allocation.

The Tamil Nadu Electricity Regulatory Commission (TNERC) has issued new net metering guidelines for solar rooftop consumers as part of its Solar Policy 2019. This net-metering mechanism was one of the key proposals included in the solar policy that is expected to help the State to achieve its installation goals. This new order applies to all new applicants from the eligible consumer category. Existing consumers under the net metering program will not be covered under this order.

Tamil Nadu, the fifth largest solar market in India as of 2018, announced the State's Solar Policy earlier in 2019 with the goal of 9 GW in solar installations by 2023 between utility-scale and distributed generation projects. The State has targeted 40 percent (3.6 GW) of installations to come from the consumer category (residential rooftop and small-scale solar installations).

Under the new program, an eligible consumer can install the maximum capacity of solar rooftop up to 100 percent of his contracted demand with the distribution licensee. Eligible consumers will also have to install two meters under the solar net feed-in program. First is for measuring solar power generation and the second is to measure import and export of energy. Both the meters will have to be installed at the same location where the existing meter for recording the consumption of energy is installed.

A Roadmap to Tamil Nadu's Electricity, Demand-Supply by 2050, Shankar Sharma, Power Policy Analyst Installation of solar generation meter is to help DISCOMs with demand forecasting, along with the calculation of total solar generation in the State. The cost of new meters provided for the net feed-in program, installation and testing charges will have to be borne by the eligible consumers. However, DISCOMs will procure, test and install the meters. The consumer will also have an option of procuring and supplying the meters. The electricity generated by the solar rooftop power project will need to be used for self-consumption. The surplus energy that flows to the grid and is recorded in the export register of the meter will be calculated at a tariff fixed by the commission and credited to the consumer's account.

Under the commercial agreement, the order says-

"The price of purchase of energy exported to the grid by the solar power generators commissioned under the solar net feed-in during a financial year will be at 75 percent of the pooled cost of power purchase

notified by the Commission for the respective financial year in the orders issued on pooled cost of power purchase under Renewable Energy Power Purchase Obligations, 2010”

Or“

75 percent of last feed in tariff determined by the Commission or 75 percent of tariff discovered in latest bidding whichever is less.”

Connectivity to rooftop solar systems will be restricted to 90 percent of the distribution transformer capacity at the local level. The DISCOMs will provide the connectivity on a first come first serve basis and update the status of cumulative rooftop solar capacity connected to each distribution transformer in their website.

The Commission specifies that the responsibility of operation and maintenance (O&M) of the solar rooftop project including all accessories and apparatus lies with the solar power generators. For example, a consumer should use sine wave inverter suitable for synchronizing with the distribution licensee's grid. However, grid-connected solar PV systems with battery backup are not covered under this order. Any battery backup will be restricted to the consumer's network, and the consumer will be responsible for taking adequate safety measures to prevent battery power extending to grid causing a failure to DISCOM's grid supply.

DISCOMs will install the energy meters and commission the solar metering facility within three weeks from the date of application by the consumer. The energy generated from the solar rooftop project can be accounted towards the fulfillment of renewable purchase obligation of DISCOMs. However, the net injection of power is not eligible for renewable energy certificates.

The order has been in effect from March 25, 2019. Other States are also mulling similar policies to incentivize rooftop solar generation as rooftop makes only 11 percent of India's total solar installation.

6.1.2.2 Proposed Activities from 2021-30 under Energy Sector

A total number of 27 activities are proposed for a long-term implementation (2021-30) in the State out of which 16 activities are to be continued from TNSAPCC and rest of the 11 activities are newly proposed by nodal departments of the sector in the State. The total amount proposed for the Energy sector was approximately INR 98,056.68 Crore. Comparing this to the proposed budget, INR 1,365.76 Crore has actually been allocated for adaptation (7 activities) and INR 83.34 Crore has been allocated for mitigation (20 activities). Out of these, 27 proposed activities, 6 are related to capacity building, 17 are investment projects, 3 are pilot projects and 1 is a policy-oriented activity. The detailed description of proposed activities for 2021-2030 and budget allocation along with implementing departments has been given in **Annexure 33** and **Annexure 33** respectively.

6.1.2.3 Priority Mitigation Actions

Given limited resources and competing priorities, all the proposed activities for 2021-30 were ranked based on a method which is described in detail in section 7.3.

Based on this method of prioritisation, the first five high priority activities under **State Enhanced Energy Efficiency and Solar Mission** for 2021-30 are listed in Table 6.7.

Table 6.7 Priority activities in Energy Sector

PRIORITY ACTIVITY	IMPLEMENTING AUTHORITY	PROPOSED BUDGET for 2021-30 in INR Crore
Energy Efficient Street lighting (Rest of Urban Tamil Nadu)	CMA	10
Solar power generation program	TANGEDCO	8600
Offshore wind generation program (50 MW + 150 MW)	TANGEDCO	4800
On-shore wind generation program (5000 MW + 5000 MW)	TANGEDCO	
Grid connected Renewable Energy Generation – Hydro Electric Projects	Rural Electrification Corporation Limited Tamil Nadu Infrastructure Development Board	14217.67
School Energy Efficiency Programme on replacement of inefficient appliances with Energy Efficient Appliances in schools	Electrical inspectorate of Tamil Nadu	12
Effective utilisation of fly ash in view of climate change	TANGEDCO	1324.4
Kundah Pumped Storage Hydro Electric Project (4*125 MW) in Nilgiris District	TANGEDCO	3700

6.2. SUSTAINABLE HABITAT

6.2.1 Stocktaking

6.2.1.1 Progress Mapping (In Last 5years)

There are totally 9 strategies with 82 activities proposed under Sustainable Habitat sector in TNSAPCC. For strategy 1, there are 8 activities and physical progress has been made in these 8 activities for the last 5 years, except for the activity of “Promote generation of disaggregated electricity (micro-grid) in villages” in which there is no significant progress. Under Strategy 1, major activities undertaken were ECBC amendment, formulation of Solid Waste Management Rules etc. For Strategy 2, there are 17 activities and for all the activities, physical achievements have been made in areas like water supply schemes, underground sewerage schemes, rainwater harvesting, protection of water bodies etc. For Strategy 3, there are 2 activities and for all the activities, physical achievements have been made in last 5 years which include climate change adaptation plans, satellite cities etc. For Strategy 4, there are 7 activities and for all the activities, physical achievements have been made in last 5 years. Under Strategy 4, some major activities were undertaken in IDSP, open defecation programme, slum free cities programme. For Strategy 5, there are 7 activities and for all the activities, physical achievements have been made in last 5 years for sustainable solid waste management. For Strategy 6, there are 6 activities and for all the activities, physical achievements have been made in last 5 years. For Strategy 7, there are 23 activities and minor physical progress has been made in these 23 activities. For Strategy 8, there are 8 activities focusing on water, air and noise pollution. For Strategy 9, there are 8 activities and for all the activities, physical achievements have been made in last 5 years. Under Strategy 9, activities undertaken were focused on greening of urban spaces.

Activities in Sustainable Habitat sector are carried out by various government bodies in the State like DTP, TWAD Board, CMWSSB, TNSCB, Department of Transport, GCC, RD&PR, DTCP, CMA, Surface and Ground Water Board and TNHB. Thirty two of these activities were adaptation, 48 were mitigation and remaining 2 activities were both adaptation and mitigation. Total amount proposed for Sustainable Habitat sector for 2012-17 was INR 207,104 Crore. Out of this budget, an amount of INR 39,104.88 Crore was allocated for adaptation activities, INR 32,483.86 Crore was allocated for mitigation activities and INR 28,499.20 Crore was allocated for activities with both adaptation and mitigation components. The detailed physical achievements and financial allocations under this sector for 2012-17 (under TNSAPCC) as part of stock taking exercise has been given in **Annexure 33** and **Annexure 37** respectively.

6.2.1.2 Key Issues and Challenges

This section (Table 6.8) deals with the major issues and challenges faced by the sector in the State concerning Climate Change and its impacts. The areas have been broadly divided into technical, institutional and regulatory, financial and socio-political.

Table 6.8 Key Issues and Challenges of Sustainable Habitat Sector

Sector	Issues/Challenges
Technical	1. Unavailability of flexible housing finance schemes 2. Lack of awareness about new sustainable building technologies 3. Changes in the scope and design of the scheme like pro-rata supply, design of conduits and other infrastructures that results in variation in the sanction of the schemes 4. Departments lack enough technical expertise 5. Low public awareness about the overall scarcity and economic value of water resulting in its wastage 6. Identification and location of sustainable sources of drinking water supply 7. Unsystematic extension of buildings and encroachment of government land contributes to traffic congestion 8. Increase in vehicular population contributes to traffic congestion 9. Lack of sustainable modern planning framework 10. Lack of effective management to manage the potential economic and social development arising from urbanization 11. Inadequate proper sanitation facilities 12. Lack of appropriate arrangements for scientific disposal of waste 13. Lack of awareness regarding waste management 14. Recovery of recyclables in an unorganized manner
Institutional and Regulatory	1. Inter departmental issues leads to delay and cost overrun of the project 2. Lack of proper training or capacity building activities 3. Dearth of skilled personnel and inadequate human resource 4. Lack of strict laws for controlling pollutions and vehicular emissions
Financial	1. Implementation is dependent on fund flow from Central Financial Assistance (CFA) and grants from different funding agencies 2. Paucity of funds results in delay of implementation leading to cost overrun of the schemes 3. The financial schemes of the local bodies for implementation of the scheme is not fulfilled in total
Social-Political	1. Increasing rate of urban population sets humongous stress on housing demand and space making living condition sun sustainable 2. Unplanned settlement and migration of rural people to urban areas creates more demand of land 3. Lack of purchasing power 4. Distribution of water is uneven 5. Full coverage of drinking water remains an elusive factor 6. Unplanned construction in the urban areas 7. Lack of effective policies for proper monitoring and balanced development in the urban region 8. Dearth of responsive approach towards the changing needs of people at policy level

6.2.1.3 Gap/Barrier Analysis

After an overall understanding of the operational and financial progress of the activities under various strategies in TNSAPCC the following analysis was put forth for the gaps and barriers of the sector in the State. Gaps/ barriers were mainly identified in the areas of institution, finance and regulation/ policy (Table 6.9).

Table 6.9 Gap/ Barrier analysis of Sustainable Habitat Sector

<u>Area</u>	<u>Gaps</u>
Institutional	✓ TNCDDBR, 2019 has come into force since 04.02.2019. This is a comprehensive rule in simplified format for easy understanding, administration and enforcement. The rules reflect realistically the requirement. The involvement of various professionals, fixing responsibilities, inspection of construction at different stages, outsourcing of inspection for speedy disposal will improve the compliance. The Government have constituted special task force to prevent unauthorised construction by enhancing the co-ordination among the stake-holding departments and the use of technology. TNCDDBR insists on the installation of rainwater harvesting measures within its premises for conservation of rainwater. The method suggested is based on a detailed evaluation study conducted to assess the effectiveness of RWH structures. All centrally air conditioner building shall have own wastewater reclamation plant and use reclaimed wastewater for cooling purpose. A separation method of bath & wash basin water and its reuse has been suggested. ✓ An inter-departmental synchronization in the State due to which certain activities are being done in a repetitive mode while other activities remain untouched must be explored. ✓ Proper integration and convergence in the departmental planning and budgeting is required ✓ Need for appropriate financial management and guidance to build governance capacity
Financial	✓ Requirement of more funds ✓ Delay of funds which result in cost overrun ✓ Paucity of funds from different schemes is a major gap for delay of implementation of activities ✓ Lack of notable investment and accounting procedure ✓ Reduced scale of climate finance
Regulatory/ Policy	✓ Need for inter-departmental co-ordination for better convergence and clarity of goals ✓ Need for convergence with the schemes attaining similar goal ✓ State level policy planning and modeling for climate finance needs to be linked to the analysis of benchmarked climate linked activities which continues to be a challenge

6.2.2 Sector Planning: Sustainable Habitat

6.2.2.1 National and State-Level Targets and Their Linkages

The basic objective of NDC in this sector aims to attain through various commitments is a sustainable lifestyle and climate justice to protect the poor and vulnerable from adverse impacts of climate change. Various commitments have been developed by the government to achieve the targeted goal. Some of the key commitments under the SDGs and the NDC pertaining to sustainable habitat are outlined in Table 6.10.

Table 6.10 NDC and SDG Commitments and Key State Level Initiatives to comply with national pledges. SDG-related targets stem from the Planning, Development and Special Initiatives Department's SDG Monitoring Platform. ⁶⁰

	SDG-related				NDC-related	
Inter-national targets	SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable	SDG3: Ensure healthy lives and promote well-being for all at all ages	SDG6: Ensure availability and sustainable management of water and sanitation for all	SDG9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		
National targets/ indicators	-	-	-	-	To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development
State-level targets 2023 (Vision Tamil Nadu 2023)	By 2023, the State has set a target to achieve: - Ensure access for all to adequate, safe and affordable housing and basic services - Upgrade slums, emphasis on slum-free cities and low-income housing - Achieve	By 2023, the State has set a target • - To build a healthy society that will be able to take part in and share the fruits of economic development • - To provide universal access to quality health care facilities • - To ensure availability of items on the Essential Drug List (EDL) to all citizens	By 2023, the State has set a target to • - Reduce the vulnerability of Urban Local bodies in sustained water supply caused by climate change • - Achieve universal and equitable access to safe and affordable drinking water for all • - 24x7 sustainable	By 2023, the State has set a target to: - Improve communication and digital connectivity - Provide best in class infrastructure facilities focused on providing universal, equitable and affordable services to all residents - Establish knowledge capital and Innovation facility Centre/		

⁶⁰ SDG India Index Baseline Report, 2018 by NITI Aayog

	SDG-related				NDC-related
2030	100 percent door to door waste collection in Towns and Cities. - 100% municipal solid waste treatment • Tree cover achieved outside forest area (State Specific): 23692 square km	- To strengthen primary and secondary care centres and upgrading tertiary care hospitals • 95: Percentage of women aged 15 - 49 years who received antenatal care, four times or more (Period 5 years/1 year) • Reducing the infant mortality rate to 10 deaths per 1000 live • 1.0 HIV Prevalence (Number of HIV positive among tested per 10000 Population) • 8000 number of deaths due to road accidents	piped and pressurized water supply Water security in the urban local bodies • -100 percent Sanitised and Open Defecation free city -100 percent Sanitised Cities - Clean and Green Garbage free city • Capacity of sewage water treated (MLD): 100%	Innovation Hub - Seamless and affordable connectivity and transportation • Share of Manufacturing in GSDP (%): 30.32 • Renewable share in the total installed capacity: 44.61% • Number of Internet subscribers: 100%	
Key state achievements and initiatives	SDG index score: 33	SDG index score: 77	SDG index score: 66	SDG index score: 46	

6.2.2.2 Proposed Activities from 2021-30 under Sustainable Habitat Sector

A total number of 24 activities are proposed for a long-term implementation (2021-30) in the State. Out of these 24 activities, 23 are carried forward from TNSAPCC and 1 activity is newly proposed in the State. The total amount proposed for this sector is approximately INR 127,489.33 Crore. Compared to this proposed budget, INR 107,736.93 Crore has been allocated for adaptation (2 activities), INR 19,752.35 Crore has been allocated for mitigation (20 activities) and INR 0.05 Crore for both adaptation and mitigation (2 activities). Activities which are more focused in terms of high budget allocation for future include 24x7 water supply schemes, underground sewerage and septage management, waste water reclamation, upgradation of road networks, sustainable solid waste management for both urban and rural etc. Out of the 24 proposed activities, 5 are related to capacity

building, 3 are investment projects, 1 is a pilot project, 1 is policy-oriented and 2 are research-based activities. The detailed description of proposed activities for 2021-2030 and budget allocation along with implementing departments has been given in **Annexure 33** and **Annexure 33** respectively.

6.2.2.3 Priority Mitigation Actions

All the proposed activities for 2021-30 were ranked based on the method which is described section 7.3.

Based on this method of prioritisation, the first five high priority activities under **Sustainable Habitat** for 2021-30 are listed in Table 6.11.

Table 6.11 Priority activities in Sustainable Habitat Sector

PRIORITY ACTIVITY AUTHORITY	IMPLEMENTING	PROPOSED BUDGET for 2021-30 in INR Crore
Providing CC resilient water supply systems, Providing water supply scheme and 24 X 7 ready water supply in extended areas	TWADB/ CMWSSB/ CMA	7114.72
Sewerage and Septage Management	CMWSSB	9232.04
Rainwater Harvesting Structures	DTP/RDPR	1717.25
Sustainable solid waste management (urban)	DTP/ GCC	5232.5
Improvement to all existing roads and maintenance at regular intervals	DTP/RDPR	13146.25

CHAPTER 7: FINANCING SAPCC

India is doing its best to meet the promised adaptation and mitigation actions as per Paris agreement, finance still remains a critical issue. It is estimated that India's climate change adaptation gap by 2030 is around 1 trillion USD¹, therefore creative financing strategy by the States is the need of the hour. It has become apparent since the TNSAPCC that additional finance is hard to come by. Therefore, high impact areas need to be identified from the State's ongoing sectoral activities for mainstreaming and tagged. In addition, more and more private sector involvement should be pooled in for high priority activities in a systematic way including public-private partnership mechanism. In addition there will be additional climate finance from International Climate Funds (Green Climate Fund, Global Environment Facility, Adaptation Fund), Bilateral Cooperation (additional financial and technical support for climate change outcomes from Swiss Agency for Development and Cooperation (SDC), German International Cooperation (GIZ), Japan International Cooperation Agency (JICA) and Department of International Development (DFID), Multilateral facility (loan and grant projects through World Bank (WB), Asian Development Bank (ADB), United Nations Development Programme (UNDP), etc.) and National Climate Fund (National Adaptation Fund for Climate Change (NAFCC), Small Grants programme, mission-specific allocation and regular schematic allocation having climate relevance).

The approach taken for financing mechanism is explained in the table 7.1. Various types of financing windows are listed down and source of fund against each of them is figured. Many kinds of instruments can be used to access the funds. The key sectors in which the funds can be used are also mentioned in Table 7.1 along with the modalities and challenges faced in the process.

Table 7.1 Key Instruments for Fund Access

Window	Source of Fund	Instrument	Key sectors	Access modalities and challenges
International climate fund (budget additional)	Green Climate Fund	Loan and grant, guarantee, equity	Food and Water, Health, Livelihood, Infrastructure and built Environment, Ecosystem (for both adaptation and mitigation)	Micro up to 10 million USD Small (10-50) Medium (50-250) Large (>250) National Designated Authority (MoEF&CC) as focal point Through (Direct Access Entity and multilateral access entities) approved as National Implementing Entities (NIE) or Multilateral Implementing Entities (MIE) by National Designated Authority (NDA), MoEF&CC 1-2 years, elaborate process
	Adaptation Fund	Grant, But Loan as co-finance (by NIE or MIE) maximum up to 50 percent of the project cost	Natural resource systems (addressing climate risks), eco-system, hazard	Regular project size >1 million USD Small <1 million USD Through NDA through NIE and MIE 8-12 months Maximum cap for country 10 million USD (India exhausted)

¹CEEW

Window	Source of Fund	Instrument	Key sectors	Access modalities and challenges
Global Fund	Global Environment Facility (GEF)	Grant	Based on the sectors under the star allocation both for adaptation and mitigation. 1) Food systems, Land Use and Restoration; 2) Sustainable Cities; and 3) Sustainable Forest Management (under GEF 7 series)	Full sized project > 2 million USD Medium size (upto 2millionUSD) Enabling activity (strategy development under a convention) Minimum 12 months
National Fund	NAFCC	Grant, Co-finance, convergence fund from State	Agriculture, horticulture, agro- forestry, environment, allied activities, water, forestry, urban, coastal and low-lying system, disaster management, human health, marine system, tourism, habitat sector and other rural livelihood sectors to address climate change related issues. Climate scenarios, capacity building, consultation, monitoring	Though no upper limit specified typical maximum for a State is about Rs 25 Crore. Through NIE Typically, 6months for preparation and sanction Maximum preparation cost is Rs 10 lakhs, NIE fee capped at 3 percent of the project cost
Bilateral and Multilateral projects/programmes	Programs/Projects linked to clear climate outcomes	Loan, Grant	Sectoral (both for adaptation and mitigation)	On State partnership basis and through the concurrence of National Government
International Non Governmental Organizations (INGOs)	Programs/Projects linked to clear climate outcomes	Grant	Sectoral (both for adaptation and mitigation)	On State partnership basis and through the concurrence of National Government
Corporate Social Responsibilities (CSR)	Programs/Projects linked to clear climate outcomes	Grant	Sectoral (both for adaptation and mitigation)	As per statutory requirement under Company Act for the eligible companies, private foundations with voluntary pledge with programmatic Convergence
Budgetary (National and State)	Regular schematic (may not be additional)	Budget (grant in aid) State, Central and Centrally sponsored schemes	Sectoral (both for adaptation and mitigation)	Some of the schemes are listed in the document, not all required/proposed strategies/priorities are covered under the scheme Guideline. This needs to be classified as climate relevant and possible have a climate tag for reporting. Currently, there is no standard approach available
Budgetary (Mission specific)	As per mission guideline	Both demand-driven and as per target	Sectoral (both for adaptation and Mitigation)	Some of these have been specified in the Report

There are four broad steps to be taken for the financing in climate change domain. Typical process to be followed in the climate finance area is explained stepwise in Table 7.2.

Table 7.2 Steps for Financing in Climate Change Domain

Step 1a: Identify high impact/high priority activity/strategy having linkage to SDG/NDC	Identify relevant schemes in the State budget and place in the right demand (some examples have been given in the report).The expenditure can be treated as a climate relevant expenditure based on how many components of the project activities have been covered.
Step 1b: Identify activities linked to National missions	Draw down resources from relevant Mission based on the demand/target
Step 2: There is no correspondence or availability of funds from State budget/National Missions	Map to Central and State (CSP), external aided projects or sources under bi-lateral or multilateral cooperation. Prepare proposal under the formats/processes given by the agency. The lead department/agency can initiate the process.
	Look for grants from CSR and INGO sources
Step 3: There is correspondence or availability of funds from special climate funds available Nationally	For NAFCC, prepare project concept note, do a preliminary go-no go check with National Implementing Entity (NIE)
	If agreed, go ahead with the detailed project report and submit through NIE to National Designated Authority
	Executing agency signs the grant agreement and project cycle operation starts.
	Baseline and endline assessment conducted by external agencies track outcomes as per the project result framework
Step 4: There is correspondence or availability of funds from special climate funds available internationally	Assess the concept based on the result/impact areas and investment criteria (for GCF)
	1) Impact potential
	2) Paradigm shift potential
	3) Sustainable development potential
	4) Needs of the recipient
	5) Country/State ownership
	6) Efficiency and effectiveness
	Submit proposal to NDA through National Implementing Entity (NIE) or MIE as per the format. Once approved by relevant board sign subsidiary agreement with NIE/MIE
	Executing agency starts the project cycle operation.

7.1 SYNTHESIS

In the TNSAPCC, 260 climate actions were proposed, out of which 59 percent of these activities were under adaptation, 36 percent were under mitigation and 5 percent of these activities had both adaptation and mitigation components (Figure 7.1). The tentative budget to implement these actions was Rs. 404,258.14 Crore for five years (2012-17). Out of this budget, 74 percent was allocated for mitigation related activities and 26% was allocated for mitigation related activities. (Figure 7.1)

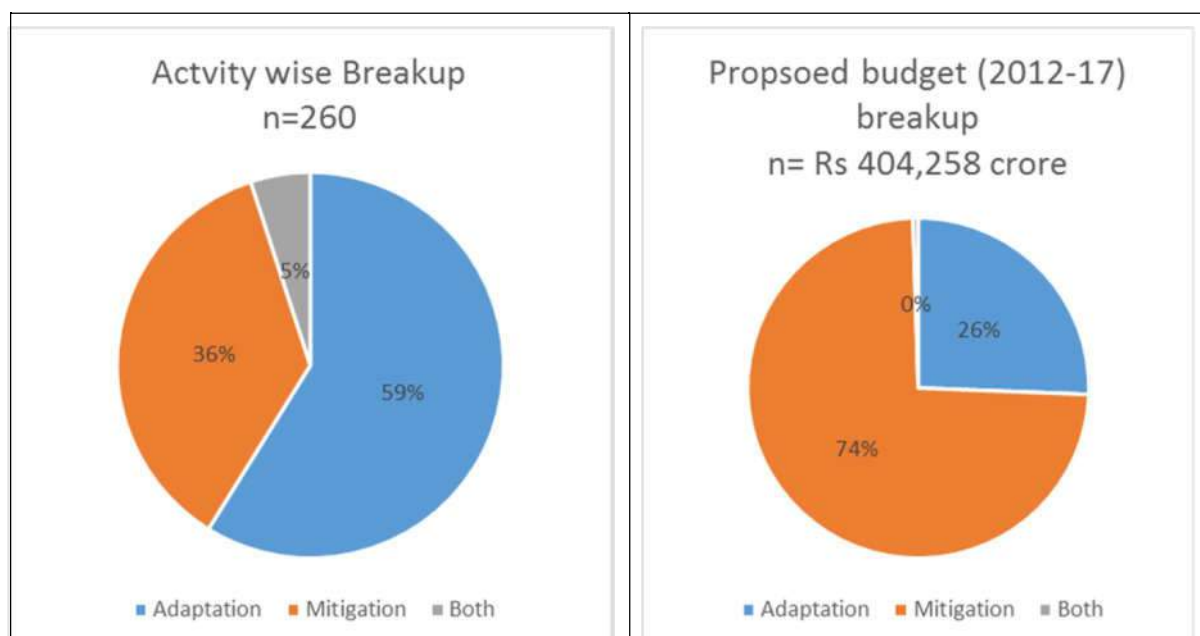


Figure 7.1 Breakup of climate actions (2012-17)

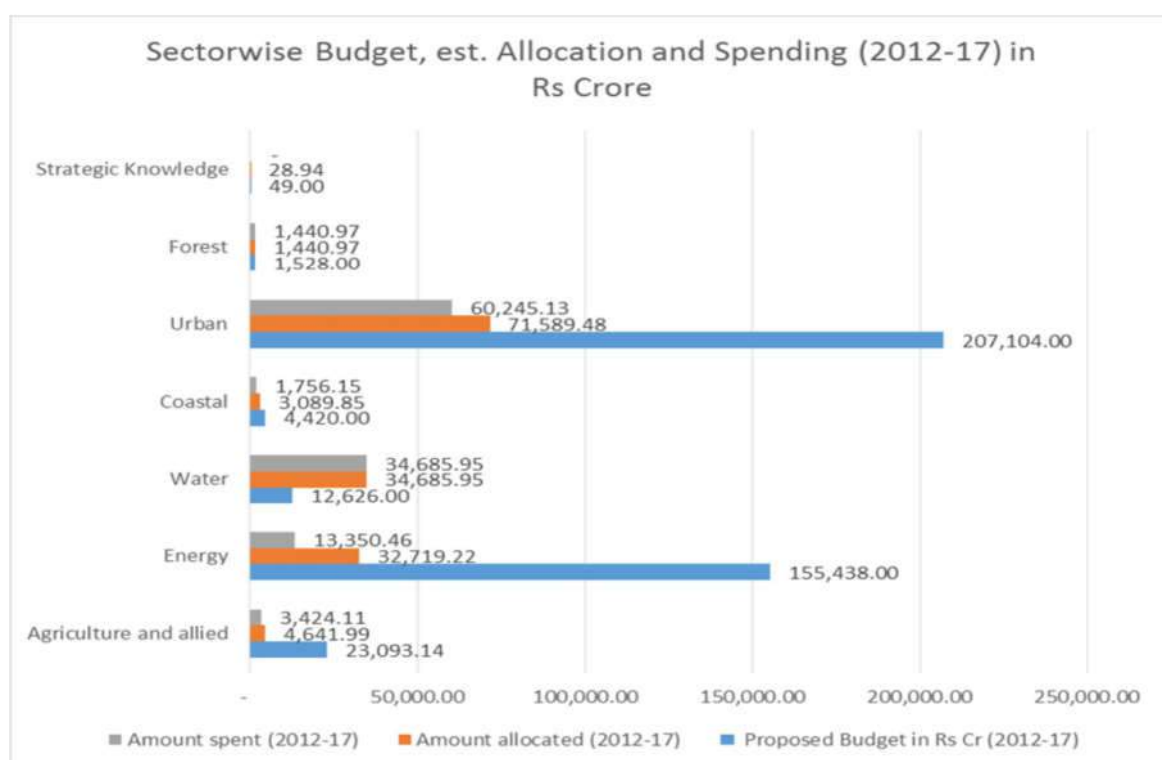


Figure 7.2 Allocation and spending by Sector wise budget

The allocation and spending by sector wise budget are given in the figure 7.2. Majority of the activities were proposed under Energy and Sustainable habitat sector those have strong linkages to mitigation targets under NDC. Table 7.3 the sector wise breakup of the proposed budget under TNSAPCC were depicted in Table 7.3.

Table .7.3 Sector wise proposed budget for TNSAPCC (2012-17)

Sector	Proposed Budget (as in SAPCC 2012-17) INR in Crore
Sustainable Agriculture	23,093.14
Water Resources	12,626.00
Forest & Biodiversity	1528.00
Coastal Area Management	4420.00
Strategic Knowledge for Climate Change	49.00
Enhanced Energy Efficiency and Solar Mission	155,438.00
Sustainable Habitat	207,104.00
TOTAL	404,258.14

The above table 7.3, the investment focus has been more on the Sustainable habitat sector which has strong relevance with the NDC and is highly affected by climate change. Investment in power infrastructure for energy efficiency has received the second highest allocation which will contribute to the NDC goals. Similarly, rapid modernisation in agriculture in the State also shows third highest allocation to Agriculture sector. The fourth allocation has been to water resources. The fifth highest allocation has been to forestry sector which has strong bearing on addressing climate variability, soil conservation as well as it helps in creating the carbon sink.

7.2 SUMMARY OF PRIORITISED INTERVENTIONS FOR 2021-30

Based on the discussion with all relevant stakeholders and departments 199 planned activities have been identified in seven sectors for prioritization, in which financial allocation have been proposed merging similar activities. The key method of prioritisation is driven by the following:

- Adaptation activities that addresses high vulnerability and fits in to the impact chain (as relevant to sector)
- Low carbon development linked to mitigation activities
- There are some activities where adaptation and mitigation both possible, the co-benefit approach has been taken. Further sharpening has been done based on their linkages to SDG-NDC, with funding linkage and implementation potential. The details have been given in **Annexure 3**.

Though for prioritization of activities, a multi criteria-based analysis-based score card was used, first the activities have been screened based on vulnerability/impact as well as low carbon development process. Thereafter, NDC-SDG linkage was assigned highest weight of 50 percent. Implementation potential based on low barriers was assigned 30 percent weight and funding linkage was assigned 20 percent weight (since our funding is mostly schematic and climate relevance for proposed activities is still not standardized). The activities based on this were scaled as (1) meager (2) reasonable (3) significant. The weighted averages were used for ranking and prioritization.

To give some examples from agriculture sector, the State suffers from water stress and extreme weather events that makes the sector more vulnerable, The top strategies (given below) clearly show such linkages: (1) Extension strategies to popularize climate resilient management practices to mitigate extreme weather events (ART and MLT)

(2) Climate proofing with Integrated Farming Systems: Popularising the Integrated Farming System for wider adoption

(3) Recharging the aquifers using the abandoned open wells and defunct bore wells.

Table 7.4 SDG-NDC linkage of proposed activities

			NDC-SDG linkage			Total
			Meager	Reasonable	Significant	
		Number	0	11	40	51
	Agriculture& Allied					
		% of Total	0.0%	5.5%	20.1%	25.6%
		Number	0	14	24	38
	Coastal					
		% of Total	0.0%	7.0%	12.1%	19.1%
		Number	0	7	20	27
	Energy					
		% of Total	0.0%	3.5%	10.1%	13.6%
		Number	0	13	24	37
	Forest					
		% of Total	0.0%	6.5%	12.1%	18.6%
		Number	1	3	8	12
	Strategic Knowledge					
		% of Total	0.5%	1.5%	4.0%	6.0%
		Number	0	8	16	24
	Urban Habitat					
		% of Total	0.0%	4.0%	8.0%	12.1%
		Number	1	5	4	10
	Water Resources					
		% of Total	0.5%	2.5%	2.0%	5.0%
		Number	2	61	136	199
Total						
		% of Total	1.0%	30.7%	68.3%	100.0%

Table 7.5 inferred that 99 percent of the planned activities across seven sectors have reasonable and significant linkages to SDG and/or NDC. Agriculture, Coastal area management, energy, urban and forestry sectors have more such linkages. These sectors significantly can contribute to climate goals under NDC as well as have reasonable co-benefits.

Since majority of the activities are having significant linkages to SDG and NDC, a further analysis was done to identify funding linkage.

Table 7.5 Funding Linkage

)			NDC-SDG linkage			Total
			Meagre	Reasonable	Significant	
Funding Linkage	None	Number	0	1	0	1
		% of Total	0.0%	0.5%	0.0%	0.5%
	Meagre	Number	0	34	31	65
		% of Total	0.0%	17.1%	15.6%	32.7%
	Reasonable	Number	2	12	59	73
		% of Total	1.0%	6.0%	29.6%	36.7%
	Significant	Number	0	14	46	60
		% of Total	0.0%	7.0%	23.1%	30.2%
Total		Number	2	61	136	199
		% of Total	1.0%	30.7%	68.3%	100.0%

Table 7.5 inferred that only 1 percent of the activities have meager SDG-NDC linkage but reasonable funding linkage. Overall 6 percent activities have reasonable funding linkage as well as SDG-NDC linkage, 23.1 percent of the activities have significant linkages to SDG-NDC as well as funding, 22.7 percent activities have meager funding and implementation linkage. 17.7 percent have reasonable funding and implementation linkage and 14.6 percent have significant funding and implementation linkages.

Table 7.6 Implementation linkage

)			Implementation				Total
			None	Meagre	Reasonable	Significant	
Funding Linkage	None	Number	1	0	0	0	1
		% of Total	0.5%	0.0%	0.0%	0.0%	0.5%
	Meagre	Number	0	45	16	4	65
		% of Total	0.0%	22.7%	8.1%	2.0%	32.8%
	Reasonable	Number	2	7	35	29	73
		% of Total	1.0%	3.5%	17.7%	14.6%	36.9%
	Significant	Number	0	4	6	49	59
		% of Total	0.0%	2.0%	3.0%	24.7%	29.8%
Total		Number	3	56	57	82	198
		% of Total	1.5%	28.3%	28.8%	41.4%	100.0%

Only 0.5 percent of the proposed activities have no funding and no implementation linkage (Table 7.6). It is also validated that without any funding linkage no implementation takes place.

A detailed score card of activities has been presented in **Annexure 66** of the report.

The proposed budget for next 10 years is given in Table 7.7 with the probable linkages to funding and gaps.

Table 7.7 Proposed Budget for next 10 years (2021-2030)

S.No	Sector	Proposed budget in Rs. Crore (2021-30)	From State/Central budget available Rs. Crore	Gap in Rs. Crore
1	Sustainable Agriculture	71,731.94	58,426.94	13,305.00
2	Water Resources	19,041.84	16,728.00	2,313.84
3	Forest & Biodiversity	2,834.44	2,301.44	533.00
4	Coastal Area Management	4,776.10	2,626.58	2,149.52
5	Strategic Knowledge for Climate Change	280.87	271.68	9.19
6	Enhanced Energy Efficiency and Solar Mission	98,056.68	42,522.31	55,534.37
7	Sustainable Habitat	127,489.33	98,021.77	29,467.56
8	TOTAL	324,211.20	220,898.72	103,312.48

The State has proposed 199 activities that include some of the existing activities and new ones based on their linkages to NDC/SDG. The total resource requirement is expected to be Rs 324,211.20Crore. Apart from accounting from all possible sources of funds, there will still be a gap of Rs103,312.48 Crore.

Out of the proposed actions for next 10 years 56 percent were for adaptation, 43 percent for mitigation and 1percent had characteristics of both. (Figure 7.3)

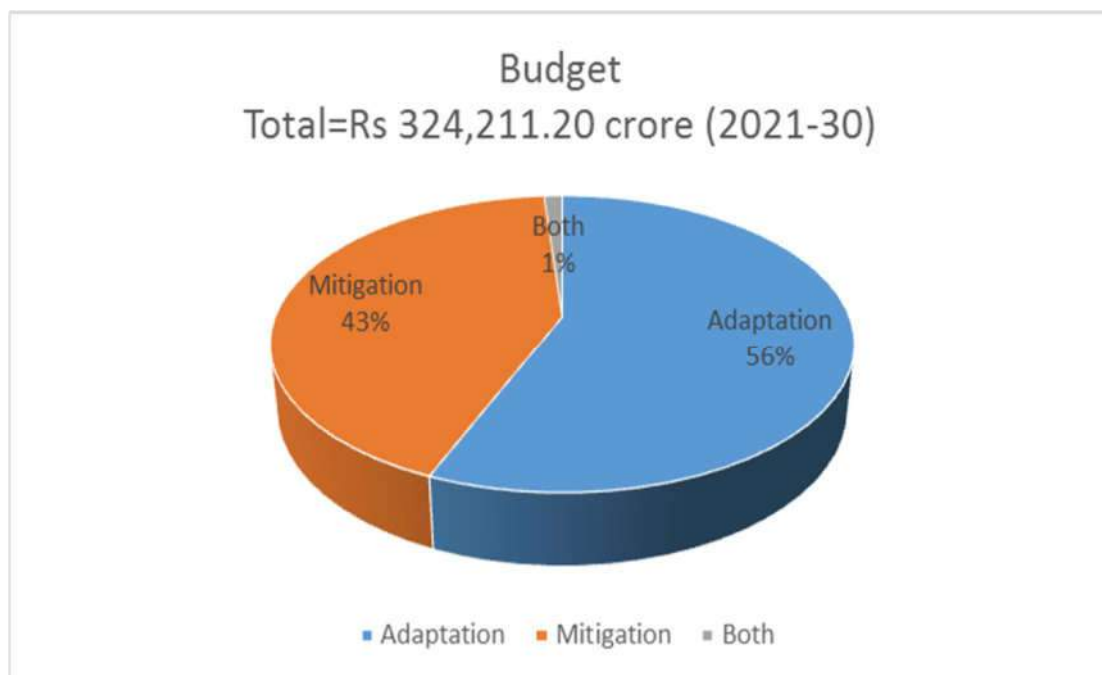


Figure 7.3 Breakup of Climate Actions (2021-30)

In terms of the nature of activity of the actions proposed for next 10 years, 64 percent of the activities were investment oriented, 18 percent were for capacity building, 11 percent for research and assessment, 4 percent of the total are pilot actions and 3 percent were meant for policy related actions. (Figure 7.4).

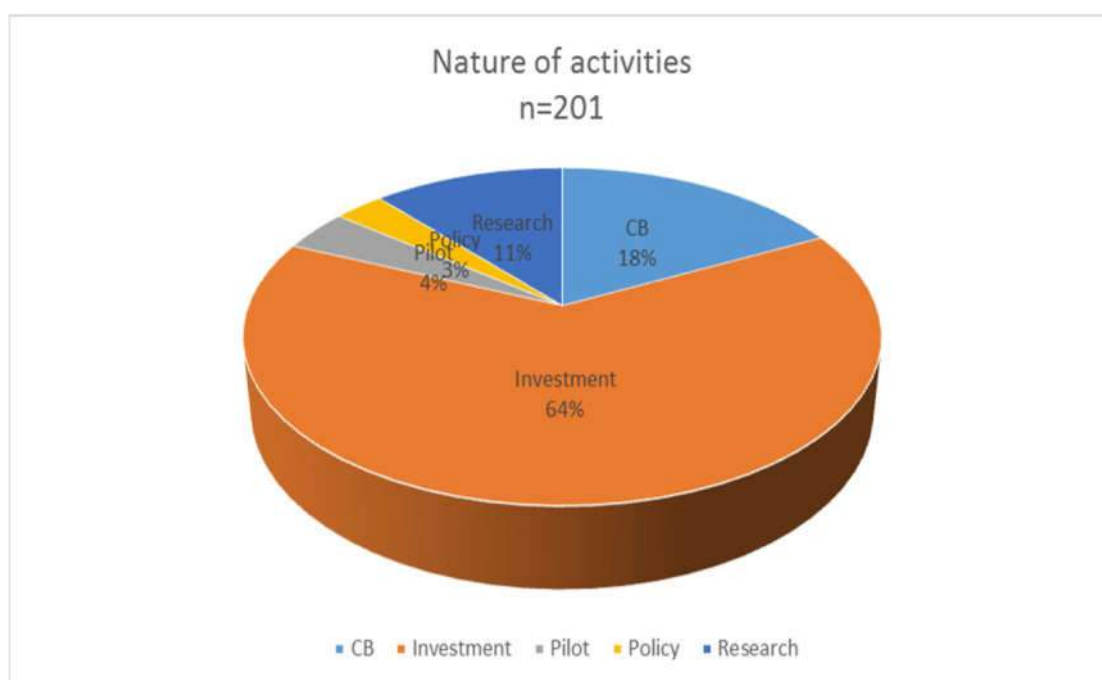


Figure 7.4 Allocation by Nature of activities (2021-30)

The focus on investment programs clearly shows a journey from pilot to policy and their main streaming through schematic convergence in various sectors. It also highlights the creation of the necessary infrastructure and institutional framework to ensure that climate change activities are carried out in a planned manner.

CHAPTER 8: IMPLEMENTATION MECHANISM

This section presents the mechanism through which the activities envisaged under TNSAPCC will be implemented. TNSAPCC will be implemented by multiple sectoral departments with the overall coordination responsibility of nodal department of climate change. This chapter also highlights the steering mechanism through which proposed interventions will be planned, operationalized, and monitored.

8.1 IMPLEMENTATION ARRANGEMENT OF THE TNSAPCC

A Climate Change Steering Committee has been set up as the apex authority, for initiating all the strategic decisions on climate change for the State. The council is headed by the Chief Secretary. The operating arm of the Climate Change Steering Committee is the Executive Council chaired by the Chief Secretary of the State. A nodal Climate Change Cell within the Department of Environment has been formulated for overseeing the implementation TNSAPCC. Additionally, Centre for Climate Change and Disaster Management, Anna University Tamil Nadu is mandated to provide the knowledge management components envisaged in the TNSAPCC. The responsibility for various Missions will rest under individual departments who designate climate change nodal officers and shall strive to attain all listed objectives within stipulated time frames and ensure its integration with the National Mission objectives of the National Action Plan on Climate Change. The Implementation arrangement for TNSAPCC is illustrated in Figure 8.1.

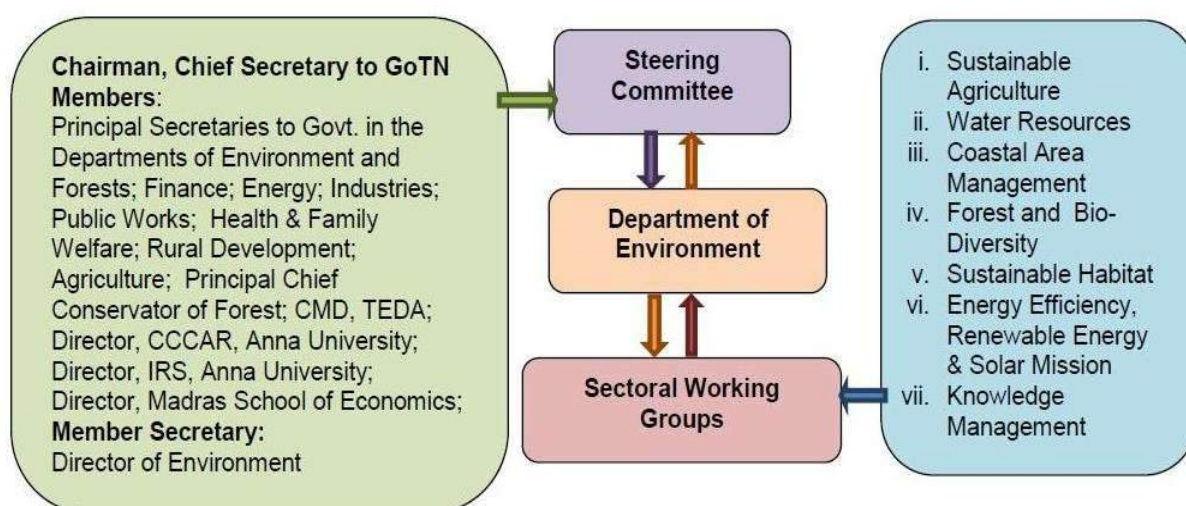


Figure 8.1 Implementation Arrangement of TNSAPCC

The State is committed to ensure that TNSAPCC implementation is complemented by a robust framework and mechanisms not only as a means of ensuring that the detailed operational plans are implemented as planned, but more importantly, as a tool for systematic review and programme improvement as the needs of the State evolve with implementation regularly.

In implementing the climate relevant strategies for achieving the desired outcomes effectively, the interdepartmental coordination plays a crucial role. The proposed strategies will require sincere efforts along with systematic and synchronized approach. Figure 8.1 shows implementation framework broadly highlights an approach that the line departments will initiate. With every proposed activity, the principle implementing agency along with supporting departments has also been identified. However, if required, a further alliance with other departments as well as agencies is also possible depending on the scale and planned interventions (Figure 8.2).

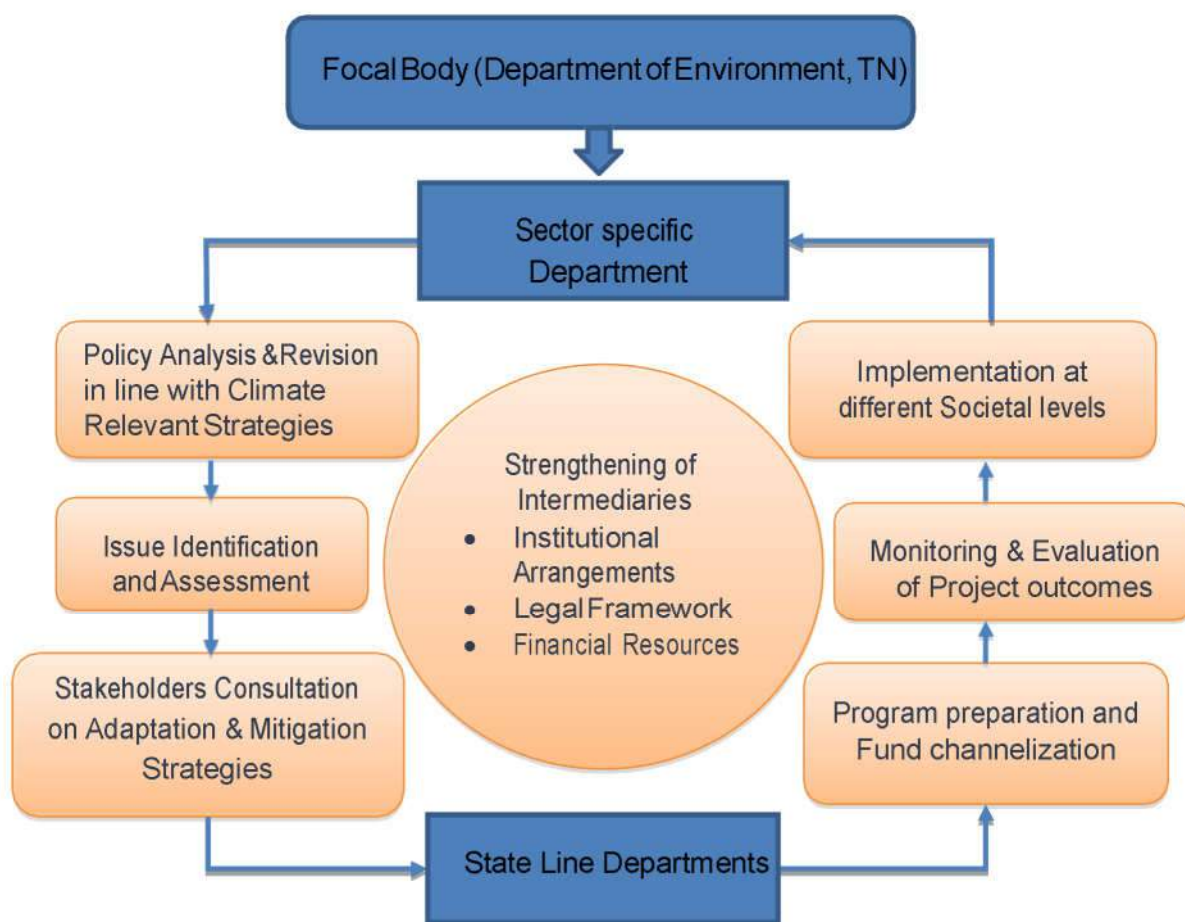


Figure 8.2: Implementation framework of TNSAPCC

8.2 PROPOSED ACTIVITIES & IMPLEMENTING AGENCIES

Addressing the challenges of climate change requires integrative thinking. For example, anticipated changes in water availability driven by climate change will spill over to decisions about urban development, agriculture, and forest and broader land use considerations. To address these linkages, different sectoral perspectives and priorities need to be brought into conversation with the climate science. Hence, climate change needs to be mainstreamed within existing departments by pointing out the activities that are cross-departmental in each of the seven sectors listed in TNSAPCC. Strategies along with their implementation agencies for all the sectors have been listed in the tables below:

a. State Mission on Agriculture

In the agriculture sector, six activities are solely implemented by Department of Agriculture (DoA), six activities are solely implemented by Tamil Nadu Agricultural University (TNAU), three activities are solely implemented by Department of fisheries, two activities are solely implemented by Department of Animal Husbandry (DoAH), one activity is solely implemented by SDMA and one activity is solely implemented by Department of Horticulture (DoH). Rest of the activities enlisted in Table 8.1 are cross departmental.

Table 8.1: State's priorities under State Mission on Agriculture

Code	Strategy	Implementing Agency
AG/5	Extension strategies to popularize climate resilient management practices to mitigate extreme weather events	KVK/ DoA
AG/7	Climate proofing with Integrated Farming Systems: Popularizing the Integrated Farming System for wider adoption	TNAU / DoA / Veterinary Dept.
AG/8	Recharging the aquifers using the abandoned open wells and defunct bore wells and artificial recharge shaft	Dept. of Water Resources/ AED
AG/9	Constructions of sub-surface dykes	TWAD/AED / Dept. of Water Resources
AG/10	Diversion of excess flood water at upper reaches to water deficit areas	Dept. of Water Resources/ AED
AG/11	Deep ploughing to break sub surface hard pan to increase infiltration efficiency and improve ground water quality and check sea water incursion	AED/DoA
AG/13	Promote minimum/no tillage during fallow period, compartmental bunding, contour farming, deep ploughing, mulching for all crops besides conducting awareness programmes and training	AED/DoA/KVK/NGOs
AG/15	Bringing fallow land and degraded land back to cultivation through Integrated wasteland development Programme	DoA/ DoF
AG/16	Organic farming including horticultural crops	DoA / Dept. of Hort. And plantation crops / Dept. of organic certification
AG/18	Increase the use of Micro Irrigation technology Viz., drip, Sprinkler, Rain gun, Mobile Sprinkler in dry land, Garden land and Horticultural farming system	DoA/ DoH/ AED
AG/19	Strengthening existing water harvesting structures and repairing and replacing the shutters in the irrigation tanks and drainage channels	Dept. of Water Resources/ AED
AG/20	Creation of additional farm ponds to capture the runoff water and utilise the harvested water to critical stages of crop growth and to recharge the aquifers to improve the quality of irrigation water	Dept. of Water Resources/ AED
AG/21	Ensuring the livelihood of the farmers in non- delta districts having surface irrigation potential with piped irrigation network by providing collection wells at regulating structures to increase the cropping intensity with assured yield and employment opportunities	Dept. of Water resources / Dept. of Agri. / Dept. of Human resources
AG/23	Establishment of network of seed banks, food banks and cold storage to ensure supply at times of contingencies	TNAU / DoA.
AG/24	GIS based village mapping for agro management system to enhance input use efficiency and overcome effect of climate change and increase farm productivity including horticulture crops	TNAU / Dept. of Hort. And plantation crops / DoA
AG/25	Integrated voice message on weather based agro advisories, market demand & price forecasting	TNAU / DoA / Dept. of marketing / KVK / NGOs

Code	Strategy	Implementing Agency
AG/28	Research project on comprehensive crop insurance products that would cover increasing extreme events	TNAU, DoA
AG/29	Development of vegetative shield for east coastal region against wind, cyclones, etc. Management and conservation of vegetative shield	TNAU / Dept. Environment / SDMA
AG/30	Development of technology for improving inland fishing; new breeds; Popularization of technology.	TNJFU / Dept. of Fisheries
AG/31	Increasing fish production and fish farming area for rural livelihood through Inland Fisheries Reservoir fisheries development, fish culture in pens and cages, establishment of hatcheries	Dept. of Fisheries / DFFDA
AG/34	To increase per hectare production and encourage new species advocating Culture of SPF <i>Litopenaeus vannamei</i>	TNJFU / Dept. of Fisheries
AG/36	Ensure year-round feed and fodder availability	TNAU/DOAH, TANUVAs, Dept. of Agri., TCMPF
AG/37	Ensure adequate animal housing and dedicated ponds for bathing in villages to protect livestock from extreme heat	Dept. of Animal Husbandry / Dept. of water resources
AG/38	Intensify Disease surveillance and develop forecasting of disease outbreaks for short& long term	DoAH, TANUVAS
AG/39	Promote breeding with indigenous varieties to improve resilience to climate change	DoAH, SEVA, TNLDA, TANUVAS, TCMPF
AG/40	Promote dairy development by training women in villages on animal care, animal disease reporting, and nutrition for optimising milk production at household level of small and marginal farmers and enabling them to participate in milk cooperatives	Dept. of Animal Husbandry and dairy
AG/N/1	Development of nutritionally enhanced climate resilient premium quality rice varieties	TNAU/DoA
AG/N/2	Enhancing maize productivity by identification and popularization of agro techniques	TNAU/DoA
AG/N/3	Revitalization of millets for nutritional security and enhanced productivity	TNAU/DoA
AG/N/4	Enhancing pulses production in delta and non-delta districts	TNAU/DoA
AG/N/5	Special package for increasing the productivity of cotton	TNAU/DoA
AG/N/6	Special package for increasing the productivity of sugarcane - Sustainable Sugarcane Initiative	TNAU/DoA
AG/N/13	Development of contingency plans for extreme weather events and implanting on the ground	TNAU/DoA
AG/N/14	Solar driers and water pumping system for irrigation	Dept. of Water Resources/ AED

b. State Mission on Water

In the Water Sector, two activities are solely implemented by PWD. Rest of the activities enlisted in Table 8.2 is cross departmental

Table 8.2: State's priorities under State Mission on Water

Code	Strategy	Implementing Agency
WR/N/1	Climate change adaptation programme in Cauvery Delta	PWD, TNAU
WR/N/3	Irrigated Agriculture Modernisation and Water- Bodies Restoration and Management (IAMWARM) Project	Agriculture, Horticulture, Agricultural Engineering, Agri-Marketing Board, Animal Husbandry, Fisheries and TNAU and WRD, PWD
WR/N/5	Desilting of Dams and Water Bodies - Desilting of Vaigai, Pechipparai, Mettur, Amaravathy Reservoirs and Srivaikundam Anicut for increasing the area under irrigation	WRD, PWD
WR/N/6	Desilting of Parappalar Reservoir to increase the command area	WRD, PWD
WR/N/7	Desilting of Veeranam tank for providing drinking water to Chennai and surrounding area	WRD, PWD
WR/N/8	Dam Rehabilitation and Improvement Project (DRIP)	WRD, PWD
WR/N/9	Increasing water use efficiency	WRD and DoA
WR/N/10	Capacity building to various stakeholder including Officials, Irrigation engineers, field level staff on maintenance of irrigation system and increasing the water use efficiency	TNAU, IMTI

c. State Mission on Forest

In the Forest Sector, nine activities are solely implemented by Forest Department, 1 activity is solely implemented by Department of Environment and 1 activity is solely implemented by Horticulture Department. Rest of the activities enlisted in Table 8.3 is cross departmental.

Table 8.3: State's prioritises under State Mission on Forest

Code	Strategy	Implementing Agency
FR/14	Establishment of biodiversity corridors	Forest Department, Biodiversity Authority of Tamil Nadu, Forest College
FR/19	Mapping of floral and faunal biodiversity in State at a high spatial resolution incorporating GPS coordinates and on GIS platform	Forest Department, Biodiversity Authority of Tamil Nadu, Forest College
FR/26	Large scale field testing of different forest species for lower strata diversification in different agro-climatic Zones	Forest Department, Dept. of Environment
FR/32	Estimating mitigation potential of forest in Tamil Nadu	TNAU, Forest Department
FR/39	Capacity building through seminars and trainings for scientists and researchers to meet the challenges of climate change	TNAU, Forest Department
FR/N/2	Increasing the green cover outside the forest area: Plantations in urban areas, industrial sites and recreational forestry	Forest and Agri Department
FR/N/3	Promotion of private social forestry, plantation in farmlands and current fallow, agro-forestry and shelterbelt plantation	Forest and Agri Department
FR/N/10	Eco restoration and conservation of Pallikaranai Marshland	Forest Department, Dept. of Environment
FR/N/11	Conservation and management of Mangroves	Forest Department, Dept. of Environment
FR/N/12	Gulf of Mannar Biosphere Reserve protection	Forest Department, Dept. of Environment
FR/N/14	Enrichment of Non-Timber Forest Product Resources in Forest Areas	Forest Department, TBGP
FR/N/16	Drought relief measures	Forest Department, JOINT forest Management Group
FR/N/17	Creation of fodder resources and improvement of wildlife habitats	TNAU, Forest Department
FR/N/18	Awareness creation and capacity building on forest fire control as well as escaping from the forest fires	TNAU, Forest Department, Dept. of Environment
FR/N/19	Sustainability of afforestation activities using carbon financing options like REDD+	TNAU, Forest Department

Code	Strategy	Implementing Agency
FR/N/20	Impact of climate change on coral reefs and associated biodiversity	TNAU, Forest Department, Dept. of Environment
FR/N/21	Capacity building programmes to JFM groups, Farmers in fringe villages, NTFP collectors, Forest officials and other stakeholders on sustainable forest Management	TNAU, Forest Department, Dept. of Environment
FR/N/22	Eco restoration and conservation of wetlands	Forest Department, Dept. of Environment
FR/N/23	Community wasteland development programme	Forest Department, Dept. of Environment
FR/N/24	Development of wildlife sanctuaries	Forest Department, Dept. of Environment
FR/N/25	Establishment of advanced institute of wildlife conservation and tribal welfare school	Forest Department, Dept. of Environment
FR/ N/26	Forest communication – Roads	Forest Department, Dept. of Environment
FR/ N/27	Project elephant	Forest Department, Dept. of Environment
FR/ N/28	Project tiger	Forest Department, Dept. of Environment
FR/ N/29	Water conservation and canopy improvement	Forest Department, Dept. of Environment
FR/ N/30	Women empowerment and medicinal plants	Forest Department, Dept. of Environment

d. State Mission on Strategic Knowledge

In the Strategic Knowledge Management Sector, 5 activities are solely implemented by Department of Horticulture, 3 activities are solely implemented by Department of Environment, 2 activities are solely implemented by SDMRI and 1 activity is solely implemented by DHAN Foundation. Rest of the activities enlisted in Table 8.4 is cross departmental.

Table 8.4: State's prioritises under State Mission on Strategic Knowledge

Code	Strategy	Implementing Agency
KM/N/11	Agro-advisory to farmers using NICE platform to adapt Climate Change in Tamil Nadu	DHAN Foundation and District Administration Tiruvannamalai

e. State Mission on Coastal Area Management

In the Coastal Area Management Sector 6 activities are solely implemented by Department of Environment, 6 activities are solely implemented by GoMBRT, 5 activities are solely implemented by CAM, 4 activities are solely implemented by MSSRF, 1 activity is solely implemented by RDPR, 1 activity is solely implemented by IOM, 1 activity is solely implemented by TWAD, 1 activity is solely implemented by TNSGDC, 1 activity is solely implemented by PWD and 1 activity is solely implemented by SDMA. Rest of the activities enlisted in Table 8.5 are cross departmental.

Table 8.5: State's prioritises under State Mission on Coastal Area Management

Code	Strategy	Implementing Agency
CAM/N/18	Capacity building for integrated coastal zone management of Tamil Nadu	TN ENVIS, IOM with DoE & CAS MB
CAM/N/20	Preparation of local level Coastal Zone Management Plan in 1:5000 scale	DoE/IRS
CAM/N/24	Eco restoration of sacred groves	MoEF&CC (DoE), SICOM

f. State Mission on Enhanced Energy Efficiency & Solar

In the Energy Sector, 9 activities are solely implemented by CEIG, 8 activities are solely implemented by TANGEDCO, 2 activities are solely implemented by BEE, 1 activity is solely implemented by CMA, 1 activity is solely implemented by REC, 1 activity is solely implemented by MoP and 1 activity is solely implemented by EESL. Rest of the activities enlisted in Table 8.6 are crossdepartmental:

Table 8.6: State's prioritises under State Mission on Enhanced Energy Efficiency & Solar

Code	Strategy	Implementing Agency
ES/9	Implementing energy Efficiency Improvements in the Small and Medium Enterprises through policy initiatives like waste heat recovery etc. by means of VAT, subsidy and grants for procurement/ implementation of Energy Efficient programme/products.	BEE, MoP, Dept. of Industries and Commerce
ES/10	Awareness Generation programs on Energy Conservation and Efficiency	Dept. of Industries and Commerce
ES/20	Grid connected Renewable Energy Generation – Hydro Electric Projects	REC, TN Infrastructure Development Board
ES/21	Reduction of AT&C losses (Set of activities to reduce ATC losses of 18percent-15percent in 12th plan and 15percent-12 percent in 13th plan)	MoP, REC

g. State Mission on Sustainable Habitat

In the Sustainable Habitat Sector, 5 activities are solely implemented by GCC, 2 activities are solely implemented by CMWSSB, 2 activities are solely implemented by RDPR, 2 activities are solely implemented by BEE, 1 activity is solely implemented by CEIG, 1 activity is solely implemented by TNHB and 1 activity is solely implemented by DTP. Rest of the activities enlisted in Table 8.7 is cross departmental.

Table 8.7: State's prioritises under State Mission on Sustainable Habitat

Code	Strategy	Implementing Department
SH/7	Development in flood prone areas, protecting and resettling encroachments	PWD, TNSCB, GCC
SH/8	Implementation of compulsory plantation of trees in all sectors (Housing, Institutional) to reduce heat island effect	DTP, RDPR, DTCP, CMA
SH/9	Providing water supply scheme and 24 X 7 ready water supply in extended areas	TWADB, CMWSSB, CMA
SH/10	Revamping existing water supply schemes to avoid loss of water by laying new pipelines in place of damaged pipelines	CMWSSB, TWADB, DTP
SH/19	Rainwater Harvesting Structures	DTP, RDPR
SH/21	Undertake regular water monitoring by establishing labs in all districts	Surface and Ground Water Board
SH/24	Reuse of Grey Water	CMWSSB, DTP, RDPR
SH/25	Recharge of Ground Water	DTP, RDPR
SH/33	Ensure 100% sanitized and open defecation	DTP, GCC, RDPR
SH/36	Sustainable solid waste management (urban)	DTP, GCC
SH/64	Improvement to all existing roads and maintenance at regular intervals	DTP, RDPR
SH/79	Development of green parks	DTP, GCC, DTCP

8.3 STEERING MECHANISM FOR TNSAPCC

TNSAPCC is proposed to be steered through three committees which are as follows:

- State Steering Committee on Climate Change
- Technical Committee on Climate Change and
- Mission specific Working Groups on Climate Change

Details regarding their proposed composition and functions are given in Table 8.8.

Table 8.8: Proposed composition and functions of committees for operationalising TNSAPCC

S. No.	Name of Committee	Key function	Composition	Frequency of meeting
1.	State Steering Committee on Climate Change (SSCCC)	This committee will be overall responsible for endorsement of intervention proposed under TNSAPCC. This committee will also review the progress of the interventions against the agreed timelines.	SSCCC exists in the State headed by Chief Secretary with Principal Secretaries/Head of Departments as members. The committee will continue to operate and implement strategies and actions proposed in this document. New policy needs, technology etc. on climate change will be reviewed by this committee as well.	This committee should meet annually to review the progress of TNSAPCC. However, this committee can also meet based on the requirement.
2.	Technical Committee on Climate Change (TCCC)	It will advise in financial and technical implementation of Tamil Nadu SAPCC, ensuring full implementation of interventions envisaged under TNSAPCC. TCCC will be responsible for: •Preparation of an implementation plan •Oversee the execution of activities, fund administration of and procurement of goods and services	Technical Advisory Committee headed by Principal Secretary, Department of Environment with members from various line departments (listed in Figure 8.1) responsible for implementing TNSAPCC.	This committee should review the progress on a quarterly basis.
3.	Mission specific Working Groups on Climate Change	TNSAPCC has 7 missions working groups on agriculture, water, coastal area management, forest & biodiversity, habitat, energy, and strategic knowledge. These working groups will be responsible for planning, implementing, financing and monitoring the prioritised interventions envisaged under TNSAPCC	These working groups will be headed by mission directors of respective 7 missions with various responsible implementing departments as its members.	This committee shall review the progress of the activities bi-monthly.

CHAPTER 9: MONITORING & EVALUATION

This section presents the monitoring and evaluation mechanism for operationalize TNSAPCC. Department of Environment, Government of Tamil Nadu, being the nodal department on climate change will be responsible for monitoring and evaluating the activities envisaged under TNSAPCC with the overall support from multiple implementing departments.

9.1 INTRODUCTION

Monitoring and Evaluation (M&E) of climate change interventions is essential to monitor and evaluate the effectiveness of implemented adaptation and mitigation measures. The Paris Agreement has necessitated countries to have harmonized measurement and reporting systems for the countries as per their NDC mitigation commitments. India's NDC also has several areas in adaptation that need systematic monitoring for an assessment of the change in vulnerability that can be attributed to related investments to be made. Some of these investments are through the government budget and some others are off-budget supported through bi-lateral and multilateral agencies, philanthropic bodies, and national and international climate funds. All this information must be consolidated nationally, and a seamless harmonization of measurement and reporting is also required at state level.

M&E for TNSAPCC envisages to determine States' overall progress towards climate resilience and can also help to assess the SAPCCs' contribution for achieving the country's NDCs and SDGs. Individual strategies proposed under respective seven missions in TNSAPCC will have their respective result framework highlighting the output and impacts. In order to aggregate the outputs/impact of each strategy under seven missions proposed under TNSAPCC up to the national level, following approach (provided in Figure 9.1) is envisaged to monitor and evaluate the interventions. This uses a sectoral approach for measuring the achievement towards India's NDC and SDGs.

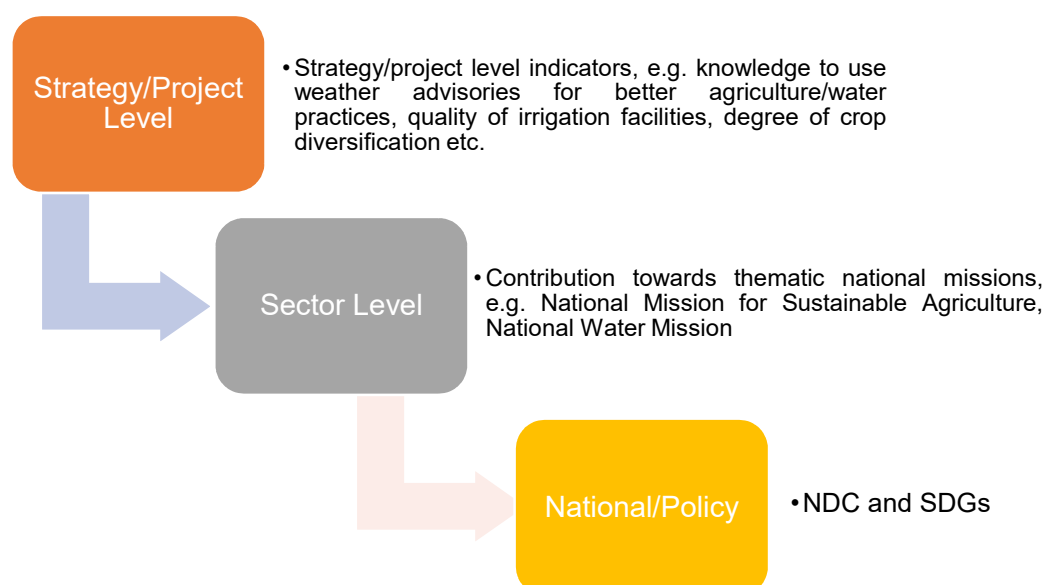


Figure 9.1: Approach for measuring impact of proposed intervention and its contribution towards NDC and SDG

9.2: BROAD INDICATORS FOR MONITORING AND EVALUATING CLIMATE CHANGE INTERVENTIONS

Indicators for climate change adaptation:

India's NDC has a non-quantifiable goal on adaptation which highlights that it is essential to better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management. In order to measure the TNSAPCCs' contribution towards climate change goals of India's NDC and SDGs, eight aggregate indicators have been designed which are as follows:

1. Stability/Increase in Income Levels:

Stability in farmer incomes over time is an important indicator for measuring the effectiveness of adaptation efforts. Stability in farm incomes could imply:

- Knowledge to use weather advisories for better agriculture/water practices
- Better irrigation facilities
- Crops resistant to extreme climate change (drought, flood etc.)
- Implementing crop diversification
- Coverage of crop insurance

2. Number of Government schemes that have been climate-proofed:

This indicator measures the interest generated in the state for considering climate change while planning and implementing various schemes (also called Mainstreaming of Adaptation Strategies into development planning).

3. Reduced Migration of local population directly and indirectly dependent on climate sensitive sectors for their livelihoods:

High migration levels are a sign of agricultural distress and degradation of the natural resources base in a region even if adaptation measures are being implemented. Decreasing levels in migration might reflect:

- Community having potable water available for domestic use
- Communities in a food-secure situation
- Community having alternative livelihood options

4. Enhanced climate resilience of communities towards climate risks:

As it is often the most marginalised that are most vulnerable to the impacts of climate change, it is essential to enhance the resilience of these communities to enhance their adaptive capacity. Examples of indicators which can be measured are listed as follows:

- Community capacitated to use weather advisories for planning activities (food, water etc.)
- Community having potable water available for domestic/occupation use during extreme events

5. Mainstreaming of women and other vulnerable sections in adaptation activities

Climate change has an impact on those sections of the population that are mostly reliant on natural resources for their livelihoods and/or who have the least capacity to respond to natural hazards, such as droughts, landslides, floods and hurricanes. Vulnerable population such as women, children, elderly people etc. commonly face higher risks and a greater burden from the impact of climate change than men. Further, members of indigenous communities, due to lack of access to resources such as forest produce, loss of forest rights due to biodiversity loss and because of poor application of laws are more vulnerable to climate risks. Examples of indicators which can be measured are listed as follows:

- Women/vulnerable sections of the population trained on adaptation measures
- Women/vulnerable communities taking part in project planning processes
- Women/vulnerable community are nominee in insurance cover due to loss in activities because of extreme climatic events (drought, flood etc.)

6. Community/Farmers having diversified sources of income

An increase in the percentage of farmers who have diversified sources of income is a step towards increasing the resilience of households depending on agriculture/livestock etc. for their incomes to face climate change risks. Diversified sources of income could be stemming from government programmes such as MGNREGAS, Pradhan Mantri Fasal BimaYojana etc. Examples of indicators ¹ which can be measured are listed as follows:

- Farmers having their source of income from agriculture and allied sector
- Farmers having their source of income from rearing animals
- Farmers having source of income from forest use

7. Capacity building of farmers for implementing CCA measures

Local communities need support to re-orient water management & agricultural systems to counter the risks posed by climate change. Climate change is accompanied by increased weather uncertainty and individuals and communities, especially smallholder farmers, are vulnerable to these fluctuations. Availability of real time weather advisories and other extension services helps them take timely actions to deal with these fluctuations and improve their adaptive capacity. This indicator can be disaggregated by Gender to understand the degree of gender mainstreaming in adaptation. Examples of indicators which can be measured are listed as follows:

- Farmers trained on planning activities based on extreme weather events (drought, flood etc.)
- Farmers trained on climate friendly practices eg: water conserving techniques, knowledge of climate resilient cropping etc.

8. Rise in groundwater levels

Healthy ground water levels in a region reflect the prevalence of sustainable agricultural practices, effective and sustainable management of watersheds and awareness levels among members of communities in the region about climate change and its effects.

¹ In measuring these indicators, duplication should be avoided.

- Enhanced groundwater depth from surface,
- Enhanced groundwater quality i.e. salinity reduction

In order to measure these eight aggregate level indicators, an excel-based Management Information tool highlighting strategy/project-wise indicators has been developed.

Aggregate indicators for climate change mitigation:

India's NDC has three quantified goals on mitigation which includes:

- To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
- To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance.
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.

In order to measure the TNSAPCC's contribution towards climate change mitigation goals of India's NDC and SDG, eight aggregate indicators have been designed which are as follows:

1. Enhanced green cover

Extending green cover contribution to the achievement of a climate resilient low-emission pathway. Examples of indicators which can be considered to be measured are listed as follows:

- Setting up of parks
- Increase in forest cover
- Increase in road-side green pathways

2. Increase of renewable energy mix in the total electricity consumption

Switching to renewable energy instead of fossil fuel-based resources leads to a carbon emission-free, healthier environment. Examples of indicators which can be considered to be measured are listed as follows:

- Establishment of new renewable resources plants/units like solar, hydro, biomass etc.
- Number of buildings adopting renewable resources
- Number of vehicles shifted from non-renewable to renewable resources (electric, cycle etc.)

3. Reduction in waste generation

Waste generation is a major challenge every state is facing which creates an unhealthy environment and has a direct impact on the environment. Managing waste efficiently is an asset for a healthy and sustainable lifestyle. Examples of indicators which can be considered to be measured are listed as follows:

- Number of households segregating waste at source
- Amount of waste segregated at source
- Amount of waste reused and recycled

A preliminary analysis of how TNSAPCC2.0 contributes to the achievement of NDC goals and SDGs is illustrated in Figure 9.2, following a similar methodology as for Figure 1.3.

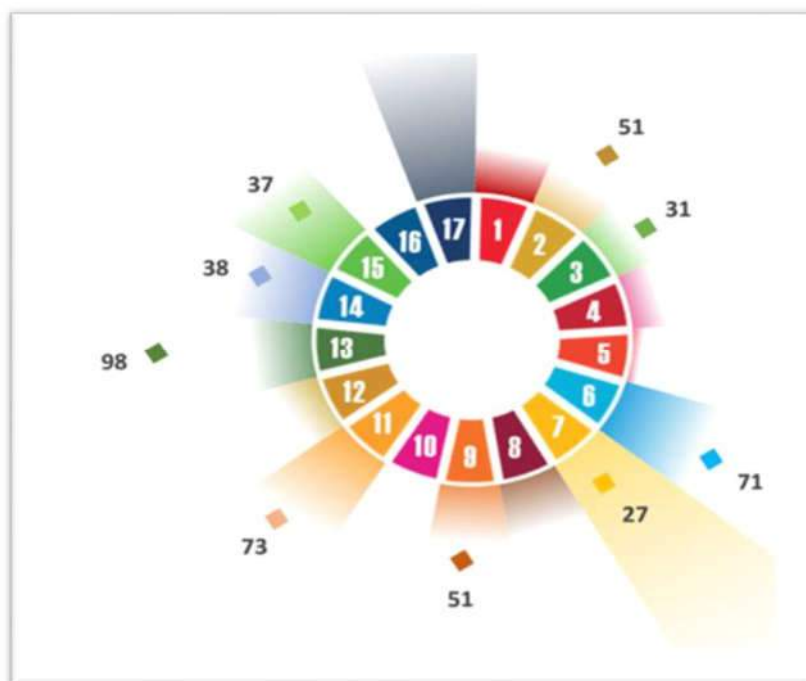


Figure 9.2: SDG-NDC-SAPCC linkages for TNSAPCC 2.0

Note: The number of proposed TNSAPCC activities of relevance to each SDG is illustrated by squares, with squares further from the centre indicating more measures. The total number of proposed identified activities relating to each SDG is given next to the squares. SAPCC-SDG linkages are plotted against SDG-NDC linkages from Figure 1.3.

9.3 INSTITUTIONAL MECHANISM

Key to an effective M&E system is the proper institutional arrangement for facilitating and operating it. The M&E system should be grounded in the existing institutional framework driven by the climate change cell within the Department of Environment, Government of Tamil Nadu, with higher-level political and executive bodies providing policy guidance and governance. DoE will act as the technical secretariat and interface with executing departments/line departments for data collection. Each department may constitute a small working group with at least one member in the working group dealing with departmental finance. The working group can be headed by a nodal officer who will interface with the climate change cell for data/MIS up-dation.

ANNEXURES

ANNEXURE 1: SUMMARY OF STOCK TAKING

Sector	Proposed Budget (as in SAPCC 2012-17) in crore INR
Sustainable Agriculture	23,093.14
Water Resources	12,626.00
Forest & Biodiversity	1528.00
Coastal Area Management	4420.00
Strategic Knowledge for Climate Change	49.00
Enhanced Energy Efficiency and Solar Mission	155,438.00
Sustainable Habitat	207,104.00
TOTAL	404,258.14

ANNEXURE 2: SUMMARY OF PLANNED ACTIONS

Sl. No.	Sector	Proposed Budget in Rs crore (2021-30)	From state/central budget available Rs crore	Gap in Rs crore
1	Sustainable Agriculture	71,731.94	58,426.94	13,305.00
2	Water Resources	19,041.84	16,728.00	2,313.84
3	Forest and Biodiversity	2,834.44	2,301.44	533.00
4	Coastal Area Management	4,776.10	2,626.58	2,149.52
5	Strategic Knowledge for Climate Change	280.87	271.68	9.19
6	Enhanced Energy Efficiency and Solar Mission	98,056.68	42,522.31	55,534.37
7	Sustainable Habitat	127,489.33	98,021.77	29,467.56
	TOTAL	324,211.20	220,898.72	103,312.48

ANNEXURE 3: SUMMARY SCORE CARD

Sustainable Agriculture

S. No.	Code	Activity	Total Score
1	AG/5	Extension strategies to popularize climate resilient management practices to mitigate extreme weather events (ART and MLT)	3
2	AG/7	Climate proofing with Integrated Farming Systems: Popularising the Integrated Farming System for wider adoption	2.5
3	AG/8	Recharging the aquifers using the abandoned open wells and defunct bore wells	2.8
4	AG/9	Constructions of sub-surface dykes	2.8
5	AG/10	Diversion of excess flood water at upper reaches to water deficit areas	2.5
6	AG/11	Deep ploughing to break sub surface hard pan to increase infiltration efficiency and improve ground water quality and check sea water incursion	2.8
7	AG/12	Reclamation of saline and alkaline soils	1.5
8	AG/13	Promote minimum/no tillage during fallow period, compartmental bunding, contour farming, deep ploughing, mulching for all crops besides conducting awareness programmes and training	2.8
9	AG/14	Build Organic carbon content of soil with green manuring: Azolla, BGA, Bio- fertilizers, Bio-pesticides, Bio-Agents and compost developed from municipal solid waste, Production and distribution of Green manure seeds, bio-fertilizers, vermi-composting	2.8
10	AG/15	Bringing fallow land and degraded land back to cultivation through Integrated wasteland development Programme	2
11	AG/16	Organic farming including horticultural crops	2.2
12	AG/17	Research on conjunctive use of Irrigation water	2
13	AG/18	Increase the use of Micro Irrigation technology Viz., drip, Sprinkler, Rain gun, Mobile Sprinkler in dry land, Garden land and Horticultural farming system	3
14	AG/19	Strengthening existing water harvesting structures and repairing and replacing the shutters in the irrigation tanks and drainage channels	2.8

15	AG/20	Creation of additional farm ponds to capture the runoff water and utilise the harvested water to critical stages of crop growth and to recharge the aquifers to improve the quality of irrigation water	3
16	AG/21	Ensuring the livelihood of the farmers in non-delta districts having surface irrigation potential with piped irrigation network by providing collection wells at regulating structures to increase the cropping intensity with assured yield and employment opportunities	2.3
17	AG/22	Development and execution of sustainable seed production and distribution network - Seed Multiplication Scheme of Paddy, Millets, Pulses, Oilseeds and Cotton	2.4
18	AG/23	Establishment of network of seed banks, food banks and cold storage to ensure supply at times of contingencies	2.2
19	AG/24	GIS based village mapping for agro management system to enhance input use efficiency and overcome effect of climate change and increase farm productivity including horticulture crops	1.5
20	AG/25	Integrated voice message on weather based agro advisories, market demand & price forecasting	1.8
21	AG/26	Establishment of dedicated climate knowledge cell to monitor, fore warn and train farmers and officials of the department on management of situation arising out of extreme events	2.3
22	AG/27	Strengthening and popularising the existing crop insurance programme	3
23	AG/28	Research project on comprehensive crop insurance products that would cover increasing extreme events	2.3
24	AG/29	Development of vegetative shield for east coastal region against wind, cyclones, etc. Management and conservation of vegetative shield	2
25	AG/30	Development of technology for improving inland fishing; new breeds; Popularization of technology.	2.5
26	AG/31	Increasing fish production and fish farming area for rural livelihood through Inland Fisheries -DFFDA, Reservoir fisheries development, fish culture in pens and cages, establishment of hatcheries	2.5
27	AG/32	Undertaking Repair and Renovation of Government Fish Seed Farms/ Hatchery to increase fish seed production for fish farming	2.3
28	AG/33	Improving inland fisheries for tank and its command areas under IAMWARM Project	2.8

29	AG/34	To increase per hectare production and encourage new species advocating Culture of SPF <i>Litopenaeus vannamei</i>	1.5
30	AG/35	Culture of Sea bass	2
31	AG/36	Ensure year-round feed and fodder availability	2.8
32	AG/37	Ensure adequate animal housing and dedicated ponds for bathing in villages to protect livestock from extreme heat	2.1
33	AG/38	Intensify disease surveillance and develop forecasting of disease outbreaks for short- and long-term time frames	3
34	AG/39	Promote breeding with indigenous varieties to improve resilience to climate change	3
35	AG/40	Promote dairy development by training women in villages on animal care, animal disease reporting, and nutrition for optimising milk production at household level of small and marginal farmers and enabling them to participate in milk cooperatives	2
36	AG/N/1	Development of nutritionally enhanced climate resilient premium quality rice varieties	2.8
37	AG/N/2	Enhancing maize productivity by identification and popularization of agro techniques	2.3
38	AG/N/3	Revitalization of millets for nutritional security and enhanced productivity	2.8
39	AG/N/4	Enhancing pulses production in delta and non-delta districts	2.8
40	AG/N/5	Special package for increasing the productivity of cotton	2.5
41	AG/N/6	Special package for increasing the productivity of sugarcane - Sustainable Sugarcane Initiative	2.8
42	AG/N/7	Special package for increasing the productivity of coconut	2.8
43	AG/N/8	Establishment of pulses-based inoculants production unit for sustainable pulse productivity of Tamil Nadu	2.8
44	AG/N/9	Establishment of pilot water soluble fertilizer production unit for facilitating farmers for stage wise crop nutrition	1.5
45	AG/N/10	Diversified agricultural cafeteria with the State of art technologies for third generation	1.5
46	AG/N/11	Remote sensing-based information for crop coverage, yield estimation and drought monitoring	1.5

47	AG/N/12	Customized agro advisory services to the farmers	2
48	AG/N/13	Development of contingency plans for extreme weather events and implanting on the ground	2.5
49	AG/N/14	Solar driers and water pumping system for irrigation	2.8
50	AG/N/15	Value addition to horticultural products (Neera, Moringa leaf power, fruit processing)	1.5
51	AG/N/16	Promotion of Integrated farming system for varied agro ecosystems	2.5

Water Resources

S. No.	Code	Activity	Total Score
1	WR/N/1	Climate change adaptation programme in Cauvery Delta	2.8
2	WR/N/2	Cauvery Modernisation Scheme Under the Accelerated Irrigation Benefits Programme (AIBP)	2.5
3	WR/N/3	Irrigated Agriculture Modernisation and Water- Bodies Restoration and Management (IAMWARM) Project	2.8
4	WR/N/4	Linking of Tamiraparani Karumeniyar And Nambiyar Rivers in Tirunelveli And Thoothukudi Districts – for flood management and increasing the irrigation area	2
5	WR/N/5	Desilting of Dams and Water Bodies - Desilting of Vaigai, Pechipparai, Mettur, Amaravathy Reservoirs and Srivaikundam Anicut for increasing the area under irrigation	1.5
6	WR/N/6	Desilting of Parappalar Reservoir to increase the command area	1.5
7	WR/N/7	Desilting of Veeranam tank for providing drinking water to Chennai and surrounding area	1.5
8	WR/N/8	Dam Rehabilitation and Improvement Project (DRIP)	1.5
9	WR/N/9	Increasing water use efficiency	2.5
10	WR/N/10	Capacity building to various stakeholder including Officials, Irrigation engineers, field level staff on maintenance of irrigation system and increasing the water use efficiency	2.6

Forest & Biodiversity

S. No.	Code	Activity	Total Score
1	FR/14	Establishment of biodiversity corridors	2.5
2	FR/19	Mapping of floral and faunal biodiversity in State at a high spatial resolution incorporating GPS coordinates and on GIS platform	2.4
3	FR/26	Large scale field testing of different forest species for lower strata diversification in different agroclimatic zones	1.4
4	FR/29	Programmes for removal of Lantana and Prosopis from dry forest and wattle from Shola ecosystem in the hills	2.5
5	FR/32	Estimating mitigation potential of forest in Tamil Nadu	2.7
6	FR/34	Valuation of bio resources in Forest ecosystem	3
7	FR/39	Capacity building through seminars and trainings for scientists and researchers to meet the challenges of climate change	2.5
8	FR/N/1	Increase the forest cover through massive afforestation programme in degraded forest lands of Tamil Nadu	3
9	FR/N/2	Increasing the green cover outside the forest area: Plantations in urban areas, industrial sites and recreational forestry	2.5
10	FR/N/3	Promotion of private social forestry, plantation in farmlands and current fallow, agroforestry and shelterbelt plantation	2
11	FR/N/4	Restoration of green cover in cyclone affected area	2.5
12	FR/N/5	Restoration of tropical dry evergreen forest (TDEF) in Nanmangalam reserved forest	2.5
13	FR/N/6	Raising Palmyrah palm plantation	1.5
14	FR/N/7	Mass production of seedlings of desired sandal clones through tissue culture technique	1.5
15	FR/N/8	Raising teak plantations on Padugai lands	2
16	FR/N/9	Integrated development of wildlife habitats	3
17	FR/N/10	Eco restoration and conservation of Pallikaranai Marshland	3
18	FR/N/11	Conservation and management of Mangroves	2.5
19	FR/N/12	Gulf of Mannar Biosphere Reserve protection	2

20	FR/N/13	Conservation, development and sustainable management of medicinal plants	1.5
21	FR/N/14	Enrichment of Non-Timber Forest Product Resources in Forest Areas	2
22	FR/N/15	Surveillance of forest and wildlife area through drone technology	1.5
23	FR/N/16	Drought relief measures	2
24	FR/N/17	Creation of fodder resources and improvement of wildlife habitats	2.5
25	FR/N/18	Awareness creation and capacity building on forest fire control as well as escaping from the forest fires	1.5
26	FR/N/19	Sustainability of afforestation activities using carbon financing options like REDD+	2
27	FR/N/20	Impact of climate change on coral reefs and associated biodiversity	2
28	FR/N/21	Capacity building programmes to JFM groups, Farmers in fringe villages, NTFP collectors, Forest officials and other stakeholders on sustainable forest management	1.5
29	FR/N/22	Eco restoration and conservation of wetlands	2.5
30	FR/N/23	Community wasteland development programme	2.5
31	FR/N/24	Development of wildlife sanctuaries	2.8
32	FR/N/25	Establishment of advanced institute of wildlife conservation and tribal welfare school	2
33	FR/ N/26	Forest communication – Roads	2
34	FR/ N/27	Project elephant	2.8
35	FR/ N/28	Project tiger	3
36	FR/ N/29	Water conservation and canopy improvement	3
37	FR/ N/30	Women empowerment and medicinal plants	2

Coastal Area Management

S. No.	Code	Activity	Total Score
1	CAM/10	Protection wall construction in vulnerable coastal areas	2.5
2	CAM/26	Artificial recharging of wells by RWH	2.2
3	CAM/31	Ensuring livelihood of fishermen	2
4	CAM/N/1	Protection of Koswari and Appa Islands in GOM from erosion	2.5
5	CAM/N/2	Integrated Coastal Zone Management	3
6	CAM/N/3	Preparation of ICZM Plan including Coastal processes studies for Shoreline management for Cuddalore-Thoothukudi Tamil Nadu	2.8
7	CAM/N/4	Addressing coastal erosion in identified sectors using soft engineering methods at selected locations in Nagapattinam district	2.5
8	CAM/N/5	Establishment of Sea Turtle Conservation Centre in Nagapattinam	2
9	CAM/N/6	Proposal for funding support to conservation and management of Gulf of Mannar Marine National Park & Gulf of Mannar Biosphere Reserve	2.5
10	CAM/N/7	Eco restoration of Sacred groves in Cuddalore and Nagapattinam Districts	1.5
11	CAM/N/8	Monitoring of coastal and transitional waters of Tamil Nadu under ICZM	2.6
12	CAM/N/9	Integrated Solid Waste Management for MSW of Keelakarai Municipality	2.8
13	CAM/N/10	Construction of Micro-compost centre for MSW Management of Kayalpattinam Municipality	1.8
14	CAM/N/11	Construction of Vermi Shed at Compostyard in Nagapattinam	1.8
15	CAM/N/12	Construction of 2 Micro Compost Centres in Sannathi street, Vedaranyam Municipality	1.8
16	CAM/N/13	Solid Waste Management in selected fishing harbours in Tamil Nadu	1.8
17	CAM/N/14	Proposal for Faecal Sludge Management in Coastal Towns in Tamil Nadu	2

18	CAM/N/15	Establishment of Sewage treatment facility in Mandapam	2
19	CAM/N/16	Hatchery Production and Sea Ranching	1.7
20	CAM/N/17	Capacity building for integrated coastal zone management of Tamil Nadu	2.3
21	CAM/N/18	Preparation of local level Coastal Zone Management Plan in 1:5000 scale	2.3
22	CAM/N/19	Promoting community-based mangrove restoration and conservation	2.3
23	CAM/N/20	Promoting Integrated Mangrove Fishery Farming System	2
24	CAM/N/21	Integration of TDEF tree plantation with water management and livelihood enhancement	3
25	CAM/N/22	Assessment of microplastics in coastal areas, estuaries and lakes in Tamil Nadu, to consider remedial and management actions for the improvement of environmental quality and benefit of socio-economic systems	3
26	CAM/N/23	Establishment of a genetic garden of halophytes and halophyte farm	1.5
27	CAM/N/24	Integration disaster resilience and marine bio resources enhancement through artificial reef	2.6
28	CAM/N/25	Promoting Fisher Friend Mobile Application	1
29	CAM/N/26	Pilot testing of cultivation of saline tolerant varieties of paddy in the coastal saline soils	1.5
30	CAM/N/27	Shore Protection in Coastal ranges	3
31	CAM/N/28	Avert enhanced coastal erosion due to climate change and protect the coastal zone	2.5
32	CAM/N/29	Strengthen resilience of coastal communities in view of projected climate change	2.5
33	CAM/N/30	Disaster Management Risk Project	3
34	CAM/N/31	Shoreline Management	3
35	CAM/N/32	Conservation Management	3
36	CAM/N/33	Coastal Livelihood Management	3
37	CAM/N/34	Eco-tourism	3
38	CAM/N/35	Institutional Arrangements, Knowledge base and Capacity building for Conservation of Specialised Marine Ecosystem	2.8

Strategic Knowledge for Climate Change

S. No.	Code	Activity	Total Score
1	KM/1	Create an enabling institutional framework for developing and disseminating strategic knowledge on climate change.	2.8
2	KM/N/1	State level campaign on climate literacy with focus on water conservation	1.5
3	KM/N/2	Setting up of climate studio at centre for climate change and adaptation research, Anna university, as part of the Capacity Building Programme for Climate Change Adaptation	1.2
4	KM/N/3	Providing training to farmers on Integrated farming system	2
5	KM/N/4	Training farmers on Organic farming cultivation practices	1.8
6	KM/N/5	For the years 2019-20 to 2021-22, 11 new crops (8 annual crops and 3 annual crops are notified under Horticulture.	2.4
7	KM/N/6	Proposal to bring an area of 8.62 Lakh hectares under Micro Irrigation in both Agricultural and Horticultural Crops in Tamil Nadu by 2017-2022	2.4
8	KM/N/7	MIDH - NHM: increasing the productivity of Horticultural crops through Hi- Tech practices	3
9	KM/N/8	Studies on the impacts of coral-competing sponges on coral community structure and associated biodiversity in the reef areas of Gulf of Mannar, South eastern India	2.8
10	KM/N/9	Studies on the status of Post-bleaching Stressors that affect the Recovery of Corals in Tuticorin group of islands, Gulf of Mannar	2.8
11	KM/N/10	Ecosystem-based Climate proofing watershed in Nammiyampattu and Kanamalai panchayat of Jawadhu hills of Tiruvannamalai district Tamil Nadu	3
12	KM/N/11	Agro-advisory to farmers using NICE platform to adapt Climate Change in Telangana and Tamil Nadu	2.8

Enhanced Energy Efficiency and Solar Mission

S. No.	Code	Activity	Total Score
1	ES/1	Detailed Mapping and auditing of all existing public buildings in conformance with the Energy Conservation Building Code (ECBC)	2
2	ES/3	Implementation of energy efficiency measures in the existing buildings through retrofit	2
3	ES/7	Energy Efficient Street lighting (Rest of Urban Tamil Nadu)	3
4	ES/9	Implementing energy Efficiency Improvements in the Small and Medium Enterprises through policy initiatives like waste heat recovery etc. by means of VAT, subsidy and grants for procurement/ implementation of Energy Efficient programme/products.	2
5	ES/10	Awareness Generation programs on Energy Conservation and Efficiency	2.1
6	ES/11	Solar power generation program	3
7	ES/12	Offshore wind generation program (50 MW + 150 MW)	3
8	ES/13	On-shore wind generation program (5000 MW + 5000 MW)	3
9	ES/20	Grid connected Renewable Energy Generation – Hydro Electric Projects	3
10	ES/21	Reduction of AT&C losses (Set of activities to reduce ATC losses of 18percent-15percent in 12th plan and 15percent-12 percent in 13th plan)	2.5
11	ES/22	Transmission Infrastructure strengthening works	2.5
12	ES/23	Distribution Infrastructure Strengthening works	2.5
13	ES/24	Feeder separation with HVDS project	2
14	ES/25	Smart grid initiatives	2.8
15	ES/26	DSM (Demand Side Management) Activities	2
16	ES/27	Preventive measures to mitigate climate change effects	2.8
17	ES/N/1	School Energy Efficiency Programme on replacement of inefficient appliances with Energy Efficient Appliances in schools	3
18	ES/N/2	School Awareness programme through Eco clubs (500 schools)	2.5

19	ES/N/3	Capacity building programme for SME on DSM	2.5
20	ES/N/4	Capacity building programme for Financial Institutions / ESCOs	2.5
21	ES/N/5	Energy Conservation Awareness for General Public	2.5
22	ES/N/6	Notification of TNECBC for Commercial Buildings in the State with the support of TNECBC cell and for training	1.9
23	ES/N/7	Notification of TNECBC for Residential Buildings in the State with the support of TNECBC cell	2.2
24	ES/N/8	Model Energy Efficient village programme	2.5
25	ES/N/9	Solar Technician Training	2.5
26	ES/N/10	Effective utilisation of fly ash in view of climate change	3
27	ES/N/11	Kundah Pumped Storage Hydro Electric Project (4*125 MW) in Nilgiris District	3

Sustainable Habitat

S. No.	Code	Activity	Total Score
1	SH/1	Implement ECBC norms in institutional, commercial and residential sectors	1.5
2	SH/2	Integrate design alternatives to withstand impacts of CC (extreme rainfall, flooding, cyclones and storm surges and other disasters)	2
3	SH/7	Development in flood prone areas, protecting and resettling encroachments	1.5
4	SH/8	Implementation of compulsory plantation of trees in all sectors (Housing, Institutional) to reduce heat island effect	2.5
5	SH/9	Providing CC resilient water supply systems, Providing water supply scheme and 24 X 7 ready water supply in extended areas	3
6	SH/10	Revamping existing water supply schemes to avoid loss of water by laying new pipelines in place of damaged pipelines	2.5
7	SH/12	Sewerage	3
8	SH/14	Wastewater reclamation programme	2.7
9	SH/19	Rainwater Harvesting Structures	3
10	SH/21	Undertake regular water monitoring by establishing labs in all districts	1.8

11	SH/22	Protection of water sources including traditional water bodies	2.3
12	SH/24	Reuse of Grey Water	2.7
13	SH/25	Recharge of Ground Water	2.5
14	SH/27	Developing Satellite townships to decongest Cities (Urban)	1.5
15	SH/33	Ensure 100% sanitized and open defecation	2.8
16	SH/34	Slum free cities programme	2.2
17	SH/36	Sustainable solid waste management (urban)	3
18	SH/37	Sustainable solid waste management (rural)	2.7
19	SH/39	Undertake source segregation through material recovery facility at disposal sites to avoid ground water pollution	1.5
20	SH/62	Developing exclusive lanes for pedestrian, Promote cycling with good cycling paths, cycle parking facilities and link between cycling and public transport	1.5
21	SH/64	Improvement to all existing roads and maintenance at regular intervals	3
22	SH/68	Organised Parking (urban)	1.5
23	SH/79	Development of green parks	2.7
24	SH/N/1	Promoting Energy Efficiency in the economy, notably in industry, transportation, buildings and appliances	2.2

**On a score of 0-3, scoring of funding, implementation and SDG/NDC linkage of the activities has been done*

Score:

3- High/ Direct linkage

2- Medium/ Moderate Linkage

1-Low/ Indirect linkage

0-Zero/ No linkage

ANNEXURE 5: R-APDRP PART-B

R-APDRP PART-B (subsumed under IPDS)-Physical / Financial progress:

(As on 30.04.2019)

Name of State & Utility	:	TAMILNADU/ TANGEDCO
Project Cost Sanctioned	:	Rs.2841.21 Cr.
Amount received as Gol Grant	:	Rs.426.18 Cr.
Amount received as Counterpart funding from REC	:	Rs.644.91 Cr.
Counterpart funding from PFC	:	Rs.717.37 Cr.
TANGEDCO's own funds	:	Rs. 80.22 Cr.
Expenditure Incurred so far	:	Rs.2589.19 Cr.
Physical Progress	:	100%
Financial Progress	:	91.13%

R-APDRP Part-B works completed in all 88 towns by 31.03.2018

Sl. No.	Description of Work	Unit	Quantity
1	New 66/33/22/11 KV Substations	Nos. MVA	55 798
2	Substation Augmentation of Power Transformers	Nos. MVA	98 892
3	New 33KV/66 KV lines	Kms.	275.33
4	New 22 KV lines	Kms.	368.57
5	New 11KV lines	Kms.	2808.399
6	New LT lines	Kms.	605.42
7	Capacity Augmentation of 33KV lines	Kms.	72.176
8	Capacity Augmentation of 22 KV lines	Kms.	443.34
9	Capacity Augmentation of 11KV lines	Kms.	748.88
10	Capacity Augmentation of LT lines	Kms.	1501.55
11	Distribution Transformers (DTs)	Nos. MVA	20144 1321
12	Consumer meters	Nos. in Lakhs	45.97
13	Ring Main Unit (RMU) for SCADA enabling work	Nos.	3284
14	Sectionlisers for SCADA enabling works	Nos.	1348
15	Automatic Power Factor Correction Panels	Nos.	19971
16	33/22/11 KV Bay Extension	Nos.	143
17	22/11 KV Capacitor Banks at Substations	Nos. MVAR	16 38.4

ANNEXURE 6: PHYSICAL PROGRESS (IN LAST 5 YEARS)

Sustainable Agriculture

Cod e	Activity	Physical Progress																		
AG/1	Breeding and testing of varieties tolerant to various climatic stress Developing and evaluating crop genotypes (rice, millets, pulses, oilseeds, fodder horticulture and forest trees) of short duration, testing of high yield potential in different soil conditions, C4 and CAM pathway plants for enhanced CO2 fixation, increased carbohydrate, protein and oil yields under stress	Breeding of new varieties resilient to climate change through conventional breeding as well as through biotechnology is in progress.																		
		Some of the resistant lines have been identified to transfer the gene to high yielding cultivars.																		
		Tamil Nadu Agricultural University has released 8 new crop varieties during 2017-18, the list of which is given below:																		
		<table><tr><th>Sl. No.</th><th>Crop & Variety</th><th>Particulars</th></tr><tr><td>1</td><td>Rice ADT 51</td><td>Long duration (150-169 days) Suitable for single samb season. Higher grain yield than CR 1009 having similar duration. Grain quality medium slender.</td></tr><tr><td>2</td><td>Cowpea VBN 3</td><td>Determinate plant type with synchronised maturity and matures in 75-80 days. Resistant to Bean Common Mosaic Virus (BCMV) disease and gives grain yield of 101 kg/ha under rainfed conditions.</td></tr><tr><td>3</td><td>Groundnut TMV 14</td><td>Short duration bunch type and matures in 95-100 days. Suitable for all seasons under rainfed and irrigated conditions. Gives 2124 kg/ha dry pod yield under rainfed and 2286 kg/ha under irrigated conditions.</td></tr><tr><td>4</td><td>Sunflower COH 3</td><td>Hybrid variety; matures in 90-95 days giving 1613 kg/ha grain yield and high oil yield of 666 kg/ha. Moderately resistant to necrosis, leaf spot and powdery mildew.</td></tr><tr><td>5</td><td>Sugarcane</td><td>Mature in 11 months. Suitable</td></tr></table>	Sl. No.	Crop & Variety	Particulars	1	Rice ADT 51	Long duration (150-169 days) Suitable for single samb season. Higher grain yield than CR 1009 having similar duration. Grain quality medium slender.	2	Cowpea VBN 3	Determinate plant type with synchronised maturity and matures in 75-80 days. Resistant to Bean Common Mosaic Virus (BCMV) disease and gives grain yield of 101 kg/ha under rainfed conditions.	3	Groundnut TMV 14	Short duration bunch type and matures in 95-100 days. Suitable for all seasons under rainfed and irrigated conditions. Gives 2124 kg/ha dry pod yield under rainfed and 2286 kg/ha under irrigated conditions.	4	Sunflower COH 3	Hybrid variety; matures in 90-95 days giving 1613 kg/ha grain yield and high oil yield of 666 kg/ha. Moderately resistant to necrosis, leaf spot and powdery mildew.	5	Sugarcane	Mature in 11 months. Suitable
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5	Sugarcane	Mature in 11 months. Suitable																		

		e COG 6	for early season planting (Dec-Jan) for Vellore region, especially in salt affected soils, with higher cane yield than Co 86032. Gives a cane yield of 140.56 t/ha. Suitable for jaggery production.
		6 Sugarcane CO 06022	Suitable for early season planting in districts of Tamil Nadu and Puducherry and matures in 10 months. Moderately resistant to red rot. Gives a cane yield 140.2 t/ha under normal conditions and tolerant to tillering phase drought. Gives more cane and sugar yield compared to CO86032.
		7 Ribbed Gourd COH 1	Hybrid variety with a seed to seed duration of 140-150 days. Green fruit harvest starts early (35-40 days) and extends up to 120-130 days. Gives a green fruit yield of 33.7 t/ha.
		8 Malai vembu MTP 2	Quick growing short rotation tree attains 12 m height with 30-45 cm girth in 24 months. Gives a wood yield of 100 t/ha in 24-36 months for pulp and wood yield of 120 t/ha at 60-72 months for plywood purpose.
AG/2	Specific to Maize •Altering crop geometry to suit mechanical weeding •Nutrient management and yield enhancement [STCR-IPNS approach on Inceptisols (red non calcareous)] for rainfed hybrid •Evaluation of genotypes for phosphorus acquisition •Insight study on benefit of nano application on seed quality improvement •Seed enhancement techniques	Package of practices for increasing the maize yield has been evolved. Site specific soil test based nutrient management is being popularized among the farming community for better yield and to increase the nutrient use efficiency. The yield of maize in Tamil Nadu for the year 2015-16 was 6549 kg/ha when compared to All India average of 2505 kg/ha. Position of Tamil Nadu at national level is 1st. During the 2018-19, under the part one (for maize crop) of NFSM Coarse Cereals scheme the components like laying out of cluster demonstration on improved	

		technologies, certified seed distribution, hybrid seed distribution, demonstration with inter-crop, integrated nutrient management, integrated pest management, distribution of hand sprayers and publicity were proposed to be implemented. During the year 2017-18, technology by TNAU for Maize Hybrid COH (M) 8 (F1 Commercial Seed) was commercialised.
AG/3	Millets • Development of newer formulations of microbial inoculants and seed treatment methods • Identification of pre-sowing seed management techniques for small millets • Enhancing the productivity of small millets • Enhancing partitioning efficiency in ragi • Developing organic technologies for cropping systems	Seed treatment for millets with microbial inoculants to increase the seedling vigour has been identified and popularised among the farming community for increasing the adoption levels Production package for the small millets have been standardized Developed organic technologies for cropping systems including millets. Considering importance of millets and its consumption various efforts were taken to increase millet production that resulted in bringing 9.17 lakh ha under millet cultivation in 2017-18. The impact area of millet increased by 22 percent during 2017-18 when compared to 2016-17. The Millets production (in lakh metric tonnes) in 2016-17 was 13.45 and 37.36 in 2017-18 according to third advance estimates. According to programme for 2018-19 for millets following are the details: • Area: 9 Lakh ha • Production: 34 lakh metric tonnes • Productivity: 3778 Kg/ha During the 2018-19, under the part two (for small millets) of NFSM Coarse Cereals scheme the components like laying out of cluster demonstration on improved technologies, certified seed distribution, hybrid seed distribution, demonstration with inter-crop, integrated nutrient management, integrated pest management, distribution of hand sprayers and publicity were proposed to be implemented. Under National Agriculture Development Programme for Millets, 142192 farmers have benefitted in 2017-18. The State government will continue its efforts during 2018-19 also to augment millets production.

		During 2017-18 a sum of Rs.50 crore is extended to the farmers as 50 percent subsidy for seeds and other critical inputs and about 5 lakh acres have been covered in Phase-I- 200 clusters for the cultivation of Millets, Pulses, Oil seeds and Cotton. Paramparagat Krishi Vikas Yojana (PKVY) aims at promotion of organics farming through cluster approach under Participatory Guarantee System (PGS) of certification. The scheme is being implemented in 42 clusters covering 2096 acres in 10 districts by DoA. The first-year activities have been completed by expending Rs. 295.83 Lakh and second year activities were implemented in 2017-18 expending Rs. 198.22 Lakh. The PGS certified organic produces of millets from PKVY clusters are then marketed under the brand name of Tamil Nadu organic Products (TNOP).
AG/4	• Land management for better crop establishment • Suitable tillage and irrigation practices and change in cropping pattern of different duration crops to counter climate change • Standardizing water harvesting techniques • Integrated nutrient management - Nutrient feedback crop cultivation for soil health sustainability Rice • Yield maximization techniques of traditional rice • Residue management and nutrient dynamics • Development and evaluation of stage-specific microbial inoculants • Mapping and management of micronutrients in rice grown soils in all districts • Alleviating Iron toxicity problem under acidic soils Groundnut • Intercropping and evaluation of organic mulch • Sulphur nutrition of rainfed groundnut in	Production package for most of the crops have been standardized. On farm trials are being laid out in the farmers field through various schemes such as IAMWARM for popularizing these technologies. Out of Gross Cropped Area under irrigation (28.45 lakh ha), 77 percent is brought under food crops and 23 percent under non-food crops in the State. Tamil Nadu is the only State to provide 100% subsidy to small and marginal farmers and 75 percent subsidy to other farmers for installation of micro irrigation system. As part of the development of water harvesting structures for irrigation, the GoTN has created 629 water harvesting structures and implemented Rehabilitation of irrigation network in Chittar Sub basin in Tirunelveli District and on farm management works in an area of 1118 ha. In order to bring more area under cultivation, the GoTN has created additional irrigation potential by extending an assistance to the District Watershed Development Agencies for adopting watersaving technologies (Per drop More crop), enhancing recharge of aquifers and sustainable water conservation practices. State government promotes farm and crop specific nutrient management and enhances the nutrient use efficiency through 31 Soil Testing Laboratories and 16 Mobile Soil Testing Laboratories functioning in the State. Annually 11.46 lakh soil samples are analysed through

	red and black soils of Tamil Nadu •Developing multifunctional bioinoculant (Burkholderia sp.) •Standardization of seed invigoration treatment for seed quality enhancement in groundnut, Organic production Oilseeds and pulses •Mapping and management of sulphur deficiency in oilseeds grown soils •Altering crop geometry to suit mechanical weeding •Optimization of sulphur for sesame through tracer technique •Seed pelleting for mechanized sowing and its storage potential in sesame •Developing package of practices for pulse–oilseed cropping system	these laboratories. Tamil Nadu ranks 1st among all Indian States in productivity of groundnut. Yield of groundnut (in kg/ha) is 2509 for Tamil Nadu as compared to a national average of 1486 kg/ha. In 2017-18, assistances for adoption of improved technologies such as demonstrations on intercropping with groundnut were extended under NFSM. Tamil Nadu has been able to sustain the first place at National level for Oilseed productivity consecutively for four years from 2011-12 to 2015-16. Yield of total oil seeds is 2230 kg/ha when compared to a national average of 968 kg/ha. An area of 4 Lakh ha was brought under Oil seeds with a normal production of 9.00 Lakh Metric Tonnes. Pulses: The area which was 6.37 Lakh Ha in 2010-11 has increased to 8.84 Lakh ha in 2014-15 and production which was only 2.45 Lakh Metric Tonnes in 2010-11 has escalated to an insurmountable record of 7.67 Lakh Metric Tonnes in 2014-15. The productivity which was hovering around 385 Kg/Ha also increased to 868 Kg/ha in 2014-15 and set a new benchmark in the production & productivity of pulses in Tamil Nadu. The efforts were continued during 2015-16 & 2016 – 17 and as a result, the pulses area was sustained to an extent of 8 Lakh Ha despite the occurrence of severe flood and drought.
AG/ 5	Extension strategies to popularize above management practices to mitigate extreme weather events (ART and MLT)	ARTs and MLTs are laid out in the farmer's field.
AG/ 6	Research Study on effect of impact for mid-term correction: Economic & social impact created due to different climate change mitigation interventions implemented by DoA/ TNAU to initiate mid-term correction	Contingency plans for various situations have been developed at block level
AG/ 7	Climate proofing with Integrated Farming Systems: Popularizing the Integrated Farming System for wider adoption	Integrated farming system specific to dry land, garden land and wet land systems have been evolved and popularized among the farming community. Rainfed Area Development (RAD) is being implemented with the objective to promote Integrated Farming System (IFS) through cluster approach. From 2012-17, 8777 Ha have been covered under Horticulture based farming, 679

		nos. of vermi-compost units, 1589 nos. of Vermibeds and Poly green houses in 71000 Sq.m. have been established in the selected clusters.																				
AG/8	Recharging the aquifers using the abandoned open wells and defunct bore wells	Under the NABARD supported climate proofing of watershed programme, well recharge pits have been created to collect the runoff water into the existing as well in the abandoned wells to improve the water table of the region. The component and scheme wise physical progress of this activity is given below: <table><tr><th>COMPONENT</th><th>SCHEME</th><th>UNIT</th><th>PHYSICAL PROGRESS</th></tr><tr><td>Bore wells</td><td>National Agriculture Development programme</td><td>Nos.</td><td>12</td></tr><tr><td>Percolation Pond</td><td>National Mission on Sustainable Agriculture Artificial Ground Water Recharge Structures</td><td>Nos.</td><td>101</td></tr><tr><td>Recharge Shaft</td><td>Rehabilitation of Irrigation network in Chittar Sub Basin National Mission on Sustainable Agriculture</td><td>Nos.</td><td>1037</td></tr><tr><td>Village pond</td><td>National Mission on Sustainable Agriculture Artificial Ground Water Recharge Structures</td><td>Nos.</td><td>47</td></tr></table>	COMPONENT	SCHEME	UNIT	PHYSICAL PROGRESS	Bore wells	National Agriculture Development programme	Nos.	12	Percolation Pond	National Mission on Sustainable Agriculture Artificial Ground Water Recharge Structures	Nos.	101	Recharge Shaft	Rehabilitation of Irrigation network in Chittar Sub Basin National Mission on Sustainable Agriculture	Nos.	1037	Village pond	National Mission on Sustainable Agriculture Artificial Ground Water Recharge Structures	Nos.	47
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AG/9	Constructions of sub-surface dykes	To increase the water harvesting the technique is promoted under the watershed programme																				
AG/10	Diversion of excess flood water at upper reaches to water deficit areas	To increase the water harvesting the technique is promoted under the watershed programme																				

AG/ 11	Deep ploughing to break sub surface hard pan to increase infiltration efficiency and improve ground water quality and check sea water incursion	Under the NABARD supported climate proofing of watersheds programme, using chisel plough sub soil hard pan breaking operation is done. Currently around 40 watershed programmes use this technology in Tamil Nadu																																				
AG/ 12	Reclamation of saline and alkaline soils	Technologies have been evolved and popularised to reclaim the problem soil. The component wise physical progress of this activity is given below: <table> <tr> <th>COMPONENT</th><th>UNIT</th><th>PHYSICAL PROGRESS</th></tr> <tr> <td>Farm Pond/Community Pond</td><td>Nos.</td><td>10</td></tr> <tr> <td>Construction of weir</td><td>Nos.</td><td>7</td></tr> <tr> <td>Channel Stabiliser</td><td>Metre</td><td>806</td></tr> <tr> <td>Formation of Peripheral Bund-in mainstream</td><td>Metre</td><td>16018</td></tr> <tr> <td>Formation of Peripheral Bund-in field channels</td><td>Metre</td><td>38115</td></tr> <tr> <td>Construction of Pipe Culvert</td><td>Nos.</td><td>5</td></tr> <tr> <td>Construction of RCC slab culvert</td><td>Nos.</td><td>1</td></tr> <tr> <td>Construction of Pipe Outlet</td><td>Nos.</td><td>25</td></tr> <tr> <td>Construction of Bed dam</td><td>Nos.</td><td>39</td></tr> <tr> <td>Chisel/Deep Ploughing</td><td>Ha</td><td>891.57</td></tr> <tr> <td>Shredded Agricultural waste materials and mixing in soil using Rotavator (supply of Green manure and ploughing with cultivator)</td><td>Ha</td><td>545</td></tr> </table>	COMPONENT	UNIT	PHYSICAL PROGRESS	Farm Pond/Community Pond	Nos.	10	Construction of weir	Nos.	7	Channel Stabiliser	Metre	806	Formation of Peripheral Bund-in mainstream	Metre	16018	Formation of Peripheral Bund-in field channels	Metre	38115	Construction of Pipe Culvert	Nos.	5	Construction of RCC slab culvert	Nos.	1	Construction of Pipe Outlet	Nos.	25	Construction of Bed dam	Nos.	39	Chisel/Deep Ploughing	Ha	891.57	Shredded Agricultural waste materials and mixing in soil using Rotavator (supply of Green manure and ploughing with cultivator)	Ha	545
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AG/ 13	Promote minimum/no tillage during fallow period, compartmental bunding, contour farming, deep ploughing, mulching for all crops besides	Under conservation tillage practise this technology is popularised among the farming community.																																				

	conducting awareness programmes and training	The component wise physical progress of this activity under River Valley Project is given below: <table> <tr> <th>COMPONENT</th><th>UNIT</th><th>PHYSICAL PROGRESS</th></tr> <tr> <td>Contour Bunding</td><td>Ha</td><td>30842.56</td></tr> <tr> <td>Contour Trenching</td><td>Ha</td><td>25</td></tr> </table> During 2017-18, in Mission on Sustainable Dry land Agriculture scheme a sum of Rs.25 crore has been given as back ended subsidy to 2,11,532 dry land farmers covering 2 lakh ha. in Phase I - 200 clusters. During 2018-19, in Mission on Sustainable Dry land Agriculture scheme a sum of Rs. 50 crore has been given as back ended subsidy to dry land farmers covering 4 lakh ha. in Phase II - 400 clusters.	COMPONENT	UNIT	PHYSICAL PROGRESS	Contour Bunding	Ha	30842.56	Contour Trenching	Ha	25
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AG/14	Build Organic carbon content of soil with green manuring: Azolla, BGA, Bio-fertilizers, Bio-pesticides, Bio-Agents and compost developed from municipal solid waste	In the NABARD supported watershed development programme as well as a part of Department of Agriculture supply of green manure seeds are done, and the farmers are encouraged to cultivate the green manure crop as a part of their cropping system. Under State Scheme every year 250 MT green manure is being procured and distributed to farmers at 50 percent subsidy. Under NADP Scheme during 2012-13 - 21200 Ha, 2015-16 - 40,000 Ha, 2016-17 - 46,600 Ha. Covered under green manure seed crop. Under NMSA - RAD, during the year 2013-14, 6226 Ha. covered under green manure seed crop. Every year 525 MT of Blue green algae and 500 MT of Azolla are being produced and distributed to farmers. Improvement of soil fertility under NADP scheme by distribution of green manure seed was carried out in 84,894 Ha and through NMSA-Rainfed Area Development in 6115 Ha. During 2012-13 to 2016-17, 14,873 MT carrier based biofertilizer and 9,68,408 litter of liquid based biofertilizer produced and distributed to farmers. Vermicompost units-2987 has been established under NMSA-RAD.									
AG/15	Bringing fallow land and degraded land back to cultivation	An extent of 100 acres of fallow lands has been brought back to cultivation at a cost of Rs.5.60									

		Lakhs during 2013-14 through land development measures, creation of irrigation structures and input distribution. A pilot project to bring back an area of 12500 acre of fallow lands to cultivation in Villupuram and Thiruvannamalai districts benefitting 8032 farmers.												
AG/16	Organic farming including horticultural crops	Almost 5 percent of the farmers are now following organic farming practices. Under PKVY, Organic farming is promoted through adoption of organic village by cluster approach and Participatory Guarantee System (PGS) certification. From 2015-16 to 2016-17, an area of 1020 Ha has been brought under Organic cultivation. During 2012-13 to 2016-17, an area of 2096 acres land is on conversion to Organic Farming. During 2018-19 another 7900 acres of land is on conversion to Organic Framing through Participatory Gurantee System of certification promoted by Paramaparagat Krishi Vikas Yojana.												
AG/17	Research on conjunctive use of Irrigation water	In progress												
AG/18	Increase the use of Micro Irrigation technology Viz., drip, Sprinkler, Rain gun, Mobile Sprinkler in dry land, Garden land and Horticultural farming system	Presently this scheme is implemented through Tamil Nadu Horticultural Development Agency in the name of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) scheme with the involvement of Dept. of Agriculture, Horticulture and Agri. Engineering. The project wise physical progress (under micro irrigation component) of this activity is given below: <table border="1"> <thead> <tr> <th>PROJECT</th><th>UNIT</th><th>PHYSICAL PROGRESS</th></tr> </thead> <tbody> <tr> <td>TN IAMWARM Project</td><td>Ha</td><td>27555.425</td></tr> <tr> <td>Command Development and water management</td><td>Ha</td><td>2111.93</td></tr> <tr> <td>Rehabilitation of Irrigation network in Chittar Sub Basin</td><td>Ha</td><td>50.52</td></tr> </tbody> </table> The PMKSY Micro Irrigation Scheme is being implemented with the aim of conserving water and increasing the production and productivity of horticultural and agricultural crops. From the year	PROJECT	UNIT	PHYSICAL PROGRESS	TN IAMWARM Project	Ha	27555.425	Command Development and water management	Ha	2111.93	Rehabilitation of Irrigation network in Chittar Sub Basin	Ha	50.52
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		2012-2017, an area of 2,69,250 ha has been brought under Drip and Sprinkler Irrigation system.																																				
AG/19	Strengthening existing water harvesting structures and repairing and replacing the shutters in the irrigation tanks and drainage channels	Through NABARD support and with the support of IAMWARM programme, this activity is being carried out. The project/ scheme wise (under check dam component) physical progress of this activity is given below: <table> <tr> <th>PROJECT/SCHEME</th><th>UNIT</th><th>PHYSICAL PROGRESS</th></tr> <tr> <td>Rainwater Harvesting and Runoff Management Programme (RWH)</td><td>Nos.</td><td>139</td></tr> <tr> <td>Soil Conservation works in Tribal Areas</td><td>Nos.</td><td>65</td></tr> <tr> <td>National Mission on Sustainable Agriculture</td><td>Nos.</td><td></td></tr> <tr> <td>Soil Conservation under Western Ghats Development Programme</td><td>Nos.</td><td>517</td></tr> <tr> <td>Hill Area Development Programme(HADP)</td><td>Nos.</td><td>2220</td></tr> <tr> <td>PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY)</td><td>Nos.</td><td>162</td></tr> <tr> <td>Dam Rehabilitation and Improvement Project (DRIP)</td><td>Nos.</td><td>12</td></tr> <tr> <td>Artificial Ground Water Recharge Structures</td><td>Nos.</td><td>429</td></tr> <tr> <td>River Valley project</td><td>Nos.</td><td>117</td></tr> <tr> <td>Rehabilitation of Irrigation network in Chittar Sub Basin (Check dam component)</td><td>Nos.</td><td>25</td></tr> <tr> <td>Rehabilitation of Irrigation network in Chittar sub basin (Extension, Renovation and modernisation of field channels component)</td><td>Ha</td><td>813.91</td></tr> </table>	PROJECT/SCHEME	UNIT	PHYSICAL PROGRESS	Rainwater Harvesting and Runoff Management Programme (RWH)	Nos.	139	Soil Conservation works in Tribal Areas	Nos.	65	National Mission on Sustainable Agriculture	Nos.		Soil Conservation under Western Ghats Development Programme	Nos.	517	Hill Area Development Programme(HADP)	Nos.	2220	PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY)	Nos.	162	Dam Rehabilitation and Improvement Project (DRIP)	Nos.	12	Artificial Ground Water Recharge Structures	Nos.	429	River Valley project	Nos.	117	Rehabilitation of Irrigation network in Chittar Sub Basin (Check dam component)	Nos.	25	Rehabilitation of Irrigation network in Chittar sub basin (Extension, Renovation and modernisation of field channels component)	Ha	813.91
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AG/ 20	Creation of additional farm ponds to capture the runoff water and utilize the harvested water to critical stages of crop growth and to recharge the aquifers to improve the quality of irrigation water	Through NABARD support and with the support of IAMWARM programme construction of farm ponds are in progress The GoTN has created 840 farm ponds in Ramanathapuram District. The project wise physical progress of this activity (under farm pond component) is given below: <table><tr><th>PROJECT</th><th>UNIT</th><th>PHYSICAL PROGRESS</th></tr><tr><td>Integrated Development of Pulses Village under National Agriculture Development Programme (NADP)</td><td>Nos.</td><td>226</td></tr><tr><td>River Valley Project</td><td>Nos.</td><td>1</td></tr><tr><td>PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY)</td><td>Nos.</td><td>203</td></tr><tr><td>Rehabilitation of Irrigation network in Chittar Sub Basin</td><td>Nos.</td><td>20</td></tr><tr><td>Reclamation of Problem soil</td><td>Nos.</td><td>10</td></tr></table> The objective of MIDH - NHM is increasing the productivity of Horticultural crops through Hi-Tech practices.	PROJECT	UNIT	PHYSICAL PROGRESS	Integrated Development of Pulses Village under National Agriculture Development Programme (NADP)	Nos.	226	River Valley Project	Nos.	1	PRADHAN MANTRI KRISHI SINCHAI YOJANA (PMKSY)	Nos.	203	Rehabilitation of Irrigation network in Chittar Sub Basin	Nos.	20	Reclamation of Problem soil	Nos.	10
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AG/ 21	Ensuring the lively hood of the farmers in non-delta districts having surface irrigation potential with piped irrigation network by providing collection wells at regulating structures to increase the cropping intensity with assured yield and employment opportunities	Integrated farming system, bee keeping, and mushroom cultivation are promoted																		
AG/ 22	Development and execution of sustainable seed production and distribution network	Seed production in the farms as well as in the progressive farmer's field are in progress. Production and distribution of Certified seeds during 2012-13 to 2016-17 as follows – <table><tr><td>Paddy</td><td>- 82609 MT</td></tr><tr><td>Millet</td><td>- 1342 MT</td></tr><tr><td>Pulses</td><td>- 14969 MT</td></tr><tr><td>Oilseeds</td><td>- 14050 MT</td></tr><tr><td>Cotton</td><td>- 102 MT</td></tr></table>	Paddy	- 82609 MT	Millet	- 1342 MT	Pulses	- 14969 MT	Oilseeds	- 14050 MT	Cotton	- 102 MT								
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AG/23	Establishment of network of seed banks, food banks and cold storage to ensure supply at times of contingencies	Cold storage construction with the support of TN government is in progress. Agricultural Engineering Department (AED) has constructed 41 Open Transaction Sheds, Godowns, Cold Storage units in different Districts for Agricultural Marketing and AgriBusiness Department from the year 2015-16. Construction of 27 storage godowns has been entrusted to Agricultural Engineering Department during 2017-18.
AG/24	GIS based village mapping for agro management system to enhance input use efficiency and to overcome effect of climate change and for increasing farm productivity including horticulture crops	The objective of NADP is increasing the productivity of Horticultural crops through focussed interventions. Geotagging of high value components is being carried out for better monitoring. From 2012-17, an area of 32 Ha has been brought under Protected cultivation to increase the productivity of Horticultural crops. During 2013-14, GIS soil mapping was done on pilot basis in 6 blocks of selected 6 districts to identify soil properties and nutrient removal pattern of crops based on which recommendations will be provided to restore the soil health and reduce the cultivation expenses. During 2014-15 & 2015-16, GIS soil mapping for 16,732 revenue villages in Tamil Nadu were completed at a financial outlay of Rs.7.76 crore under National Mission on Sustainable Agriculture (NMSA).
AG/25	Integrated voice message on weather based agro advisories, market demand & price forecasting	More than 5 lakh Farmers have been provided with voice message of agro advisory. In order to make weather-based crop decision based on the statistics received from the Automatic Weather Stations, the AgroClimate Research Centre (ACRC) is making block level medium range weather forecast. Agro advisory bulletins are prepared twice in a week. During 2017-18, totally, 96 bulletins each with four advisories were prepared and 96 SMS were sent to 8.89 lakh farmers each time on six topics viz., agricultural crops, horticultural crops, plantation crops, cattle and small ruminants, poultry and other birds and extreme weather events. Special bulletins were disseminated to the Southern districts affected by Ockhi Cyclone.
AG/26	Establishment of dedicated climate knowledge cell to monitor, fore warn and train farmers and officials of the department on management of situation arising out of extreme events	Climate change cell is in place in Anna University, department of Environment in Chennai, WRO, Trichy and in few other places

AG/ 27	Strengthening and popularizing the existing crop insurance programme	Pradhan Mantri Fasal Bhima Yojana (PMFBY) scheme is being implemented in all districts of Tamil Nadu from Kharif 2016 onwards in place of NAIS and MNIAS scheme. For the Period from 2012-13 to 2016-17 1,80,480 no of farmers were enrolled at an expenditure of Rs.27.372 Cr as State share subsidy. During 2012-13 under NAIS scheme, 10.62 Lakh number of farmers enrolled (Area insured 11.81 Lakh Hectare). During 2013-14 under NAIS scheme, 7.96 Lakh number of farmers enrolled (Area insured 9.29 Lakh Hectare). During 2014-15 under NAIS scheme, 7.08 Lakh number of farmers enrolled (Area insured 8.69 Lakh Hectare). During 2015-16 under NAIS scheme, 10.90 Lakh number of farmers enrolled (Area insured 12.45 Lakh Hectare). During 2016-17 under PMFBY scheme, 15.36 Lakh number of farmers enrolled (Area insured 12.89 Lakh Hectare). During 2017-18 under PMFBY scheme, 13.27 Lakh number of farmers enrolled (Area insured 1078 Lakh Hectare). During 2018-19 under PMFBY scheme, 22.68 Lakh number of farmers enrolled (Area insured 13.61 Lakh Hectare).
AG/ 28	Research project on comprehensive crop insurance products that would cover increasing extreme events	Weather perils have been developed and compensation mechanism evolved by TNAU for various crops
AG/ 29	Development of vegetative shield for east coastal region against wind, cyclones, etc.	Slow progress is made
AG/ 30	Management and conservation of vegetative shield	
AG/ 31	Development of technology for improving inland fishing; new breeds; Popularization of technology.	Adopting intensive cage farming in Reservoirs, encouraging farmers by providing subsidy for setting up of fish/prawn hatchery, fish culture in grow out ponds, feed mill and hygienic marketing infrastructure. Propagation of hatchery technology for the fast growing fish species. Intensive fish culture in irrigation systems. Promoting fish species. Intensive fish culture in irrigation systems . promoting fish culture in farm ponds. Expansion

		of fish culture area Reservoir fisheries development, fish culture in pens and cages, establishment of hatcheries are done.
AG/ 32	Increasing fish production and fish farming area for rural livelihood through Inland Fisheries -	State Fisheries is performing this activity.
AG/ 33	Undertaking Repair and Renovation of Government Fish Seed Farms/ Hatchery to increase fish seed production for fish farming	In good progress
AG/ 34	Improving inland fisheries for tank and its command areas under IAMWARM Project	Fisheries department is carrying out this task.
AG/ 35	To increase per hectare production and encourage new species advocating Culture of SPF <i>Litopenaeus vannamei</i> / Culture of Sea bass	Central Institute of Brackish Water Aquaculture (CIBA) and Coastal Aquaculture Authority (CAA) are carrying out this task.
AG/ 36	Ensure year-round feed and fodder availability	State Fodder Development Scheme (SFDS): 1,86,750 acres of farmers land brought under various grass/ cereal / leguminous fodder varieties; 72.5 Lakh tree seedlings distributed; 4178 Nos of Chaff Cutter and 40,000 silage bags distributed to farmers; 20958 Azolla units established across the State. Establishment of Fodder production units in Meikkal Poramboke Lands at Villupuram and Vellore Districts: Area achieved: 62 acres Cultivation of fodder crops like Co4/Co5, Co (Fs)29, Desmanthes, Cowpea taken up in 22.78 acres and 39 acres of meikkal land at Vellore and Villupuram respectively through TANUVAS. National Livestock Mission: 440 quintals of certified seeds distributed to farmers through PPP mode for fodder production; 4699 chaffcutters distributed to farmers Tamil Nadu Irrigated Agricultural Modernisation Project (TN-IAMP): Totally 8270 acres are to be brought under fodder cultivation (Fodder cholam, fodder maize, cow pea, agathi) from 2018-19 to 2023-24.
AG/ 37	Ensure adequate animal housing and dedicated ponds for bathing in villages to protect livestock from extreme heat	Capacity building programmes to maintain the sheds in proper condition are given to the farmers.

AG/ 38	Intensify disease surveillance and develop forecasting of disease outbreaks for short- and long-term time frames	In practice now and the capacity of the officials on disease forecasting has been built. National Project on Rinderpest Surveillance and Monitoring (NPRSM): Rinderpest surveillance by village and stock route searches is being carried out to maintain the "Zero Rinderpest" status in the State. Foot and Mouth Disease Control Programme (FMDCP): Around 93 lakh eligible bovine population are vaccinated against Foot and Mouth Disease bi-annually. Assistance to States for Control of Animal Diseases (ASCAD): Preventive vaccination against endemic diseases like Black quarter, Haemorrhagic septicemia, Anthrax and Sheep pox are carried out. PPR - Control Programme (PPR-CP): Sheep and goats are vaccinated against PPR. Brucellosis - Control Programme (B-CP): Heifer calves aged between 6-8 months are vaccinated against Brucellosis. National Animal Disease Reporting System (NADRS): Reporting of outbreaks of diseases. Avian Influenza Surveillance: Samples collected from sanctuaries, markets, water bodies and screened for Avian influenza virus.
AG/ 39	Promote breeding with indigenous varieties to improve resilience to climate change	In good progress. Artificial Insemination: Around 58 lakh artificial Insemination is being carried out in Indigenous as well as other cattle and buffalo breeds by Animal Husbandry Department 3704 Artificial Insemination Centres annually. Tamil Nadu Irrigated Agricultural Modernisation Project (TN-IAMP): Totally 26400 animals are covered in programmed breeding from 2018-19 to 2023-24.
AG/ 40	Promote dairy development by training women in villages on animal care, animal disease reporting, and nutrition for optimizing milk production at household level of small and marginal farmers and enabling them to participate in milk cooperatives	Trainings were given to women self-help groups/ farmers on animal husbandry and milk production.

Water Resources

Code	Activity	Physical Progress
Hilly region interventions		
WR/1	Undertaking rainwater harvesting measures along the hill slopes	Rainwater harvesting structures have been constructed along the hill slopes of Western ghats and eastern ghats to collect the rainwater
WR/2	Construction of Water harvesting structures such as check dams, recharge shafts, farm ponds, etc.	To construct the Water harvesting structures such as check dams, recharge shafts, an amount of 44 crore was allocated and the same was utilized for construction in both western and eastern ghats by Water Resources Department of PWD, GoTN.
WR/3	Repairing, renovating and restoring tanks and traditional water bodies	Rehabilitation and Improvement works in 16 dams, viz. Siddhamalli dam, Vaniyar dam, Kesarigulihalla dam, Thoppaiyar dam, Nagavathy dam, Thumbalahalli dam, Kuthiraiyar dam, Poigaiyar dam, Shoolagiri Chinnar dam, Kelavarapalli dam, Adavinainarkoil dam, Vadakkupachaiyar dam, Kodumudiyar dam, Nambiyar dam, Mordhana dam and Pambar dam, under the Dam Rehabilitation and Improvement Project (DRIP) at a cost of Rs.39.25 crore completed.
WR/4	Interlinking of Rivers, and Construction of Mini Reservoirs	In the hilly region, no activity related to linking of river was taken up
WR/5	Desilting & Widening of Channels and Drains, strengthening of embankments & removing water weeds from channels	Periodical desilting has been carried out to restore the capacity of channels
WR/6	Strengthening infrastructure to manage disaster	In the hilly region, not much work progress has been done on infrastructure development to manage disasters
Strategy 2: Plain region interventions		
WR/7	Interlinking of Rivers and Construction of Reservoirs	6 new canals and supply channels were formed in the districts of Dharmapuri, Krishnagiri, Tiruppur and Vellore at an estimated cost of Rs.26.35 crore assuring irrigation to an ayacut of 8,422 acres. These canals benefit Totlampatti tank, Papparapatti tank, Baleguli tank, Balethottam tank, Kagankarai tank, Viruppampatti tank and 47 other tanks and 1 pond and Kesarigulihalla Reservoir and Uppar system
WR/8	Construction of anicuts and regulators	213 Check dams, 29 Percolation ponds, 266 Recharge shafts, 2 Diaphragm walls, 5 Grade walls, a bed dam and 6 Sub-surface dykes were constructed at an estimated cost of Rs.164.03 crore under Master Plan Artificial Recharge Scheme (MPARS). 3 artificial recharge structures were constructed with

		NABARD loan assistance at an estimated cost of Rs.14.74 crore benefiting an ayacut of 96.89 acres. 56 artificial recharge wells were constructed under IAMWARM project, at an estimated cost of Rs.24.82 crore
WR/9	Construction of Water harvesting structures such as check dams, recharge shafts, farm ponds, etc.	89 check dams at an estimated cost of Rs.303.78 crore was constructed in Ariyalur, Coimbatore, Dharmapuri, Dindigul, Erode, Kancheepuram, Karur, Krishnagiri, Namakkal, Salem, Sivagangai, Theni, Thanjavur, Tiruppur, Tiruvannamalai, Tiruchirapalli, Tirunelveli and Virudhunagar
WR/10	Desilting & Widening of Channels and Drains, strengthening of embankments & removing water weeds from channels	Periodical desilting has been carried out for the benefit of farming community to improve the status of soil organic matter content
WR/11	Repairing, renovating, restoring tanks and traditional water bodies	1,335 artificial recharge shafts and 2 subsurface dykes were constructed at an estimated cost of Rs.37.05 crore with the State fund
WR/12	Strengthening infrastructure to manage disaster	67 Anicuts have been rehabilitated in 14 districts, viz. Coimbatore, Cuddalore, Dharmapuri, Karur, Kancheepuram, Madurai, Salem, Thanjavur, Theni, Tiruchirapalli, Tirunelveli, Tiruppur, Tiruvannamalai and Villupuram at an estimated cost of Rs.90.64 crore benefiting an ayacut of 41,401 acres. The rehabilitated anicuts are located across Kuniyamuthur channel, Coonoor River, Manimuktha River, Kallar River, Palar River, Amaravathy River, Oothampari Aru, Ariyar River, Kothamangalam Drain, Kottankulam tank surplus course, Varahanadhi channel and Nambiyar River.
Coastal region interventions		
WR/13	Construction and rehabilitation of tail end regulators	2 Regulators were rehabilitated in Cuddalore, at an estimated cost of Rs.10.06 crore
WR/14	Desalination plants	
WR/15	Construction of Water harvesting structures - check dams farm ponds, etc.	29 check dams at an estimated cost of Rs.105 crore was constructed in Cuddalore, Tiruvallur, Thoothukudi and Ramanathapuram
WR/16	Desilting & Widening of Channels and Drains, strengthening of embankments & removing water weeds from channels	39 Canals and Supply Channels were rehabilitated in 21 districts, viz. Cuddalore, Kanniyakumari, Nagapattinam, Thanjavur, Thiruvallur, Thoothukudi, Tiruvallur, at an estimated cost of Rs.377.91 crore benefiting an ayacut of 6,74,738 acres. Krishnaiyengar channel, PAP Contour Canal, Distributaries up to 150 cusecs capacity in Wellington Reservoir Project, Gundar - Chittar - Karuppanadhi Project and Thirukoilur Anicut Project,

		Athoor anicut Channel, Kalingarayan Channel, Arakkankottai and Thadapalli Channels, Thovalai Channel, Radhapuram Channel, Kottayadi Channel, Puthanar canal were rehabilitated.
WR/17	Repairing, renovating & restoring tanks and traditional water bodies and bed dams	9 bed dams at an estimated cost of Rs.113.96 crore was constructed in 4 Districts, viz. Cuddalore, Ramanathapuram, Sivagangai and Thanjavur benefiting an ayacut of 56,264 acres. These Bed dams were constructed across Periya Odai, Vaigai and Cauvery Rivers.
WR/18	Strengthening infrastructure to manage disaster	19 grade walls at an estimated cost of Rs.62.91 crore was constructed in 3 Districts, viz. Nagapattinam, Thanjavur and benefiting 43,786 acres. These grade walls were constructed across Veeracholan River, Cauvery River, Kudamurutty River, Vennar River, Pamaniyar River, Palavar River, Manniyar River, Koraiyar, Maraikkoraiyar and Sola- Sudamaniyar River. 43 Flood Protection works in 11 Districts, viz. Ariyalur, Chennai, Cuddalore, Kancheepuram, Karur, Madurai, Nagapattinam, Thanjavur, Tiruvallur, Tiruchirappalli and Villupuram were completed at an estimated cost of Rs.1,478.30 crore.
Research and Capacity Building interventions		
WR/19	Establish high resolution weather monitoring, river inflow monitoring, hydrograph monitoring, and early warning system for floods	Through NADP project, AWS network has been created at block level at a cost of 40 crore. Aliyar reservoir has been fitted with modernized flow monitoring system
WR/20	Assess water availability by region, assess current demand of water by sector and future demand by sector by factoring in Climate change for short, medium- and long-term timelines	TNAU in collaboration with IMTI and WRD makes assessment of water demand at river basin scale
WR/21	Monitor quality of water to understand the impacts of warming of the atmosphere and for providing remedies	Water quality studies are being carried out by WRD, for checking the basic parameters.
WR/22	Identify vulnerable areas of ground water contamination by point sources of industrial, municipal solid waste landfills and agricultural pollutants	Limited studies have been done by Ground water division and surface water division of PWD
WR/23	Map water availability, Minor surface water bodies, Aquifers in time and space, and Water use in conjunction with land use and land classification	Geo data base with respect to WRD tanks is being created.
Policy interventions		

WR/2 4	Introduce pricing regulation for use of piped water for domestic use and drinking water	
WR/2 5	Undertake periodical census of medium & minor irrigation projects to check sustainability, detect dis-functionalities & implement remedial measures	Done by PWD institutions regularly

Forest & Biodiversity

Code	Activity	Physical Progress
Strategy 1: Increasing the forest cover, both inside and outside notified forest areas through afforestation programmes as well as restoration of degraded forests		
FR/1	Participatory Forest Management or Joint Forest Management (JFM)	Good progress has been made in Participatory Forest Management or Joint Forest Management through the NTFP scheme. The Forest Cover of the State increased by 73 sq. km during the period 2013-15 as per ISFR 2017 vis-a-vis the revised figure of ISFR 2015. The forest and tree cover of the State now is 30,952 sq. km which constitutes 23.80 percent of the total geographical area of the State as against 33 percent forest and tree cover to be achieved as mandated in the National Forest Policy, 1988. Planting and maintenance of 3.99 crore seedlings in the 32 districts throughout Tamil Nadu have been achieved through Massive Tree Planting Programme till 2017-18. During 2017-18, the programme was continued by planting 69 lakh seedlings out of which 64 Lakh seedlings were planted by the Rural Development and Panchayat Raj Department and the remaining 5 Lakh by Forest Department under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). The scheme will continue with planting of 71 lakh seedlings during 2019-20.
FR /2	Promotion of Industrial and Energy Plantation	TAF CORN and TANTEA has promoted Industrial and Energy Plantation under public private partnership mode. <i>Melia dubia</i> & <i>Acrocarpus fraxinifolius</i> are the best suited tree species for afforestation using treated domestic sewage. Foliage and flowers of trees namely, <i>Mellingtonia hortensis</i>, <i>Mimopsis elangii</i> were found to release scents which alleviate the bad odour.
FR /3	Promotion of Climate Resilient Agro and Farm Forestry	Under NICRA and other climate change adaptation programmes Climate Resilient Agro and Farm Forestry is being promoted in vulnerable regions of Tamil Nadu. Developed climate resilient plantation forestry techniques for wastelands/ drought affected areas by planting identified tree species suitable for climate resilience and in drought vulnerable areas. Trees are characterized as carbon partitioning for higher carbon sequestration. Tree cultivation in Private lands (TCPL) is promoted in a big way for ensuring food and wood security and achieving 33 percent of geographical area under forest and tree cover. TCPL is the

		major component under the TamilNadu Biodiversity Conservation and Greening Project (TBGP).
FR/4	Sandal wood: (a) On degraded forest area in sandalwood Belt; (b) On farmlands in sandalwood tract	Low progress has been made due to permission for cultivation of sandal wood trees. Good forestry practices are framed for cultivating Sandal. Host association is studied to improve the growth rate of Sandal. Research Wing of the Forest department has standardized the procedure for mass production of seedlings of desired sandal clones through tissue culture technique. The scheme of Raising of Sandal plantations in Reserved Forests in the traditional natural sandal bearing areas of Jawadhi Hills, Shervaroyan hills, Kolli Hills, Pachamalai hills and Chitheri hills for a period of 10 years from 2015-16 to 2024-25 with an outlay of Rs.100 crore.
Strategy 2: Enhancing Biodiversity Conservation efforts: In situ / ex situ (both inside the Protected Area as well as in other Reserved Forests)		
FR/5	Biodiversity Conservation: (both inside Protected Areas as well as in Reserved Forests) including Shola Forest	Constant efforts are taken under TBGP for biodiversity conservation
FR/6	Establishment of fodder banks in the Protected Areas as well as in other Reserved Forests	Good progress has been made Creation of Fodder plantations at an amount of Rs.32.60 lakh in forest areas to improve wildlife habitats and to avoid human animal conflict.
FR/7	Greening of villages and Establishment of Village Seed Banks	Very good progress has been made and almost all the villages in Tamil Nadu has been covered under this programme. Supply of 4 Lakh seedlings to the public in rural and urban areas at a subsidized rate was the highlight of the year 2017-18.
FR/8	Conservation of genetic resources by screening and preserving existing wild germplasm for developing climate resilient varieties	IFGTB and Forest College and Research Institute, Mettupalayam are undertaking conservation of genetic resources by screening and preserving existing wild germplasm for developing climate resilient varieties
FR/9	Training and extension activities to develop institutional capacity for biodiversity conservation and ecosystem management	Regular trainings are organized for building the capacity of managers on the biodiversity conservation and ecosystem management. At present, 13 Forest Protection Squads are functioning for the protection of forests, apart from territorial and wildlife staff. Besides the Forest Protection Squads, there are 5 Strike Force squads, 17 Forest Stations, 11 Roving Check Posts and 112 Forest Check Posts to protect the forest and wildlife wealth of the State.
FR/10	Collection, conservation and documentation of in Nilgiris, Kolli hills, Kodaikanal (Shola Forests), Kalakkad-Mundathurai Tiger Reserve (KMTR) Conservation of genetic resources by screening and preserving existing wild germplasm for developing climate resilient varieties	Slow progress has been made in this activity, due to complexity of terrain. Documented floral diversity (Trees, Shrubs and Herbs) in The Nilgiri Forest Division.
FR/11	Strengthening the ex situ conservation facilities: Gene Banks	IFGTB is taking up this activity
FR/12	R & D on orthodox and recalcitrant seeds	IFGTB is taking up this activity

	cryopreservation for long term storage - Establishing Cryopreservation facilities	
FR/13	Renewable power generation for powering the freezer facility	Not much progress has been made
FR/14	Establishment of biodiversity corridors / species garden for education purpose	Biodiversity corridors / species garden for education purpose has been created in many places
Strategy 3: Coastal & marine biodiversity conservation		
FR/15	Conducting regular assessment & monitoring of Coral reef as indicator species	Slow progress*(Well explained in Coastal Area Management Chapter)
FR/16	Coral rehabilitation using resilient & resistant native species	Yet to be started*(Well explained in Coastal Area Management Chapter)
FR/17	Alternative livelihood for reef associated fishery dependent people	Slow progress*(Well explained in Coastal Area Management Chapter)
FR/18	Conservation of mangroves and associated biodiversity	Good efforts are being taken for conservation of Mangroves. The mangroves such as Muthupet, Pitchavaram and Ramanathapuram are under the control of Forest Department. Habitat improvement measures like mangrove restoration in degraded lands, maintenance of older plantation, removal of invasive species, protection and vigilance, eco development activities, awareness creation, monitoring and evaluation are the major activities. *(Well explained in Coastal Area Management Chapter)
Strategy 4: Creation of Biodiversity Registers		
FR/19	Mapping of floral and faunal biodiversity in State at a high spatial resolution incorporating GPS coordinates and on GIS platform	Not much progress made.
FR/20	Creation of Peoples Biodiversity Register - BMC level (Panchayat)	Not much progress made.
FR/21	Identification, conservation and protection of biodiversity of heritage sites (10 sites) and ecologically sensitive districts (9) as suggested by the Gadgil Committee.	Good progress has been made to identify, conserve and protect the Biodiversity heritage sites
FR/22	Disseminate - includes devising access and benefit sharing mechanisms of resources and indigenous knowledge with communities dependent on the same	Good progress made
Strategy 5: Lower strata diversification		
FR/23	Identification of suitable fodder genotypes by evaluating existing germplasm- Germplasm collection and documentation	Suitable fodder crops grown under different crops have been identified
FR/24	Intensive evaluation of the collected forage germplasm suitable to the different ecosystem and testing for climate resilience-Screening of germplasm	Identified germplasms have been screened for its suitability to different ecosystems
FR/25	Large scale multiplication of seeds	Seed multiplication of forage crops have been done.
FR/26	Large scale testing – field trials in different agroclimatic zones where degraded	Yet to be started

	forests with invasive species are identified-Approx. 3 sites for each agroclimatic zones will be selected	
Strategy 6: Management of Forest fires and alien invasive species		
FR/27	Training, field review of AIS management: Procure partners; Training on management of AIS with field review of species (TNFD staff); Strategy and manual on management of AIS (in English and Tamil)	Large number of people were trained through various capacity building programmes
FR/28	Survey, monitoring and reporting-Baseline survey of biodiversity in critical habitats prior to removal of AIS; Enter georeferenced data in biodiversity database/ GIS	Limited work has been done. Baseline survey and documentation of floral composition in Prosopis, Lantana and Wattle grown areas of Kodaikanal Forest Division, Coimbatore Forest Division and Sathyamangalam Tiger Reserve were carried out.
FR/29	Removal of AIS; Phased removal of Lantana, Prosopis from dry forest; Phased removal of wattle from Shola ecosystem in the hills	Continuous efforts are being made to remove the Alien Invasive Species
FR/30	Monitoring biodiversity in critical habitats after removal of AIS; Monitor impact of fencing and removal of exotics from shoal and grassland habitats	Yet to be started
FR/31	Strengthening firefighting infrastructure to address Forest Fires	Created firefighting infrastructure to address Forest Fires
Strategy 7: Research & capacity building on impact of climate change on forest & biodiversity & ecosystem services		
FR/32	Estimating mitigation potential of forest in Tamil Nadu	Work is in progress
FR/33	Intensification of research on forest plant diversity conservation and utilisation to identify climate resilient plants.	Work is in progress. Documented green cover data of four major metro cities namely Chennai, Madurai, Coimbatore and Tiruchy, Screened and identified trees tolerant for different pollutants namely SO ₂ , NO ₂ , CO, CO ₂ and Particulate matter, Documented air quality data for the four major cities, Create awareness on urban forestry and climate change management through training and demonstration for 20000 people across the State, Conducted two national level workshop for urban forestry methodology and policy, Created ambient air quality monitoring - mobile van facility for real time monitoring of urban pollution. The main activities of Research wing are biodiversity studies like, Retrieval of Rare, Endangered and Threatened (RET) species, Clonal assemblage of important timber species (Teak etc), Standardizing clonal technology for important timber and fruit bearing species, assemblage of medicinal plants and their common uses. There are 54 Research centers spread over 7 agro climatic zones falling in 32 districts in Tamil Nadu. Forest Department has undertaken research on increasing the utility and market potential of NTFPs.
FR/34	Valuation of bio resources in 3 ecosystems; Coastal; Wetland; Forest	Work is in good progress

FR/35	Focused research on impact of climate change on coral reefs and associated biodiversity	Work is in good progress
FR/36	Capacity building and dissemination activities	Done regularly. Dissemination of information to farmers on tree cultivation is done by 32 Forestry Extension Centres established in each district. The Extension wing has disseminated information to various stakeholders including farmers through training programmes, workshops, field visit and publications. The Tamil Nadu Forest Academy, Coimbatore and Forest College at Vaigai Dam also impart training to in-service front-line staff like, Forest Range Officers, Foresters and Forest Guards for upgrading their professional skills for conservation and protection of biodiversity.
Strategy 8: Awareness generation and capacity building on climate change for integrating CC in governance		
FR/37	Creating awareness on climate change impact on forest to rural poor, farmers, farm labourers and people lives in forest fringes by training, field visits, and field demonstrations.	Awareness programmes are organized at regular interval. Awareness on biodiversity conservation, climate change was given to farmers and farm labours in Coimbatore district of Tamil Nadu.
FR/38	Creating awareness on climate change and resilient mechanism through forestry by appropriately training NGOs, self-help groups, etc.	Series of training programmes have been organized by Climate Change Centre in Anna University in this regard. Planted over 10000 trees in 10 different educational institutions in Coimbatore, Documented carbon sequestration potential of 36 tree species, Documented carbon foot print in organisation and educated carbon foot printing to 3000 students and staffs, Demonstrated waste recycling through vermicomposting, mushroom cultivation and other modern waste management techniques, Trained about 6000 students on forest conservation through jungle walk and field training, Create awareness on carbon neutrality over 10000 students.
FR/39	Capacity building through seminars and trainings for scientists and researchers to meet the challenges of climate change	Done on a regular basis
FR/40	Capacity building through training to forestry field staff, managers	Done on a regular basis
FR/41	Awareness building among all stakeholders in Gulf of Mannar Biosphere Reserve	Done on a regular basis
FR/42	Capacity building of frontline conservation staff and community in Gulf of Mannar Biosphere Reserve	Slow progress is made.

Coastal Area Management

Code	Strategy	Achievements
Strategy 1. Develop a Tamil Nadu Integrated Coastal Protection Plan (TN-ICPP) to adapt to projected sea level rise, enhanced intensities of cyclones, storm surges and extreme rainfall		
CAM/1	Habitation shifting to safer areas	Development in flood prone areas and resettling encroachment under Integrated Cooum River Eco

		restoration by CRRT and Tamil Nadu Slum Clearance Board
CAM/2	Holistic integrated development of coastline of Tamil Nadu	- Preparation of Coastal Zone Management Plan (CZMP) for Tamil Nadu through the National Centre for Sustainable Coastal Management (NCSCM). - Classification of different coastal zones, like CRZ I (ecological sensitive areas), CRZ II (developed Areas), CRZ III (Undeveloped and under developed areas), CRZ IV (Water Areas), High Tide Line (HTL), Low Tide Line (LTL) and other special features like mangroves, coral reefs etc.
CAM/3	Access intensity & recurrence frequency of natural hazards	- Coastal Hazard Monitoring projects by Institute for Ocean Management(IOM), Anna University - Hazard and Risk Zone maps prepared - Real time monitoring and beach imagery software for Timely flood warning and emergency response system
CAM/4	Evaluation of individual & combined impacts of natural disasters due to climate change	Impact of the Gaja cyclone in the Vedaranyam Block was assessed. Impact of the Gaja cyclone on Muthupet mangroves is being assessed with the permission of the Tamil Nadu Forest Department
CAM/5	Central coastal database centre establishment	- Environment Information Dissemination Centres were formed - Establishment of Climate change cell
CAM/6	Institutional Arrangements strengthening	Formation of Environment Information Dissemination Centres (EIDC) by DOE
CAM/7	ICZM demonstration projects	- Preparation of Integrated Coastal Zone Management Plan for Tamil Nadu - Training & Awareness programme and Capacity Building - Development of Integrated water and coastal zone management programmes - Research, planning, implementation and evaluation of measure against coastal pollution, erosion and degradation - Maintenance and restoration of Biodiversity - Identification of responses to the effects of Climate Change - Coastal vulnerability Mapping - Coastal habitats health Monitoring by SDMRI - Special Area Management Plan (SAMP) development - Preparation of ICZM plan for TN, preparation of vulnerability maps and training modules by CDRRP - Training programmes on ICZMP by CDRRP
CAM/8	Disaster preparedness-Decision support system (DSS) for disaster management	- Emergency Tsunami Reconstruction Project (ETRP) - Coastal Disaster Risk Reduction Project (CDRRP) - State Disaster Management Perspective Plan for 2018-2030 - Greater Chennai Corporation Disaster Management Plan - Preparation of Comprehensive Flood protection Plan from SDRF - Installation of Early Warning System (EWS)/ Disaster Warning Announcements System (DWAS) at 450 sites, to deliver the warning alerts and messages to the targeted coastal community is under progress by CDRRP - Capacity building of school students in disaster risk

		management from class 7-12 and introduction of teacher's training course curriculum by CDRRP 3,34,457 persons in 5892 batches were trained under Community Based disaster risk management (CBDRM), by CDRRP
CAM/9	Revision of norms & implementation for Coastal zone infrastructure development, waste management. Awareness activities	----
Strategy 2. Avert enhanced coastal erosion due to Climate change & protect the coastal zone		
CAM/10	Protection wall construction in vulnerable coastal areas (Creating resilient infrastructure)	- Vaan Island in Gulf of Mannar is protected from submergence due to erosion through the deployment of Artificial Reef Modules and Coral Rehabilitation. - The island area is to be increased from 2.33 ha in Dec. 2015 to 3.54 ha in Dec. 2018 - AR Modules Deployment 3600 Nos (2m height) – completed. 2400 (1m height) construction –completed and out of which 1315no's AR modules Deployment were completed.
CAM/11	Study on impacts of climate change on coastal regions	- Support Research and Development of innovations to address climate change impacts and vulnerabilities by NCCR - Climate Adaptation and Resilience in South Asia” – Study on effect of climate change on agriculture in Cauvery delta by WRD and ADB - Identification of vulnerable district and project for CCA - Vulnerability assessment in coastal villages by SDMRI
CAM/12	Design augmentation requirement/ retrofitting of coastal protection works (sea wall, groynes)	- Demarcation of High Tide Line along the State coastline from Palar River Mouth to Thengapattinam - Erection of Stone pillars on High Tide Line reference points under CDRRP - Hard structure build up as a part of Comprehensive Coastal Zone Management Plan - Demarcation of High Tide Line (HTL) along the coast of Tamil Nadu by CDRRP
CAM/13	Id & plantation of heat tolerant location specific mangrove species for afforestation in moderate and high erosion areas	An experimental plantation was taken for 300 m along the coastal areas of Karanagadu in Ramanathapuram District with the participation of the Karanagadu Panchayat by MSSRF
CAM/14	Tree cover increase along coast with appropriate trees	- Mangrove Plantation in coastal areas prone to cyclonic storms to be developed as per Vision Tamil Nadu 2023 - Plantation of tropical dry evergreen forest trees was taken up in about 60 acres of common land with the participation of Panchayat in the Vedaranyam Block by MSSRF

		- Plantation of total of 1,43,818 saplings from 173 species of Coromandel coastal vegetation including mangroves and associated plants in Adyar wetland restoration by CRRT - Riverbank vegetation and mangrove plantations in the Cooum riverine system by CRRT
CAM/15	De-siltation/creation for rainwater/river water drainage into sea	- Desiltation, demarcation & fixing boundary and bio-metric survey under Cooum River Eco-Restoration Plan - Construction and rehabilitation of tail end regulators by WRD
Strategy 3. Strengthen resilience of coastal communities in view of projected climate change		
CAM/16	Strengthening resilience of fishing communities	- Training on livelihood schemes, Awareness, revolving fund, Infrastructure - Completed for 1st phase by DoE - Conduction of Alternative livelihood tailoring training and various awareness program by DoE - Construction of 4 mending sheds has been completed by DoE - Provision of certificate courses of Marine and Safety to the fisher folk youth by DoE - Cage culture training with CMFRI Institute Thoothukudi by DoE - Nearly 3200 training programme have been organised during 2012-17 on Sustainable Fisheries in the era of climate change for the fishing communities through the Fish for All Centre of MSSRF, located in Poompuhar by MSSRF - Out of 171 beneficiaries for the conversion of trawlers into tuna boat, 7 beneficiaries work is in Progress - Wireless communication facilities to reach fishermen on high seas. Hand held VHF marine radios with built-in GPS receivers have been procured and distributed to the fishermen by CDRRP
CAM/17	Strengthening resilience of coastal farming communities-sustainable agriculture	- Introduction of saline tolerant varieties of paddy in the Kadinalvayal village in Vedaranyam District by MSSRF - Survey on Halophytes, "Future crops" for saline affected coastal areas of Tamil Nadu, indicated the presence of 19 true halophytic species by MSSRF - Attempts to develop Bio-saline agriculture practices for 3 halophytes by MSSRF - Using ICT technology to provide site specific weather data to build resilience of farming communities
CAM/18	Strengthening coastal communities and habitat improvement (rural)	- GoMBRT is founded to support livelihood of 3 lakh fishing community members - Village Marine conservation and eco development committees in 248 coastal villages - Advise measures of retrofitting/ relocation of coastal rural housing in view of the recurrence and intensity of extreme events and sea level rise due to climate change by RD&PR - Eco-development and alternative entrepreneurship
CAM/19	Strengthening resilience of coastal city habitats	Ecosystem-based Climate proofing watershed in Nammiyampattu and Kanamalai panchayat of Jawadhu hills of Tiruvannamalai district Tamil Nadu. The implementing agency is DHAN Foundation.

		14,347 Multi hazard resistant houses were constructed for 488 coastal habitations and insured for 10 years. Alongside, 143 routes with signage boards constructed to ensure connectivity of coastal habitations and shelters by CDRRP - Conversion of overhead electrical lines into underground cables in Nagapattinam, Cuddalore and Velankanni towns under progress by CDRRP
Strategy 4. Avert enhanced saltwater intrusion in ground water and ensure water security in coastal Tamil Nadu		
CAM/20	Protective measures to arrest sea water intrusion & beach nourishment	- Preparation of Database on Coastal dynamics - Construction of Coastal defence structures, both hard and soft engineering structures for Coast stabilisation - Greenbelt/buffer zone/natural barrier set up through extension of coastal vegetation - Monitoring of shoreline dynamics
CAM/21	Coverage increase of monitoring of wells for water quality assessment	- Adaptations to climate change: Water and, Afforestation to small holders in Rainfed Rural context of Tamil Nadu - Repairing, Renovation and Restoration of tanks and traditional water bodies by PWD
CAM/22	Id & operationalisation of appropriate areas for new bore wells	Proposed to construct 74 nos. of piezometers by SGWB
CAM/23	Soil management Moisture retention measures, continuous vegetation, infiltration, groundwater recharge & erosion reduction encouragement	Construction of Water harvesting structures like check dams and farm ponds by RD&PR
CAM/24	Reduction in extraction of groundwater through low power pumping machines (renewables)	—
CAM/25	Id of areas and establishment of desalination plants	Three desalination plants have been established by Chennai Water Desalination Limited under CMWSSB in Minjur, Nemili funded by AMRUT.
CAM/26	Artificial recharging of wells by RWH	Rainwater harvesting structure established by RD&PR
Strategy 5. Conserve biodiversity in the coastal zone		
CAM/27	Assessment of baseline flora and fauna data on biodiversity in coastal zones	- Comprehensive baseline data on seagrass diversity, distribution and status in Palk Bay covering 170 Km between Rameshwaram and Athirapattinam must be collected and documented by SDMRI - Updating of Baseline data on coral reefs in Gulf of Mannar by SDMRI - Baseline survey on coastal habitats and associated biodiversity between Rameshwaram and Kanyakumari under update by DoE

		Assessment of fish types, fishing pressure and the need assessment of the communities are under process by DoE
CAM/28	Conservation/protection of marine biodiversity including GoM (coral reef/sea grass bed)	4 coral rehabilitation covering 12 sq.km. degraded coral reef in GoM by SDMRI - Seagrass rehabilitation covering 9 sq.km. degraded seagrass bed in GoM by SDMRI - Seagrass rehabilitation covering 2 sq.km. degraded seagrass areas in Palk Bay by SDMRI - Artificial reefs deployed in Vann island to protect the island from shrinkage and erosion and to enhance fish production/biodiversity funded by NAFCC - Artificial reefs deployed covering 0.5 acres area in Palk Bay to protect seagrass beds and to enhance fish production funded by NAFCC
CAM/29	Mangrove protection	Conservation of 515 ha mangrove blocks by MSSRF
CAM/30	Estuary management	Pioneering project on wetland conservation, restoration of 358 acres of Adyar creek and estuary by CRRT
CAM/31	Ensuring livelihood of fishermen	- Trainings on Livelihood schemes, awareness, revolving fund and infrastructures like construction of fish landing centre, net mending centre, community halls by Department of Fisheries - Schemes have been implemented for provision of financial and technical assistance by CDRRP for fisheries management and Sustainable Livelihoods
Strategy 6. Avert pollution of water and soil in the coastal zones caused by industrial (power plants & other industries) and domestic wastewater & solid waste management (SWM) practices		
CAM/32	Development of integrated SWM plan in coastal zone areas to avert water entering in the sea using new technology	Upgradation of sewerage system & preventing entry of sewage in Chennai City waterways by Chennai City River Conservation Project (CCRCP), 4 STPs with a total capacity of 264 MLD
CAM/33	Implementation of additional cooling of wastewater from power plants by mixing with sewage & other technologies	—
CAM/34	Reusing wastewater through biological treatment	—
CAM/35	Study & monitoring of coastal pollution along coasts	- Water quality monitoring under Monitoring of Indian National Aquatic Resources (MINARS) and Global Environmental Monitoring System (GEMS) - Abatement of pollution in rivers under National River Conservation Plan (NRCP) - Integrated Cooum River Ecorestoration Plan for pollution abatement by CRRT - Adyar River Restoration from Origin to River Mouth by CRRT

Strategic Knowledge for Climate Change

Cod e	Strategies	Achievements
KM/1	Create an enabling institutional framework for developing CSIS and disseminating strategic knowledge on climate change	- NMSKCC Project has created Tamil Nadu State Climate Change Data Bank, State Climate Change Knowledge portal, State climate Change Knowledge Management Cell, State Climate Change compendium for standard protocols for vulnerability and risk analysis by DoE through CCCAR. - The Climate Cell has addressed Global Climate Change through effective climate change governance by implementation of SAPCC and climate services by connecting climate change science- policy -society in order to make TN a resilient State. Implemented by DoE through CCCAR - A Total number of 159 Training to 4770 market committee staff, agricultural marketing and agri-business staff and farmers from 2012-13 to 2017-18 by TNSAMB - Awareness programmes in schools, colleges for NCC & NSS towards better motivation and support creation
KM/2	Develop a scientific basis for a deeper understanding of climate change issues around the Globe	- Santiago Dialogue Forum of Climate Proof Urban Development by GCC - Exchange programme with Thekwini Municipality (Durban) to share climate friendly practices in Durban through by GCC - Multimedia publicity for conservation initiative by GoMBRT - Assess water availability by region, assess current demand of water by sector and future demand by sector by factoring in Climate change for short, medium and long term time lines by WRD
KM/3	Support Research and Development of innovations to address climate change impacts and vulnerabilities	- Adaptation to Climate Change: Water and Afforestation to small holders in Rainfed Rural context of Tamil Nadu, involving vulnerability assessment, sensitisation of community and Panchayat of CCA, thereby increasing adaptive capacity through Farm ponds, tank silt application, Agro-forestry and Insurance strategies. Project implemented by DHAN Foundation - Action Research on Adaptation to Climate Change on rainfed farming, in order to support research and development of innovations to address climate change impacts and vulnerabilities by DHAN Foundation 'Climate Adaptation and Resilience in South Asia' Study on effect of Climate Change on agriculture in Cauvery delta, for vulnerability assessment and tested scorecard tool by DHAN Foundation - Conduction of Cities Fit for Climate Change Kick-off workshop, 2016 with 27 participants by GCC - Conduction of Climate Finance Study, 2017 with participants from GCC, Chennai Smart Cities, TNSCB and CMDA by GCC - Seminar on Climate Proof Urban Development in India with special reference to Chennai and

		Weißeritz River, Germany -Flood Adaptation and Urban Rehabilitation, 2017 conducted with 13 participants through GIZ by GCC • 580 trainings and 279 demonstrations have been conducted under Rainfed Area Development from 2017-18 to 2018-19. 25550 farmers were benefitted by the interventions of Dept. of Horticulture • 153 trainings were conducted under Paramparagat Krishi Vikas Yojana from 2015-16 to 2016-17, with a total number of 3060 farmers by Dept. of Horticulture • Study on coral diseases prevalence in GoM and Palk Bay during 2012-2015 by SDMRI • Study on diversity, abundance and role of reef binding coralline algae in coral reef ecosystem along Tuticorin coast, GoM, during 2013-2016 by SDMRI • Study on impact of exotic seaweed, <i>Kappaphycus alvarezii</i>, on corals, associated resources and management measures in GoM Marine National Park during 2013-2017 by SDMRI • Study on Rejuvenation and restoration of mangrove species <i>Pemphis acidula</i> in Gulf of Mannar, conducted by Anna University and SDMRI • Study on Artificial reefs for the enhancement of fishery production and improved livelihood in Tuticorin coast of Gulf of Mannar by SDMRI • Study on Quantification and impact of domestic and industrial effluents into Gulf of Mannar by SDMRI • Study on Impact of ocean acidification on calcification of marine shellfishes in Gulf of Mannar by SDMRI • Study on Impact of anthropogenic activities and seasonal variation in plankton biomass in Gulf of Mannar by SDMRI • Extensive amount of research works conducted during 2012-2016 by PWD
KM/4	Undertake Demonstration, Field implementation &Extension; Ground truth verification &Field Demo for choosing adaptation options	• Training of 1176 Farmer Producer Groups on installation and commissioning of Micro Irrigation System conducted during the year 2018-19 by Dept. of Horticulture • Development and implementation of CCA demonstration projects in Tamil Nadu for identification of vulnerable districts and projects on CCA by DHAN Foundation • Ecosystem based Climate proofing watershed in Nammiyampattu and Kanamalai district of Jawadhu hills of Tiruvannamalai district, Tamil Nadu, for demonstration of integration of mainstream funds in order to address climate change and build resilience of tribal communities by DHAN Foundation • Conducting Demonstration and training programmes on underutilised seafood through value addition for the Socio-economic upliftment of women through SHGs from coastal villages of Tuticorin district during 2014-2017 by SDMRI • Farming of <i>Gelidiella acrosa</i> – demonstration of improved methods of cultivation to the fisher folk by SDMRI

KM/5	Support regular monitoring of critical ecological parameters and urban landscape	- National Workshop on “Rapid Response Plan (RRP) for Managing Coral Reef Ecosystems of India, to mitigate Threats of Coral Bleaching and Disease Outbreak”, held in Tuticorin by MoEF&CC with assistance by SDMRI - Living resources of the Gulf of Mannar: Assessment of key Species and habitats for enhancing awareness and for conservation policy formulation during 2013-2014 by SDMRI
KM/6	Mainstream traditional knowledge	115 seminars were conducted under MIDH- NHM, with a total number of 23002 benefitted farmers by Dept. of Horticulture - SHG skill training by GoMBRT - Folklore programmes in coastal villages by GoMBRT
KM/7	Undertake capacity building initiatives to integrate steps to manage climate sensitive natural resources and mitigate climate change drivers Training/Capacity building; Workshops/Seminars/Consultation Exposure Visit to areas where success stories pertaining to adaption to vagaries of climate change can be studied	- Conducted a series of training programs to provide wide knowledge to the participants about emerging issues in climate change in various sectors such as agriculture, coastal, water, forestry and health. This enabled the participants to assess CC-related vulnerability & risks, the need for adaptation & mitigation strategies and the importance of monitoring and evaluation systems. Trainings are conducted by DoE - Updation of the Government Schemes and Newly formed Strategies adopted under TNSAPCC by conducting workshops in the 7 sectors namely, Sustainable Agriculture, Water Resources, Coastal Area Management, Forest & Biodiversity, Sustainable Habitat, Energy efficiency, Renewable Energy & Solar Mission, Knowledge Management by DoE - Capacity Building on Climate Resilient Development, 2017 with 27 participants from GCC, CMDA, TNSCB and CMWSSB by GCC - Capacity Building of Forest Staff in Scuba diving, 2015-18 through support from Tamil Nadu Forest dept. & MoEF&CC by SDMRI - Capacity building on seed production of selected marine ornamental fishes to fisher women in Gulf of Mannar by SDMRI - Training workshop on “Coral Disease Research’ in 2016, organised by SDMRI - Awareness creation through workshops, seminars and exhibition during 2013-14 by GoMBRT, supported by SDMRI - Eco development activities conducted during 2013-14 by GoMBRT through SDMRI - Conducting training programmes during 2012-2016 by PWD - Conducted about 205 in house trainings, with approximately 9217 participants/stakeholders through CPHEEO by CMWSSB - Ongoing Capacity building programmes on Climate Change Adaptation under CCA-RAI programmes of GIZ is taken up by CCCAR under the assistance of DoE
KM/8	Support creation of Monitoring and Evaluation (M & E) tools of various initiatives of the climate sensitive sectors	- Undertaking coastal hygiene, fish landing centre improvements - Agro-advisory to farmers using NICE platform to adapt Climate Change in Tamil Nadu. Involves use

		of ICT Technology to provide site specific weather data to build resilience of farming communities by DHAN Foundation Monitoring and Evaluation programmes during 2012-16 by PWD
KM/9	Implement CSIS through a knowledge portal to the end users	Establish high resolution weather monitoring, river inflow monitoring, Hydrograph monitoring, and early warning system for floods by WRD

Enhanced Energy Efficiency and Solar Mission

Code	Activity	Achievements
ES/1	Detailed Mapping and auditing of all existing public buildings in conformance with the Energy Conservation Building Code (ECBC)	The Government has constituted a technical committee for evolving technical guidelines for adoption by the building planning authorities while issuing approval for building plans and an Empowered committee to advice and evolve policy decision for the implementation of the ECBC in buildings with a connected load of 100kW and above in Tamil Nadu. Accordingly, Technical committee meetings comprising of various departmental officials were conducted on 03.08.2012, 18.10.2012, 11.12.2012 and 21.05.2013 to evolve the TNECBC. The draft Amendment to the Energy Conservation Building Code has been completed to suit the local climatic condition prevailing in the State of Tamil Nadu as per the ECBC 2007. The draft Amended by the Tamil Nadu Energy Conservation Building Code has been updated in line with ECBC 2017 and is submitted to the Empowered Committee for approval and notification.
ES/2	Incorporation of design features and consultancy services for new public building in conformance with Energy Conservation Building Code (ECBC)	No substantial operation progress till date.
ES/3	Implementation of energy efficiency measures in the existing buildings through retrofit	Demonstration projects on Energy Efficiency at Nammakkal Kavingar Maaligai and Ezhilagam buildings were completed during the 12th Five-year plan.
ES/4	Incorporation of ECBC measures in all new Government buildings at construction stage	No substantial operation progress till date.

ES/5	Adoption of Enhanced Energy Efficient generation including supercritical technology	Included as a future proposed activity.
ES/6	Energy Efficient Street lighting (world class cities programme)	81460 nos. of FTL lights converted into 81460 Nos. LED
ES/7	Energy Efficient Street lighting (Rest of Urban Tamil Nadu)	134965 nos. of FTL lights converted into 123499 Nos. LED
ES/8	Energy Efficient Street lighting (Chennai)	Providing LED Street Light infrastructure improvement project in the newly added areas of GCC. 1,10,000 Lamp Post with energy efficient LED street Light fittings have been implemented.
ES/9	Implementing energy Efficiency Improvements in the Small and Medium Enterprises through policy initiatives like waste heat recovery etc. by means of VAT, subsidy and grants for procurement/ implementation of Energy Efficient programme/products.	Capacity building trainings have been conducted on Energy Efficiency in SME- DSM, for units under Rice mill cluster and Tannery cluster located in Vellore District
ES/10	Awareness Generation programs on Energy Conservation and Efficiency	• A training Programme on “ Perform Achieve and Trade scheme for Cement Sector was conducted in Chennai during 2012-2013 • Energy Conservation Awareness rally for college students, Energy Efficiency awareness programme for industries were conducted during the Energy conservation week celebrations during 2018-19 • LED display screen has been installed at TNEI head quarters for creating awareness among general public on energy efficiency and energy conservation. • 40 awareness camps conducted • Energy Conservation Awareness (TANGEDCO):The programme of energy conservation awareness to school students was initiated across the State by the officers of the distribution network from October 2014 onwards. About 11.9 lakh students have been addressed in the above programme so far. The training wing of TANGEDCO emphasizes the need for Energy Conservation and propagates the usage of

		energy efficient lighting and star rated equipment in all training programs / workshops / seminars conducted for school children and public throughout the year. Flex boards with the message of energy conservation have been erected at TANGEDCO headquarters and EDC offices at Chennai. Seminar/talk/lecture on Energy Conservation for disseminating the knowledge and the latest technical knowhow is being taken up for central government sectors, micro / small / medium enterprises, private / public sector, MNCs and higher educational institutions. Further, every year the Energy Conservation Day/ Week is usually arranged to be celebrated on December 14th to 20th across the State in a grand manner by organizing various events. Energy conservation tips along with other suggestions have been displayed in the website of TANGEDCO. As a permanent measure, the slogan on Energy conservation "SAVE ELECTRICITY" is being sent as SMS to about 2.79 crore consumers along with the SMS alerts for payment of cc charges thereby instilling awareness from grass root level to higher echelons of society.
ES/11	Solar power generation program	- All the solar and wind power plants are developed by the private developers only. Hence no expenditure and investment are incurred by the Government/ TANGEDCO. Total capacity added from 2012-13 to 2018-19 (till Jan) 1.Solar -2272.272MW 2. Wind - 1388.465MW 3. Biomass - 96.6MW 4. Cogen – 85MW with the following capital cost by the private developers: 1. Solar: Rs.4.5 crore/ MW 2. WEG: Rs.6 crore/MW 3. Biomass: 4.45 crore/MW 4.Cogen: 5.2 crore/ MW - Promotion of bagasse Co-generation is taking place. - At present, total installed capacity of solar power plants in the State including Roof Top and Net metering schemes is 2444.23 MW. During the period from 2012 - 2013 to 2018 - 19 (as on date), the total grid connected solar installed capacity is 2272.272 MW. In order to evacuate solar power, a dedicated 1 no. 230 KV substation at Thiruchuli, Virudhunagar district at a cost of Rs.81.11 crore and 1 no. 400 KV substation near Kamuthi, Ramanathapuram district at a cost of Rs.518.70 crore have been commissioned.
ES/12	Offshore wind generation program (50 MW + 150 MW)	
ES/13	On-shore wind generation program (5000 MW + 5000 MW)	
ES/16	Biomass (1000 MW + 1000 MW)	
ES/17	Co-generation (250 MW + 250 MW)	

		M/s. NLC Limited, has commissioned 2X65 MW capacity of solar power plants under Preferential tariff scheme at Cuddalore District. Further 100 MW capacity of solar plants has been commissioned by M/s.NLC Limited at Tirunelveli. Another 2X100MW capacity solar plant has been commissioned by M/s. NLC Limited in Virudhunagar Districts during 02.05.2018 and 04.05.2018 respectively. Further 50 MW SPV plant has been commissioned on 16.10.2018 in Ramnad District by M/s.NLC Ltd. M/s.NLC Ltd., has commissioned 5 MW SPV plant out of 100 MW at Virudhunagar District on 09.10.2018. M/s.NHPC Ltd. has commissioned 50 MW capacity solar plant in Dindigul District. In order to meet solar RPO, as fixed by MNRE, TANGEDCO floated a tender for procurement of solar power at the rate of Rs.4.50/- per Unit, and 20 MW capacity of SPV plants have been commissioned on 6.12.2017. Another Tender was floated for procurement of 1500MW of solar power and PPA has been executed for a combined capacity of 1500 MW at the rate of Rs.3.47 per unit. So far 81 MW capacity of SPV Plant has been commissioned under this tender and project works for balance capacity are under progress. TANGEDCO has proposed to float another tender for procurement of 1500 MW Solar Power and the Hon'ble TNERC has issued orders on 24.04.2018 for procurement of Solar Power in 3 stages of 500 MW in each stage and with upper ceiling limit of Rs.3/- Per Unit. The first stage of 500 MW capacity tender which was due to be opened on 27.12.2018 has been extended up to 10.01.19. Since no response was received, the due date for opening tender was extended up to 31.01.2019. Even after extending the due date twice, there has been no response from the developers. Further, course of action is to be taken in this regard. Under the REC scheme, 66 developers have established solar power plants for a combined capacity of 120.152 MW. Under the Central Govt. Scheme, 9 developers have established solar power plants for a combined capacity of 26MW capacity. Under the Rooftop scheme, so far 119.227 MW capacity solar plants have been established. Further, it is expected to generate grid connected power of 5000 MW by 2023 for the State. The programme would augment renewable energy in the form of solar power. Under the Indo-European Co-operation on Renewable Energy Program, Supported by MNRE, GoI, TANGEDCO is carrying out grid study on "Facilitating Offshore Wind in India (FOWIND)" project in co-ordination with the Global Wind

		Energy Council (GWEC) led consortium towards developing a road map for development of offshore wind power in the State of Tamil Nadu. As per the original vision 2023 document released during March 2012, investment of Rs.25,000 Cr was targeted through wind power by 2023. However, it was learnt from TEDA that as per version (2) of vision 2023, the same was revised at the office of Energy Department as Rs.60,000 Cr targeting 10000 MW @ Rs.6 Cr/MW in 2014. But, during the period 2012- 2016, the wind installed capacity achieved is only 700 MW due to constraints such as elimination of Accelerated Depreciation benefit by Gol, adhering to grid code by TANTRANSCO etc. Now 4 Nos. 400 KV Sub Stations are being established in the southern region of Tamil Nadu exclusively for wind and solar power evacuation. Hence the targeted capacity is again revised back to 5000 MW that would contribute investments to the tune of Rs. 30,000 crore against Rs.60,000 crore by 2023.
ES/14	Solar home lights	Chief Minister's Solar Powered Green House scheme 3,00,000 houses in five years @ 60,000 per year from 2011-12 to 2015-16. - Sanctioned cost of Rs. 900 crore @ Rs.180 crore/year. - Houses constructed by RD Department over an area of 300 sq. ft. - TEDA entrusted with Supply, Installation & Commissioning of Solar Lighting Systems & 5-year Comprehensive Maintenance Contract. - Provision of 5 Nos. CFL /LED lamps -100W Panel – CFL - 9W - 5 Nos. 50W Panel – LED - 7W - 2Nos., 5W - 2Nos. & 3W - 1No. - Monitoring of components' quality by Pre-Dispatch Inspecting Agency at manufacturing point. 100 percent Quality check of I&C by Third Party Inspection Agency and sample checking by TEDA's District Engineers. - Data monitoring through Work Order Progress Software.
ES/15	Energizing streetlights with solar power	1,00,000 streetlights @ 20,000 nos./year over a period of 5 years. - First of its kind in the country. - Two kinds: 1) Centralised Solar Plant 500W/600W - Energising a cluster of 10/15 streetlights with 20 W LED lights replacing existing 40W Tube lights/ Bulbs.

		➤ Charging only between 10 AM to 6 PM. ➤ Auto Dimming to 6W from 10 PM to 5 AM. 2) Standalone streetlights - 20W LED, operates with the help of 50W panel & 40 AH battery. • Government Orders issued only for 2011-12 and 2012-13.
ES/18	Electric vehicles	
ES/19	Adoption of Enhanced Energy Efficient generation including supercritical technology	Same as ES/5
ES/20	Grid connected Renewable Energy Generation – Hydro Electric Projects	Kollimalai Hydro Electric Project (1x20 MW): Type:Hydel; Capacity:1x20 MW. Location: Pulianchola Village, Namakkal District; Project cost: Rs.338.79 crore. Present status: • The Board of TANGEDCO has accorded revised administrative approval for taking up the Kollimalai Hydro Electric Project (1x20 MW) at a Cost of Rs.338.79 crore. • The proposal to award the work has been approved in the Board meeting of TANGEDCO for Kollimalai Hydro Electric Project (1 x 20 MW). • Based on the above approval, the work has been awarded to M/s. K.Rajagopalan & Co, (Leader of Consortium)-SSIPL-GMW-HUNAN ALLONWARD Consortium, Mettur Dam, Salem District. Tamil Nadu. • The Project work commenced on 30.10.2016 and is under progress. • The survey works for the various components of this project are completed. • The works in Power Tunnel, Surge Shaft Excavation and road formation in weir - 3 are under progress. • Rural Electrification Corporation Limited has sanctioned the Rupee Term Loan of Rs.324.66 crore to M/s. TANGEDCO for implementation of Kollimalai Small Hydro Electric Project 1x20 MW at Namakkal / Trichy District. • The project is expected to be commissioned by April 2021. Sillahalla Pumped Storage Hydro-Electric Project- Stage-I: • Tamil Nadu Infrastructure Development Board/GOTN has sanctioned Project Preparation Fund for an amount of Rs.21.83 crore for DPR preparation works. • Financial agencies will be approached for the project

		execution works on approval of DPR. Kundah Pumped Storage Hydro Electric Project: E & M package is yet to be awarded, hence, cost overrun, and deficit can be worked out only on the award of the same.
ES/21	Reduction of AT&C losses (Set of activities to reduce ATC losses of 18percent-15percent in 12th plan and 15percent-12 percent in 13th plan)	Erection of New Sub-stations, Power Transformers, Re-Conducting of lines at 33/22KV/11KV level, Load Bifurcation, HVDS, RMU, APFC panels & Sectionalizers, Capacitor Banks and installation of tamper proof Static Meters.
ES/22	Transmission Infrastructure strengthening works	Transmission Infrastructure strengthening works
ES/23	Distribution Infrastructure Strengthening works	Distribution Infrastructure Strengthening works
ES/24	Feeder separation with HVDS project	As a first phase, segregation of agricultural loads from mixed loads has been taken up in 29 Nos. feeders in Villupuram, Tiruvannamalai and Cuddalore districts of Villupuram region at a cost of Rs.125 crore under DDUGJY scheme as a pilot study. Based on the results, segregation of the balance feeders will be taken up.
ES/25	Smart grid initiatives	Included as future proposed activity.
ES/26	DSM (Demand Side Management) Activities	Under UJALA scheme, TANGEDCO has permitted M/s. EESL to sell energy efficient appliances viz. LED bulbs, LED tube lights and 5-star EE ceiling fans at affordable rate through the counters set up in TANGEDCO's collection centres. This scheme is in operation in 20 districts so far and will be extended to other districts shortly.
ES/27	Preventive measures to mitigate climate change effects	Included as future proposed activity.

Sustainable Habitat

Code	Strategy/Actions	Activities Undertaken
Strategy 1: Promote sustainable habitats to adapt to Climate Change (CC)		
SH/1	Implement ECBC norms in institutional/commercial and residential sectors	The Government has constituted a technical committee for evolving technical guidelines for adoption by the building planning authorities while issuing approval for building plans and an Empowered committee to advice and evolve policy decision for the implementation of the

		ECBC in buildings with a connected load of 100kW and above in Tamil Nadu. Accordingly, Technical committee meetings comprising of various departmental officials were conducted on 03.08.2012, 18.10.2012, 11.12.2012 and 21.05.2013 to evolve the TNECBC. The draft Amendment to the Energy Conservation Building Code has been completed to suit the local climatic condition prevailing in the State of Tamil Nadu as per the ECBC 2007. The Empowered committee directed to study the implementation model in the neighbouring States of Karnataka, Andhra Pradesh, Telangana and to conduct a stakeholder meeting to understand the impact of the ECBC implementation process 2. Once the TN ECBC is notified, it will be incorporated as part of Tamil Nadu Combined Development and Building Rules, 2019 (TNCDBR). At present, the TNCDBR provides for solar energy capture in the form of solar water heating system and by erection of solar photovoltaic panels. Installation of solar energy system is mandatory in all the buildings with more than 16 dwelling units or 300 sqm of commercial use. 3. Public buildings, streetlights and water supply installation of Corporations, Municipalities and Local Urban Bodies are instructed to meet 30 percent of their energy demand from solar energy by 2022
SH/2	Integrate design alternatives to withstand impacts of CC (extreme rainfall, flooding, cyclones and storm surges and other disasters)	1. TNSCB has so far rehabilitated 12,675 families by providing housing along with the one-time shifting allowance of Rs.5,000 to the slum families, who were living on the banks of Adyar and Coovum Rivers. Further it is proposed to rehabilitate 38,000 families from the waterways of Adyar, Cooum and B Canal through World Bank Assistance in Chennai, Kancheepuram and Thiruvallur Districts. TNSCB has also proposed to rehabilitate the slum families who are living on the waterways in other towns and cities of Tamil Nadu under ADB funding assistance. TNSCB wherever required has a proposal for Stilt floor to prevent entry of extreme rainfall, flooding into dwelling units 2. Number of Slum families resettled in Adyar, Coovum and GCC canals is 14035 (from Dec 2015 to till date) under CRRT, GCC scheme, (PWD, TNSCB, GCC) 3. Construction of ISWD in Adyar and Cooum Basin in extended areas of Greater Chennai Corporation in Alandur, Valasaravakkam and Ambattur; 405 kms at Rs.1261.70 crore (2015-16, 2016-17, 2017-18)

SH/3	Develop new housing policy including CC aspects	1. As a State initiative to have a comprehensive housing and habitat scenario, the policy aims to cover all income groups with a special focus on the vulnerable and low-income groups. To create enabling solutions to bridge the gap between demand and supply of housing and habitat infrastructure through various measures to increase supply of land, housing at affordable prices, rental housing for migrants, inclusive and resilient housing 2. The Combined Development Regulation and Building Rules developed by the State facilitates construction of more housing units for the urban poor, optimum utilization of urban land, rainwater harvesting, reuse of grey water, eco-friendly construction materials, innovative construction technologies, etc. 3. TNCDDBR insists for installation of rainwater harvesting measures within each premise for conservation of rainwater. The method suggested is based on a detailed evaluation study conducted to assess the effectiveness of RWH structures. All centrally air-conditioned building shall have its own wastewater reclamation plant and use reclaimed wastewater for cooling purpose. A separation method of bath & wash basin water and its reuse has been suggested 4. Tamil Nadu State Housing and Habitat policy is under finalization. It is a comprehensive policy based on an integrated habitat approach considering the principles of spatial planning, sustainability and climate resilience 5. Based on the recommendations, CMDA has been asked to frame suitable regulations for promoting green building in the State. A study "Consultancy Assignment for Formulation of Incentives Policy for promoting Green Buildings in Tamil Nadu" was carried out by CMDA through the Consultant M/s TERI, Bengaluru. The consultant submitted the final report during 2016. The various recommendations of the consultant were submitted to Govt. for taking a policy decision.
SH/4	Research and designing alternative construction materials like M. Sand, fly ash etc. to reduce the pressure on natural resources	1. Fly ash brick making manufacturing units by engaging MGNREGS workers 2. Fly ash bricks are being utilised for construction of new building of Tamil Nadu Pollution Control Board, and many houses by Tamil Nadu Housing Board 3. Public Works Department, responsible for the construction of government buildings, obtains a cost advantage by preferring fly ash bricks 4. TNHB which was practicing R&D in alternative construction materials started practicing Prefabrication Technology mode of construction in some of the projects 5. From the year 2012 - 2017, RDPR has taken up total length of 2,727.45 Km and completed under PMGSY and TNRRIS (Plastic & New Technology Roads)

		6. TNSCB and TNHB are adopting innovative construction technologies and cost effective, eco-friendly materials in the construction of their projects. The technologies used are Pre- Fab, Miwan, use of fly ash bricks etc., keeping in view the need for preserving natural resources, all the projects have been implemented
SH/5	Promote generation of disaggregated electricity (micro-grid) in villages as a community source	
SH/6	Develop policies/ New regulations for - Green management of solid waste and liquid waste within houses - Standards for waste disposal	1. Formulation of Solid Waste Management and Plastic Waste Management Rules - 2016 2. Identification of waste disposal sites so as to avoid ground water contamination
SH/7	Development in flood prone areas, protecting and resettling encroachments	1. TNSCB has so far rehabilitated 12,675 families by providing housing along with the one-time shifting allowance of Rs.5,000 to the slum families, who were living on the banks of Adyar and Coovum Rivers. Further it is proposed to rehabilitate 38,000 families from the waterways of Adyar, Coovum and B Canal through World Bank Assistance in Chennai, Kancheepuram and Thiruvallur Districts. TNSCB has also proposed to rehabilitate the slum families who are living on the waterways in other towns and cities of Tamil Nadu under ADB funding assistance 2. The rehabilitation is proposed to be taken up in a sustainable and equitable manner, accompanied with capital investment for restoration and improvement of current water. This could also include greening of areas (public spaces, parks, wetlands), strengthening resilience (flood management), piloting land value capture mechanisms and other financing instruments for maximizing the impact of riverfront development 3. Number of Slum families resettled in Adyar, Coovum and GCC canals is 14035 (from Dec 2015 to till date) under CRRT, GCC scheme, (PWD, TNSCB, GCC) 4. By GCC, so far 53 water bodies restoration under progress
SH/8	Implementation of compulsory plantation of trees in all sectors (Housing /Institutional) to reduce heat island effect	1. Due to various efforts, nearly 15000 trees have been planted in Town Panchayats 2. Trees have been planted in the STP site located in Karunkuzhi of Kancheepuram District 3. Formation of Tree Grower's Societies in Tiruvannamalai, Pudukkottai, Coimbatore, Cuddalore, Villupuram and Sivaganga districts 4. Development of green parks under AMRUT-

		- In 2015-16, 90 green park projects were taken up and completed - In 2016-17, 133 green park projects were taken up and completed 5. RDPR has planted 74,10,000 plants under Avenue Plantation, Mass Tree Plantation
Strategy 2: Providing CC resilient water supply systems		
	URBAN AREAS	
SH/9	Providing water supply scheme and 24 X 7 ready water supply in extended areas	- Regarding water supply, out of 528 Town Panchayats combined water supply scheme is implemented in 329 Town Panchayats (63%). Remaining 199 Town Panchayats are using their own local sources for water supply (37%) - In 2015-16, 1 water supply project was completed under AMRUT at a cost of Rs. 50.85 crore - In Vellore Corporation, Combined Water Supply Scheme was completed at an estimated cost of Rs 1295.00 crore, out of which the ULB contribution is Rs 104.50 crore and the balance funds were contributed jointly by HUDCO, Kfw and IUDM. - Under Atal Mission for Rejuvenation and Urban Transformation (AMRUT 2015-2016 and 2017-2020), 14 Water Supply Improvement Schemes have been taken up at an estimated cost of Rs 5386.17 crore. Out of 14 Schemes, 11 water supply improvement schemes are in progress and remaining 3 works administrative sanction has been obtained and action is being taken for the implementation of the project. 6 Water Supply Improvement Schemes (WSIS) have been taken up at an estimated cost of Rs 660.37 crore under Tamil Nadu Sustainable Urban Development Project (TNSUDP) - Under AMRUT 2015-16, the Water Supply Improvement Scheme for the 8 added areas in Coimbatore Corporation has been taken up at a cost of Rs. 395.41 crore and works are under progress. Implementation of 24X7 Water Supply Scheme in former Corporation area under AMRUT 2016-17, was sanctioned at a cost of Rs. 556.56 crore - In the year 2015-2016, 9 Water Supply Improvement works, one Under Ground Sewerage Scheme, and 90 parks in 24 ULBs was taken up at an estimated cost of Rs. 2056.53 crore. In the year 2016-17, Kumbakonam Water Supply Improvement Scheme and Coimbatore 24x7 Water Supply Improvement Scheme, 8 Under Ground Sewerage schemes 133 parks in 24 ULBs at a cost of Rs. 2914.93 crore. For the year 2017-20, 3 Water Supply Improvement Scheme, 4 Under Ground Sewerage schemes and 135 Parks in 24 ULBs totally at a cost of Rs. 4472.00 crore were taken up. - From the year 2011-12 to 2017-18, 9012 works, under

		various water supply schemes, were taken up in Town Panchayats, out of which 8977 works have been completed. The remaining 35 works are under progress and being done by the TWAD board. During the year 2017, 1515 water supply improvement works at an estimated cost of Rs. 16.38 crore have been taken up under State Disaster Relief Fund and 1951 works at an estimated cost of Rs. 26.44 crore have been taken up under Town Panchayats General funds. In total, 3466 works at an estimated cost of Rs. 42.82 crore were taken up and completed. 9. In Thiruvottiyur, Kathivakkam, Ambattur, Maduravoyal, Valasaravakkam, Porur, Alandur, Meenambakkam, Injambakkam, Nandambakkam, Nolambur and Karambakkam Water supply schemes have been completed. In Edayanchavadi, Sadayankuppam, Kadapakkam, Theeyambakkam, Vadaperumbakkam, Manali, Surapattu, Kathirvedu, Puthagaram, Puzhal, Chinnasekkadu, Madhavaram, Ramapuram, Manapakkam, Mugalivakkam, Ullagaram-Puzhuthivakkam, Pallikaranai, Perungudi, Kottivakkam, Palavakkam, Sholinganallur, Karapakkam and Okkiyum-Thoraipakkam, Water supply schemes are under process 10. Madhavaram water supply scheme with the assistance of JICA has been taken up at a cost of Rs. 55 crore and is under progress 11. In Avadi, Anakaputhur Municipalities and Sriperumbudur Town Panchayats, water supply works are taken up at a cost of Rs. 160.01 crore and are under progress
SH/10	Revamping existing water supply schemes to avoid loss of water by laying new pipelines in place of damaged pipelines	1. From Chembarambakkam to Poonamallee bye-pass junction, laying of second water transmission main at an estimated cost of Rs. 43.75 crore 2. To convey water to the Poondi reservoir, laying of pipeline from the newly formed reservoir at Kannankottai and Thervoykandigai at an estimated cost is Rs. 93.77 crore 3. Replacement of damaged water mains in Chennai City under Infrastructure and Amenities Fund at a cost of Rs. 116.04 crore 4. During 2012-13, 676 revamping works covering 2,640 Habitations have been taken up under MNP / NRDWP Assistance at a cost of Rs. 91.82 crore and completed 5. During 2013-14, 627 revamping works have been taken up under MNP/NRDWP Assistance at a cost of Rs. 48.41 crore and completed 6. During 2014-15, Rs. 55.12 crore has been allotted for 74 revamping works under SMS/NRDWP and the works were completed 7. During 2015-16, 5262 revamping works were completed at a cost of Rs. 40.04 crore under SMS/ NRDWP / Gol

		National Calamity Fund / SDRF 1,898 Revamping works were taken up during 2016-17 at a cost of Rs. 98.57 crore under SMS/NRDWP/Gol National Calamity Fund / SDRF - With respect to water supply system created by RD&PR Department damaged pipelines are being replaced by Village Panchayats by utilising their own resources (Rural)
SH/11	Regulate use of water through compulsory metering	- In the Corporations and municipalities, application of the Supervisory Control and Data Acquisition (SCADA) system has been initiated regularly check the transfer of data on water flow, performance and efficiency of pumps and motors, physical and chemical quality parameters of water - Detailed Project Report has been prepared for Rs. 9.50 crore and the tender is under evaluation for installing 12708 numbers of AMR water meters to water intensive and commercial establishments / consumers in Chennai city - Detailed Project Report has been prepared for Rs. 11.63 crore and the tender is under evaluation for installing 251 numbers of Electromagnetic water meters to all the head works and water treatment plants of CMWSS Board.
SH/12	Sewerage in extended areas of Chennai city	- UGSS were taken up in 14 Town Panchayats by TWAD out of which 3 Town Panchayats have been completed and the remaining is under progress - Septage Management is completed and functioning successfully in Karunkuzhi Town Panchayat. Further, Septage management is implemented in 11 Town Panchayats by DTP and 59 Town Panchayats have been taken up in cluster approach with nearby Municipalities - In 2015-16, 1 underground sewerage scheme was completed under AMRUT at a cost of Rs. 23.5 crore - Underground sewerage schemes, under the Tamil Nadu Urban Development Project-III, have been taken up for implementation in 22 towns at a total cost of Rs. 1025.51 crore. Underground sewerage schemes in Udhagamandalam, Chinnamanur, Namakkal, Dharmapuri, Perambalur, Dindigul (part), Thiruvannamalai, Kancheepuram, Ramanathapuram, Tiruvarur, Cuddalore, Theni- Allinagaram, Vellore, Nagapattinam (part), Pudukottai, Tiruvallur, Virudhunagar, Krishnagiri and Pallavapuram municipalities have been completed and put into use at a cost of Rs. 757.04 crore. - In Madurai and Coimbatore corporations, Avadi and Tambaram Municipalities, underground sewerage scheme was taken up under the Urban Infrastructure and Governance component of Jawaharlal Nehru Urban Renewal Mission at a total cost of Rs. 925.49 crore and the works are at various stages of implementation.

		6. Under Ground Sewerage Scheme in 10 towns namely Maraimalai Nagar, Ariyalur, Arakkonam, Sattur, Chidambaram, Thirupathur, Periakulam, Mettur, Nagercoil and Udumalaipet were taken up at a total cost of Rs. 575.86 crore under the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) component of Jawaharlal Nehru Urban Renewal Mission, out of which works in Maraimalai Nagar Udumalaipet, Periyakulam and Ariyalur have been completed and put into use. 7. Under Ground Sewerage Scheme for Erode Corporation at a cost of Rs. 209.09 crore, for the Karaikudi Municipality at a cost of Rs. 112.53 crore, Pollachi municipality at a cost of Rs. 109.62 crore, Villupuram Municipality at a cost of Rs. 49.36 crore and Mettupalayam Municipality at a cost of Rs. 91.70 crore were taken up under German Development Fund (KfW). Villupuram UGSS has been completed 8. Underground sewerage scheme for Bodinayakkanur at a cost of Rs. 71.10 crore, Ariyalur (left out area) at a cost of Rs. 3.30 crore, Perambalur (left out area) at a cost of Rs. 9.50 crore, Sathyamangalam at a cost of Rs. 54.26 crore and Rasipuram at a cost of Rs. 55.42 crore were taken up under Integrated Urban Development Mission (IUDM). Bodinayakkanur, Ariyalur (left out area) and Perambalur (left out area) UGSS has been completed 9. Underground sewerage scheme in Hosur Municipality for Rs. 283.94 crore under Tamil Nadu Sustainable Urban Development Programme and action is being taken 10. Under Ground Sewerage Schemes for Pallavaram Municipality for Rs. 22.00 crore, Kumbakonam Municipality for Rs. 59.84 crore, Tiruchirappalli Corporation phase – II for Rs. 344.00 crore, phase – III for Rs. 312.14 crore, Tirunelveli Corporation phase – II for Rs. 289.01 crore and phase –III for Rs. 440.19 crore, Vellore Corporation phase II for Rs. 343.69 crore and phase – III for Rs. 293.77 crore, for Rameswaram Municipality for Rs. 40.33 crore, for added areas in Coimbatore Corporation for Rs. 442.00 crore, for Rajapalayam Municipality for Rs. 246.99 crore and for Ambur Municipality for Rs. 165.55 crore and for added areas of Tirupur Corporation for Rs.604.05 crore has been taken up with AMRUT and ADB financial assistance
SH/13	Plugging outfalls and improvement in core areas	1. Water distribution pipelines which were more than 30 years old in the core areas of Chennai city have been identified for a length of about 914 km and are being renewed regularly under various schemes. 2. Under the Infrastructure and Amenities Fund, in phase-I works for plugging 179 of the 337 outfalls were taken up

		at a cost of Rs. 150 crore and in phase-II, the works of plugging of balance 158 sewage outfalls, at a cost of Rs. 163 crore is taken up under 7 packages.
SH/14	Wastewater reclamation programme	1. Treated wastewater in place of fresh water is reused for industrial purposes 2. Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) through the Project Development Grant Fund of the Government has entrusted the work of preparing a "Feasibility report for setting up of a wastewater reuse grid and preparation of a policy framework for the State of Tamil Nadu
SH/15	Strengthening rainwater harvesting	1. Up to March 2017, out of 43.05 lakh buildings in Corporations (Except Chennai) and Municipalities, 36.47 lakh buildings (26,532 Government buildings and 36.21 lakh private buildings) have been provided with RWH rainwater harvesting structures. 2. About 8,03,228 buildings are in existence with a total number of 8,73,700 rainwater harvesting structures in Chennai city. During the year 2016-17, a total number of 15,200 rainwater harvesting structures were constructed.
SH/16	Storage of surplus water during floods	1. Building of check dams on various rivers
	RURAL AREAS	
SH/17	24 X 7 water supply	1. All the Village Panchayats in Tamil Nadu are provided with sufficient portable drinking water supply through Street Public fountains on regular basis.
SH/18	Sewerage in un sewerred areas	Not Applicable
SH/19	Rainwater harvesting	1. Ponds and temple tanks have been provided with RWH structures 2. RDPR has constructed 68539 Farm Ponds under MGNREGS 3. Construction of 25253 Check Dams by RDPR
SH/20	Storage of surplus water during floods	1. Construction of 25253 Check Dams by RDPR
	URBAN & RURAL AREAS	
SH/21	Undertake regular water monitoring by establishing labs in all districts	1. The regional water laboratories established in 4 places in Guindy, Trichy, Tirunelveli and Coimbatore to cover 32 districts. Additionally, there is proposal for establishing water laboratories in all districts. 2. At Chennai, TWAD Board has established State level water testing laboratory apart from 31 districts and 56 sub districts water testing laboratories all over Tamil Nadu to achieve the objective of ensuring safe drinking water supply to the public. 3. Around 50,000 water samples have been tested in State and district laboratories and 1,68,000 water samples have been tested in sub district laboratories during the year 2016-17.

		4. There are four quality control laboratories functioning in the TWAD Board at Coimbatore, Madurai, Trichy and Tindivanam. During the financial year 2017-18, 6,070 samples have been tested in the 4 laboratories.
SH/22	Protection of water sources including traditional water bodies	1. Out of 1,916 water bodies in the Town Panchayats, so far 1,215 water bodies have been restored under various schemes and it is planned to rejuvenate the remaining water bodies in Town Panchayats 2. Rejuvenation / Restoration of water quality of polluted river stretches identified in 29 Town Panchayats in 6 rivers and action is under progress for preventing the sullage water let out into the rivers
SH/23	Increase storage capacity of water bodies / traditional water bodies	1. Ooranies- 234 works has been taken up and completed at cost of Rs 54.32 crore
SH/24	Reuse of grey water	1. To treat the Grey water for the reuse of various purposes, Liquid Waste Management has been implemented in various Town Panchayats. E.g.Panapakkam, Andipatti, Jalakandapuram etc 2. Treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a ground water basin (referred to as ground water recharge) 3. In April 2017, CMWSSB made an announcement that it is not going to provide new water and sewerage connections to buildings that lack the facility of separating the black water from grey water and not reusing the grey water 4. RDPR has constructed 481796 Soak Pits under MGNREGS
SH/25	Recharging of ground water	1. Implementation of Rainwater Harvesting Structures 2. The Greater Chennai Corporation has prepared a detailed project report for Kosasthalayar, Coovum, Adayar and Kovalam basin for the length of 1,069.40 km of Integrated Storm Water Drain network at a project cost of Rs. 4,034.30 crore 3. RDPR has constructed 17156 Recharge Pits/Shfts under MGNREGS
Strategy 3: Urban and Rural development		
SH/26	Include CC adaptation measures in Master Plans, DDPs, CDPs, CMPs, CRP & etc.	1. The Master plans helps to prevent urban sprawl, mixed used development to reduce travel, intensive development and promote transit-oriented development. As per Annexure-XVII of Tamil Nadu Combined Development & Building Rules, developments are prohibited or restricted in certain areas like proximity to quarries or crushers, aquifer recharge areas, Red Hills catchment Areas, Pallikaranai Swamp Area, Coastal Regulation Zones, etc. Rainwater Conservation has been made mandatory in all the buildings. For Multi-Storeyed Buildings certificate from Structural Engineers for Structural Sufficiency of the building and Certificate from Geo-Technical Experts are being insisted. Where

		there are no sewer systems, Sewage Treatment Plants are insisted as per the designs approved by CMWSSB. 2. Formulation of Geographical Information System based Master Plans for AMRUT cities development of common digital geo-referenced base maps and land use maps using Geographical Information System (GIS) 3. Preparation of comprehensive master plan and detailed project report (DPR) for the Eco-restoration of Kovalam and Ennore creek 4. Road network plans are prepared separately, and approvals are issued based on the proposed road network
SH/27	Developing Satellite townships to decongest Cities (Urban)	1. The formation of a Satellite Town at Thirumazhisai to the extent of 311.05 acres of land abutting Chennai–Bangalore Highway is being carried out by TNHB in a phased manner. 2. Development works are nearing completion for an Integrated Satellite Township at Thoppur – Uchapatti, located adjacent to the expanded area of Madurai City. A Central Park, a Convention Centre and a Shopping Complex will also be provided in the Satellite Town making the township a self-contained neighbourhood with all facilities
Strategy 4: Health and sanitation (urban and rural)		
SH/28	Strictly enforce Panchayats Act & Corporation Municipal Act for giving priority for disposal of solid and liquid waste to avoid mosquito breeding	1. In all Town Panchayats Solid Waste Management and Plastic Waste Management Rules - 2016 have been enforced
SH/29	Strengthen IDSP by • Instituting Rapid Response Cell at the District and Block levels • Including non-communicable diseases keeping in view the likelihood of heat stress and other impacts	1. The Rapid Response Teams (RRT) under IDSP (Integrated Disease Surveillance Project) is investigating all outbreaks of diseases within their districts and First Information Report (FIR) and detailed investigation report submitted year wise as from 2013(313), 2014(270), 2015(153), 2016(150), 2017(126), 2018(168)
SH/30	• Undertake research to understand short- and long-term impacts of CC on health • Conduct training and awareness for different target audiences on CC and health and incorporate in the curriculum of medical education	1. The Project of web-based disease surveillance is being implemented in all districts. Additionally, information on vector indices, water quality indices, climate information services are being collected and planned to be integrated with disease surveillance information. These data over a period will help in predicting the occurrence of outbreaks for earlier intervention.

SH/31	Strengthen the integrated health management system at District and Block level	1. In the past six years, 212 new PHCs have been established at a cost of Rs.175 crore and 129 PHCs have been upgraded with 30 beds and Ultra Sonogram, Operation facility, etc., have been provided at a cost of Rs.145.98 crore. Maternity and Child Health centres have been established in 42 PHCs at a cost of Rs.19.45 crore. 2. Under National Urban Health Mission (NUHM) 40 new urban PHCs in Chennai Corporation and 37 new urban PHCs in the other Corporations and Municipalities have been established.
SH/32	Develop capacities for forecasting disease outbreaks	1. The Project of web-based disease surveillance is being implemented in all districts of the State. Additionally, information on vector indices, water quality indices, climate information services are being collected and planned to be integrated with disease surveillance information. These data over a period will help in predicting the occurrence of outbreaks for earlier intervention
SH/33	Ensure 100 percent sanitized and open defecation • Urban • Rural	1. Construction of new sanitary complex in 244 Town Panchayats at a cost of 45.20 Cr for 376 works under NABARD RIDF XIX 2. All 528 Town Panchayats were submitted the proposal to MoUD for Open Defecation Free Assessment. ODF – out of 528 Town Panchayats 501 Town Panchayats were declared as open defecation free and the remaining 27 are under reassessment by Quality Control of India. 3. From 2015-16 to 2018-19 2, 26,907 IHHLs, 10,916 Community Toilets were taken and completed. Further construction of 2125 Community toilets are under progress 4. During the year 2016-17, a target of 90150 number of IHHLs constructed at an estimated cost of Rs.108.18 crore and construction of 2620 seat of Community Toilet taken up at an estimated cost of Rs 17.03 crore. 5. In Municipal and Corporations, construction of 1048 new Community toilets and rehabilitation of 1,930 existing Community toilets have been completed and remaining works are in various stages of progress. A “Universal Design Toilet – Namma Toilet” has been developed by the Commissionerate of Municipal Administration, 230 of them have been completed 6. 1166 No. of Community Toilets have constructed by GCC
SH/34	Slum free cities programme	1. From 2015-19 under “Housing for All” 5, 97,025 Housing Units were approved in 527 Town Panchayats out of which 1, 06,656 units were completed and remaining are in progress. It is proposed to construct 119885 units under BLC and 53819 units under AHP. 2. Construction of 42318 houses under Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

		3. Construction of 4763 houses under Rajiv Awas Yojana (RAY) 4. Construction of 20,000 houses under Green houses for Economically Weaker Sections (EWS) in Town Panchayats 5. It is proposed to rehabilitate 71,200 slum families along the waterways (adyar, Cooum and Bcanal) in Chennai.
Strategy 5: Waste Management (Urban and Rural)		
SH/35	Information, education and communication (IEC) for general public on • source segregation and disposal of waste & usage of plastic bags • Inclusion of CC impacts on health at all levels of education	1. In all 528 Town Panchayats many IEC activities have been conducted. The activities are like giving awareness to the public like rally, community programme, pamphlet distribution, drama, etc., by the 1382 Animators and 12086 SHGs. Fortnight Activities will be conducted for 15 days under Swachh Bharat Mission, that activities is also been followed in all the 528 Town Panchayats 2. The State Level High Powered Committee had sanctioned the ADHOC payment of Rs 2.88 Cr for all 664 ULBs for the year 2015-16 to undertake various activities like competitions among school children, cleaning activities in School and College areas by distribution of awareness Pamphlets, wall Painting & Posters etc. Further, the Committee had sanctioned for engaging 2846 Animators at a cost of Rs. 153.71 crore for 3 years from 2016-17 to 2018-19 towards effective Information, Education and Communication (IEC) activities to create awareness on Cleanliness and Sanitation and to eradicate Open Defecation and to efficiently handle the Segregated Bio waste and recyclable waste. An amount of Rs. 56.97crore has been approved by the SHPC for the year 2016-17 to carry out the IEC activities. Administrative sanction has been accorded vide G.O.(Ms) No.37MAWS(MAIV) Department dated 13.04.17. 3. Concept of carrying out IEC activities in the State through the engagement of manpower namely animators, supervisors, & Coordinators is unique in nature and first of its kind in the whole Nation. About 2846animators, 230 supervisors, and 11coordinators are being engaged in 664 ULBs. 4. Various awareness program has been conducted by Health Educational Officer and Zonal Offices 1 to 15
SH/36	Sustainable solid waste management (urban)	1. From 2013-14 to 2017-18, there were 30553 works in SWM and out of that 27705 work have been completed and other balance works are in progress 2. During 2013-14, special Solid Waste Management in 77 Town Panchayats, Integrated Solid Waste Management project in 214 Town Panchayats for the year 2014-15 were taken up. Solid Waste Management was also taken up in 104 Town Panchayats in 2015-16 and 104 Town Panchayats in 2017-18 3. Bulk Waste Generators have been identified in all the

		ULBs and encouraged to set up onsite composting facilities
SH/37	Sustainable solid waste management (rural)	1. Solid Waste Management Projects in rural areas under Swachh Bharat Mission Gramin 2. Community Preparation through IEC activities
SH/38	Identify the MSW disposal sites in all cities/and districts	1. Out of 528 Town Panchayats, 504 Town Panchayats are having their own land for processing the collected Solid waste 2. The TNPCB is vested with the responsibility to conduct public hearing for identification of sites to establish municipal Solid waste management facility and treatment storage and scientific disposal facilities for municipal solid waste as per the provisions of Municipal Solid waste Rules, 2016 3. TNPCB insists for source segregation of municipal waste based on the potential for further use. Items which can be recyclable and resalable are collected and sold to potential recyclers/vendors. Plastic waste which is unsuitable for recycling are disposed to Cement kilns as alternative fuel resource. All non-saleable plastics are collected and given to cement industries and for small pyrolysis setup by Municipalities. 7 Cement Industries were identified for disposal of waste. As many as 39 ULBs have entered into MoU with M/s Ultra Tech cements for disposal of waste. In 664 ULBs, 1, 40,219 MT of Plastic waste are sold and Rs. 38.86 Cr. collected and disbursed to the sanitary workers. 7953 Bulk Waste Generators have been identified in all the ULBs and encouraged to set up onsite composting facilities
SH/39	Undertake source segregation through material recovery facility at disposal sites to avoid ground water pollution	1. In 528 Town Panchayats Daily Waste Generation is 2100 MT, 90 percent are doing Door to door collection, trying to achieve 100 percent 2. Establishment of Resource Recovery Centres 3. 504 resource recovery centres have become functional and 16 are under progress.
SH/40	• Study to carry out composition of solid waste in different regions to finalise the solid waste management in the city • Implement penalty for non-compliance of segregation of waste at source • Attempt waste to energy initiatives like	1. BYE-Law has been framed in all 528 Town Panchayats and User Charges have been collected in all the Town Panchayats for Solid Waste Management 2. Construction of Bio-Mass gasifier crematorium: Construction of Bio - mass Gasifier Crematorium in 2 Town Panchayats namely Annamalaiagar and TNPL Pugalur 3. To increase the revenue of the Town Panchayat, Revision of Property Tax is carried out and 60 percent of the income has been increased in Town Panchayats. User charges are being collected from the public for SWM activities. Waste to wealth activities are being carried out in all Town Panchayats. Thus, Town Panchayats are marching towards waste to wealth 4. Establishment of Waste to Energy project in Sholingur, Chengam, Vathlagundu, Uthamapalayam, and

	biomethanation etc., • Penalty for littering in public places	Periyarayakkanpalayam Town Panchayats 5. There is no penalty for non-complaints of source segregation since draft bylaws for SWM Rules 2016 awaiting for approval 6. There is 176 Nos. of decentralised waste processing units are being functioned in GCC including ordinary composed, vermi-composed, bio-methanization plant (Biogas) and bio-methanization plant (BARC Technology) 7. Penalty for littering of garbage & debris in public places is being collected by GCC (From 2017 onwards functioning)
SH/41	Recycling of domestic and industrial wastewater (urban)	1. As per the CMWSSB water reuse plan, the Greater Chennai Corporation launched a by-law that sets the rules for mandatory wastewater recycling. By using a PPP model, CMWSSB treats wastewater to a standard and sells it to large industries in Chennai that further treat it to tertiary standards. In the last 8 years, CMWSSB Board has ordered 6 Sewage Treatment Plants (STPs) with a total capacity of 378 MLD 2. Sewage Treatment Plant (STP) has been installed in two parks in Chennai city on a pilot basis. The sewage water is tapped from the abutting main sewer line and treated using the STP and the treated water is then used for watering the green space in the parks. Thus, these STPs help in overcoming the dependency on the Ground water / Water Tanker Lorries for watering of plants 3. In-situ wastewater reuse in residential areas
Strategy 6: Energy		
SH/42	Formulate a policy to encourage LED and solar lighting in streets and buildings (subsidy, incentives etc.,)	1. Tamil Nadu Solar Energy Policy 2012 for the promotion and use of solar energy 2. Implementation of Chief Minister's Solar Powered Green House Scheme which fulfils the housing requirement of rural poor people along with Solar Powered Home Lighting System and thereby promoting green energy. Under this scheme, 3 lakhs Green houses have been constructed at an estimate cost of Rs 5940 crore from 2011 to 2016 3. The State has also been executing the scheme of energising one lakh streetlights through Solar Energy by replacing the existing lamps with LED lamps (with auto dimming provision from 10 p.m. to 5 a.m.) over a period of 5 years from 2011-2012 to 2015-2016 4. 38,575 streetlights have been energized so far through Solar Energy 5. 1,10,000 Lamp Post with energy efficient LED street Light fittings 6. 175Kwp Solar roof top plant
SH/43	Enforce labelling of domestic appliances for energy efficiency rating,	1. In order to promote Energy Efficiency in office buildings, implementation of Energy Efficiency Measures at Namakkal Kavingnar Maaligai, Secretariat and

	capacity building on usage of BEE labelled appliances	Ezhilagam Main Building, Chepauk have been undertaken. The project involves replacement of Air conditioners and ceiling fans by star labelled ones and conventional tube lamps by energy efficient T5 fittings so that an energy saving of about 20 percent is achieved
SH/44	• Replace all old pump sets with energy efficient pump sets • Promote use of energy efficient & solar pump sets across the State through subsidies including agriculture	1. A scheme for the provision of Solar agriculture pump sets with 50 percent of the cost as State subsidy, 30 percent of the cost as central subsidy and with a beneficiary contribution of 20percent is being implemented by the Agriculture Engineering Department (AED) 2. In 2012-13, the State announced that subsidized Solar Pumps will be provided on pilot basis to the waitlisted applicants registered with Tamil Nadu Electricity Board (TNEB) for agriculture service connections. Under this scheme solar energized pump sets to the farmers have been installed. Since 2013-14, up to 31.03.2018, 2295 nos. of 5 HP AC pumps have been energized with a subsidy of Rs.8076.80 lakhs.
SH/45	Assess the energy generation from SW in the State and recover energy in terms of CH ₄ from waste	1. Establishment of Waste to Energy project in Sholingur, Chengam, Vathlagundu, Uthamapalayam, and Periyamayakkanpalayam Town Panchayats 2. For generating energy from Industrial wastes/residues, 13 project proposals for a cumulative capacity of 3.2 MW were sanctioned by Ministry of New and Renewable Energy in 2016-17 and a total Central Financial Assistance of Rs.130.21 lakhs have been released 3. For generating energy out of wastes from sago factories and poultry farms, 15 project proposals for a cumulative capacity of 2.2MW were sanctioned by Ministry of New and Renewable Energy and a total Central Financial Assistance of Rs. 823.5 lakhs have been sanctioned. Another 17 proposals relating to generation of energy out of wastes from sago factories and poultry farms for a cumulative capacity of 2.55 MW with total Central Financial Assistance of Rs. 900 lakhs are under scrutiny 4. Integrated MSW Processing facility with waste to energy plant in existing Dumping site at Kodungaiyur (Package-IIIB) 5. Integrated MSW Processing facility with waste to energy plant in existing Dumping site at Perungudi (Package-IV B)
SH/46	Promote Energy Labelling for Rating of all buildings including residential	1. As per the powers conferred under clause 15(a) of the Energy Conservation Act, 2001, the Government of Tamil Nadu has constituted a technical committee for evolving technical guidelines for adoption of ECBC through local body and an Empowered committee to advise and evolve policy decision for the implementation of the ECBC.

SH/47	- Create awareness for alternate energy - Address constraints of alternate energy sources including cost (subsidies, collection & replacement of old parts, maintenance agreement with supplier etc)	- Promoting the State Nationally and Internationally as an attractive investment destination for Renewable Energy by organising event under the name RENERGY - Conducting different activities like rallies, mini-marathon, competitions such as essay writing, painting, quiz, debate etc. among the students that has inculcated the much-needed mass awareness about the need, benefits and the relevance of alternate energy - TEDA has produced a short film for promoting Renewable Energy amongst school students "Green Energy Virumbuvom Campaign", a mega mass awareness campaign on alternate energy
Strategy 7: Developing an efficient integrated transport system		
SH/48	Introduce Multi Model Transport System such as Metro Rail, Mass Rapid Transit Systems, Monorail, develop BRTS corridors	5 km from Velachery to St. Thomas Mount
SH/49	Expansion of Mass Transit Public Transport-I	
SH/50	Expansion of Mass Transit Public Transport-II	Mass Rapid Transit System Phase II Project from Thirumylai to Velachery by CMDA along with Metropolitan Transport Project (Railways) at a cost of Rs 605 crore to a length of 10.306 km
SH/51	Mass Public Transit System for second tier cities	
SH/52	Implementation of CUMTA	Chennai unified Metropolitan Transport authority Act (2010) has come into force from 16th day of Jan 2019 and rules there under have been notified on 16th day of Jan 2019 itself, Vide G.O.Ms.No.1011, dt: 16.01.2019. The MS/CMDA has been addressed to convene the first meeting of CUMTA and it is under process.
SH/53	Introduce feeder services from all 371 metro stations	
SH/54	Create freight corridors for rails and roadways	- Feasibility study for the development of elevated corridor from the Chennai airport (Tiruisulam) to Chengalpattu along the GST(NH-45), during 2014-15 - Preparation of DPR for an Elevated Road from Taramani to Siruseri under Phase-I and from Siruseri to Mahabalipuram under Phase-II, for a total length of 45 Km - In Phase- I of Rajiv Gandhi Salai (IT Corridor), dual three lane road from Madhya Kailash to Siruseri for a length of 20.10 km was developed. The link road connecting Sholinganallur and East Coast Road for a length of 2.15 km was also included in the project and was widened to a four-lane road - In Phase-II of Rajiv Gandhi Salai (IT Corridor),

		formation of six lane road from Siruseri to Mahabalipuram for a length of 25 km, including two bypasses (Kelambakkam and Thiruporur)
SH/55	Create additional parking areas through MLCP/MLTWP	1. Under Part II schemes, construction of parking shed 2. Detailed Feasibility Report (DFR) of Multi Level Car Parking (MLCP) at Siruseri has been prepared 3. MLPs with ICT application – Thanickachalam Rd 4. Piles completed. Southern side: 2 basement roof slab completed Central portion: Pile cap work in progress. Northern side: EW is in progress. 15 percent work completed (By GCC)
SH/56	Impose traffic free areas in markets	
SH/57	Increase number of auto LPG dispensation stations in cities	
SH/58	Introduction of Congestion tax for private vehicles, Including GHGs gases in Green Tax	
SH/59	Low floor buses to support differently abled and senior citizens (patronizing public transport)	
SH/60	Mandating parking spaces for registering new cars	
SH/61	Convert all the public transport vehicles to alternate fuel in phased manner	
SH/62	• Developing exclusive lanes for pedestrian • Promote cycling with good cycling paths, cycle parking facilities and link between cycling and public transport • Encourage car pooling • Introducing no-driving day for private vehicles	1. Development of Infrastructure (Pedestrian Sub-Ways) in Chennai Metropolitan Area- • Out of 7 locations, the preparations of DPR for the 5 locations was taken up by Greater Chennai Corporation (GCC) and the rest 2 locations were taken up by the CMDA 2. Cycle lane marking completed at Rs 0.36 crore. Cycle sharing at Rs 9.49 crore under PPP mode is in implementation. Car free Sunday at Beasant Nagar beach. 3. Cycle sharing system taken up under PPP mode (7 years) and Cycle lane marking taken up under Smart city fund
SH/63	Increased subsidy/reduced excise duty on hybrid vehicles and battery-operated vehicles	
SH/64	Improvement to all	1. Town Panchayats Department:

	existing roads and maintenance at regular intervals	NABARD Rural Infrastructure Development Fund (RIDF)-During the years 2011-2012 to 2017-18, Rs. 891.51 crore was allocated for 2626 works out of which 2624 works are completed and remaining 2 works are under progress <table><tr><th>Sl. No.</th><th>Year</th><th>No. of works</th><th>Amount (Rs. crore)</th><th>Remarks</th></tr><tr><td>1</td><td>2011-12 to 2016-17</td><td>2459</td><td>761.51</td><td>All works are completed.</td></tr><tr><td>2</td><td>2017-18</td><td>167</td><td>130.00</td><td>Work order issued for 167 works and 165 works completed. Balance 2 works are progress in various stages.</td></tr><tr><td colspan="2">Total</td><td>2626</td><td>891.51</td><td></td></tr></table> 2. Tamil Nadu Urban Road Infrastructure Project (TURIP)- Tamil Nadu Urban Roads Infrastructure project is being implemented since 2011-12 with a view to upgrade the urban roads in the State to the International Standards with pavements and storm water drains. Accordingly, from 2011-2012 to 2017-18, Rs.469.16 crore has been allocated for execution of 1771 road works to a length of 1718 kms, have been completed <table><tr><th>Sl. No</th><th>Year</th><th>No. of works</th><th>Amount (Rs. crore)</th><th>Length (in Km)</th><th>Remarks</th></tr><tr><td>1</td><td>2011-12 to 16-17</td><td>1562</td><td>391.91</td><td>1438.86</td><td>All works are completed.</td></tr><tr><td>2</td><td>2017-18</td><td>209</td><td>77.25</td><td>279.54</td><td>All works are completed.</td></tr><tr><td colspan="2">Total</td><td>1771</td><td>469.16</td><td>1718.4</td><td></td></tr></table> 3. From the year 2012 - 2017, RDPR has taken total length of 51,555 Km for Up-gradation/Strengthening/renewal of roads. So far 50,074 Km has been completed. Other works are in progress	Sl. No.	Year	No. of works	Amount (Rs. crore)	Remarks	1	2011-12 to 2016-17	2459	761.51	All works are completed.	2	2017-18	167	130.00	Work order issued for 167 works and 165 works completed. Balance 2 works are progress in various stages.	Total		2626	891.51		Sl. No	Year	No. of works	Amount (Rs. crore)	Length (in Km)	Remarks	1	2011-12 to 16-17	1562	391.91	1438.86	All works are completed.	2	2017-18	209	77.25	279.54	All works are completed.	Total		1771	469.16	1718.4	
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Total		1771	469.16	1718.4																																										
SH/65	Adoption of alternate/ advanced technology including mixing of plastic	1. By getting financial help from Urban Local Bodies general fund and Government special fund, 1,634.274 metric tonnes of plastic waste have been utilized in																																												

	to ensure endurance to the roads	laying 1,035.23 Km length of roads during the last five years 2. From the year 2012 - 2017, RDPR has taken up total length of 2,727.45 Km and completed under PMGSY and TNRRIS (Plastic & New Technology Roads)
SH/66	World Class Arterial Roads program	1. Chennai Outer Ring Road- Phase 1 of the project connecting NH-45 at and NH-205 at Nemilchery for a length of 29.2 km has been completed and opened for traffic
SH/67	Integrated Urban Road Development program	1. Since the launch of IUDM in municipalities and corporations, from the year 2011-12 to 2014-15, 2,115 works were taken up in 1,416.03 Km length of roads at an estimated cost of Rs 501.58 crore. Out of this, 2,114 works have been completed at a cost of Rs 530.40 crore 2. During 2011 to 2017 in Town Panchayats, 6056 road works were taken up of total length of 6360 km, of which 6054 works are completed and the rest are in progress
SH/68	Organised parking (urban)	1. Organised parking is in implementation under PPP mode (by GCC)
SH/69	City Bus Terminals	
SH/70	Inter-city bus terminals	
Strategy 8: Abating enhanced air and water pollution in a CC scenario		
SH/71	Improved quality monitoring of Air, Water, Noise pollutions by increasing monitoring locations in State	TNPCB in coordination with CPCB is carrying out the following towards monitoring of Air, Water and Noise: • Air monitoring • Tamil Nadu Pollution Control Board is operating twenty-eight ambient air quality monitoring stations under National Air Quality Monitoring Programme (NAMP) in Chennai and other important cities of Tamil Nadu in order to know the ambient air quality of the State • In addition to the above, TNPCB has installed six Continuous Ambient Air Quality Monitoring stations (CAAQMS) in Chennai and Coimbatore and another 25 CAAQM stations are in under establishment condition • Further TNPCB established continuous real time emission monitoring system at Care Air Centre in Head office, Chennai in order to monitor the source emissions and ambient air quality of the industries such as industries pertaining to 17 category of highly polluting industries, red large industries, common hazardous waste incinerator facility, and common bio-medical waste treatment facilities on 24*7*365 basis. 424 stocks emissions and 114 air ambient air quality monitoring stations located in units are connected to CARE AIR center. The emission levels exceed norms, inbuilt system informs concerned industry, DEE through SMS and e-mail to take immediate remedial actions.

		• Monitoring during festivals (Pongal, Deepawali etc.) • Action plan for abatement of air pollution (2019): Thootukudi city is a non-attainment city based on particulate matter of size lesser than 10 microns (PM 10) values exceeded prescribed standards (Under National Air Quality monitoring programme) • Water Monitoring • Tamil Nadu Pollution Control Board is monitoring the inland water quality under two major programmes namely Global Environmental Monitoring System (GEMS) from 1984 and Monitoring of Indian National Aquatic Resources System (MINARS) from 1988 along the four major rivers i.e., Cauvery, Tamiraparani, Palar and Vaigai and eight lakes Udhagamandalam, Kodaikanal, Yercaud, Veeranam, Porur, Poondi, Pulicat and Redhills. At present 55 stations are being monitored • TNPCB is monitoring the water quality of four city water ways in Chennai city (i.e.) Adyar River, Buckingham Canal, Cooum River and Otteri Nallah to assess the pollution level by collecting monthly water samples from April 2003 both in water bodies and sewage / industrial outlets into the said water bodies. There are 30 monitoring locations • Further TNPCB has established a Water Quality Watch Centre at the Head Office, Chennai in order to monitor the quality of treated effluent at the outlet of the treatment plant on continuous (24x7) basis through online. The 17 category highly polluting industries, Red-large industries, Common Effluent Treatment plant are connected to this centre • Noise Monitoring • TNPCB has established 10 Real Time Ambient Noise Monitoring Stations in Chennai City under National Ambient Noise Monitoring Network Programme. The locations are 1) Egmore, 2) T. Nagar, 3) Perambur, 4) Guindy, 5) Triplicane, 6) Pallikaranai, 7) Velachery, 8) Washermanpet, 9) Anna Nagar, 10) Sowcarpet
SH/72	Monitoring Ground Water Quality	1. The TNPCB involved in conduct of public hearing for identification of sites to establish municipal Solid waste management facility and treatment storage and disposal facility for hazardous waste as per the provisions of Municipal Solid waste Rules, 2016 and Hazardous and Other Waste (Management and Trans-boundary) Rules, 2016 2. While issuance of CTE necessary condition are imposed to the effect that the land fill facilities are provided with proper leachate collection and treatment system as well as piezometric well to monitor the quality of ground water in the vicinity of landfill 3. The TNPCB has identified the location of defunct industry of M/s. Tamil Nadu Chromates and Chemicals

		Limited as ground water contaminated site due to dumping of hazardous waste generated from the industry while in operation during 1975 to 1995
SH/73	Providing UGSS with STP in all towns and CETPs	Under Ground Sewerage System (UGSS) - UGSS were taken up in 14 Town Panchayats at an out lay of Rs.503.45 crore. Out of which 3 schemes (Mamallapuram, Thiruchendur and Orathanadu) have been completed at an estimated cost of Rs.41.45 crore. Works are under progress in 11 Town Panchayats namely, Thirumazhisai, Sriperumbudur, Ulunurpettai, Perundurai, Palanichettipatti, Velankanni, Ponneri, Thiruporur, Vallam Manachanallur and S.Kannanur Town Panchayats at an estimated cost of Rs.462.00 crore. Septage means Partially treated sewage that is stored in a septic tank. It includes liquids, solids (sludge), as well as fats, oils and grease (scum) that accumulate in septic tanks overtime. Septage management includes the process of design, collection, safe treatment & disposal of septage. A comprehensive programme that regulates periodic septic tank cleaning, as well as septage transport, treatment, re-uses and scientific disposal is important at present. As a Pilot scheme, for implementation of Septage Management a sum of 5.18 crore had been sanctioned and completed in Karunkuzhi Town Panchayat and running successfully. Based on the impact of the Septage management, the Government have sanctioned Rs.31.17 crore under IUDM to implement Septage Management in 11 Town Panchayats vide G.O.(MS) No.12, MA&WS Department, dt.29.1.2019 by the project sanctioning and Mentoring Committee meeting held on 19.12.2018 under IUDM. According Administrative Sanction has been accorded to implement septage management in 11 Town Panchayats vide this office Roc No. 14034/2017/B5 Date.8.2.19. Tender fixed on 10.4.19. In respect of PN Palayam FSTP have been taken up at an estimated cost of Rs.3.50 crore duly funding by BMGF Old contractor terminated, New contractor to be fixed by IIHS. Further, 59 ULBs have been identified for construction of FSTP works and Tendering works under are progress.
SH/74	Study of impacts of CC on air & water pollution	
SH/75	• Revision of pollution standards • Strict enforcement with penalty for violation of pollution standards • Ensuring ZLD in industries	

SH/76	Awareness and Capacity Building/ Training programs for different target groups on impacts of CC and pollution	1. Establishment of Environmental Training Institute (ETI). ETI is an organisational wing of TNPCB with an objective to impart training and awareness at all levels.
SH/77	Measures to reduce Urban • Water pollution • Air pollution • Noise pollution	1. Tamil Nadu Pollution Control Board is operating twenty-eight ambient air quality monitoring stations 2. TNPCB has installed six Continuous Ambient Air Quality Monitoring stations (CAAQMS) in Chennai and Coimbatore 3. Identification of disposal sites to establish municipal Solid waste management facility and treatment storage and disposal facility for hazardous waste 4. TNPCB has established a Water Quality Watch Centre at the Head Office, Chennai in order to monitor the quality of treated effluent 5. Adyar River Restoration from origin to river mouth (Ongoing) 6. Ecological Restoration of Adyar Creek- 58 Acres Phase I 7. Ecological Restoration of Adyar Creek and Estuary- 300 Acres Phase II 8. Integrated Cooum River Eco-Restoration Plan 9. TNPCB has established 10 Real Time Ambient Noise Monitoring Stations in Chennai City 10. Rejuvenation / Restoration of water quality of polluted river stretches identified in 29 Town Panchayats in 6 rivers and action is under progress for preventing the sullage water let out into the rivers
SH/78	Measures to reduce Rural • Water pollution • Air pollution • Noise pollution	1. Sewage and Septic Management 2. Carrying out IEC activities to create awareness at the base root level
Strategy 9: Greening of Urban Spaces		
SH/79	Develop greenery/green belt to be made mandatory and inclusion in DCR	1. Development of green parks under AMRUT- In 2015-16, 90 green park projects were taken up and completed. In 2016-17, 133 green park projects were taken up and completed 2. In order to promote green buildings in the State, a study "Consultancy Assignment for Formulation of Incentives Policy for promoting Green Buildings in Tamil Nadu" was carried out by CMDA through the Consultant M/s TERI, Bengaluru. The consultant submitted the final report during 2016. The various recommendations of the consultant were submitted to Govt. for taking a policy decision 3. By GCC, one work is in progress and 8 works to be taken up under CRRT
SH/80	Conversion of OSR lands into parks	1. Parks developed and maintained by Chennai Corporations in Kamaraj Salai, Poonamalle High Road,

		Konnur High Road, Bricklin Road, Puliur Village, Nelson Manicakkam Road, Kilpauk, Vada Agaram, Pycroft Road, College Road, Greams Road Nungambakkam, Anna Salai, Velachery, Thiruvannamiyur, R. A. Puram
SH/81	Stringent compensatory plantation for tree cutting, including refundable deposit	1. In greater Chennai corporation limits the tree cut permission granted in public roads provided the cause any hindrance to vehicle movement/pedestrian movement (or) abstract building construction activity when trees are cut for any of the reason cited above, for everyone tree cut ten saplings must be planted in lieu of it
SH/82	Study to identify suitable plant and tree species for urban greenery.	1. A consultant was appointed to study suitable plant species for Chennai city depending on the local environmental, soil condition water table and other ecological factors. M/S care earth trust has submitted the detail report in this regard, this is being implementable in phases

ANNEXURE 7: FINANCIAL ALLOCATIONS UNDER TNSAPCC

The following section gives the sector-wise allocation of the amount allocated against the activities that were proposed in TNSAPCC .

Sustainable Agriculture :

Table 1 Financial Allocation for each key strategy

Code	Activity	Source: Scheme/ Project	Total budget proposed (in crore) (2012-17)	Total budget allocated (in crore) (2012-17)	Total budget spent (in crore) (2012-17)	Type
Strategy 1: Research and development to improve the productivity of crops: crop season, water conservation, varietal development for major crops						
AG/1	Breeding and testing of varieties tolerant to various climatic stress Developing and evaluating crop genotypes (rice, millets, pulses, oilseeds, fodder horticulture and forest trees) of	TNAU	130	90	90	AD

	short duration, testing of high yield potential in different soil conditions, C4 and CAM pathway plants for enhanced CO2 fixation, increased carbohydrate, protein and oil yields under stress					
AG/2	Specific to Maize •Altering crop geometry to suit mechanical weeding •Nutrient management and yield enhancement [STCR-IPNS approach on Inceptisols (red non calcareous)] for rainfed hybrid •Evaluation of genotypes for phosphorus acquisition •Insight study on benefit of nano application on seed quality improvement •Seed enhancement techniques	TNAU DoA	80	21	21	AD
AG/3	Millet •Development of newer formulations of microbial inoculants and seed treatment methods	WRD PWD	40	30	30	AD

	•Identification of pre-sowing seed management techniques for small millets •Enhancing the productivity of small millets •Enhancing partitioning efficiency in ragi •Developing organic technologies for cropping systems					
AG/4	•Land management for better crop establishment •Suitable tillage and irrigation practices and change in cropping pattern of different duration crops to counter climate change •Standardizing water harvesting techniques •Integrated nutrient management - Nutrient feedback crop cultivation for soil health sustainability Rice •Yield maximization techniques of traditional rice •Residue	NADP, NFSM, TNAU DoA PWD Ag.Engineering Dept.	1000	5.964	5.964	AD

management and nutrient dynamics					
•Development and evaluation of stage-specific microbial inoculants •Mapping and management of micronutrients in rice grown soils in all districts •Alleviating Iron toxicity problem under acidic soils					
Groundnut					
•Intercropping and evaluation of organic mulch •Sulphur nutrition of rainfed groundnut in red and black soils of Tamil Nadu •Developing multifunctional bioinoculant (Burkholderia sp.) •Standardization of seed invigoration treatment for seed quality enhancement in groundnut, Organic production					
Oilseeds and pulses					
•Mapping and management of sulphur deficiency in					

	oilseeds grown soils •Altering crop geometry to suit mechanical weeding •Optimization of sulphur for sesame through tracer technique •Seed pelleting for mechanized sowing and its storage potential in sesame •Developing package of practices for pulse-oilseed cropping system					
AG/5	Extension strategies to popularize above management practices to mitigate extreme weather events (ART and MLT)	TNAU DoA	500	231.85	200	MI
AG/6	Research Study on effect of impact for mid-term correction: Economic & social impact created due to different climate change mitigation interventions implemented by DoA/ TNAU to initiate mid-term correction	TNAU DoA	70	2	2	AD
AG/7	Climate proofing with Integrated Farming Systems: Popularising the Integrated	TNAU, DoA, NFSM, NADP,	1500	88.62	88.62	AD

	Farming System for wider adoption	NMSA				
AG/8	Recharging the aquifers using the abandoned open wells and defunct bore wells	DoA PWD Ag.Eng. NADP, NMSA, AGWRS, RINCSB	120	13.62	13.62	AD
AG/9	Constructions of sub-surface dykes	PWD Ag.Eng.	300	20	20	AD
AG/10	Diversion of excess flood water at upper reaches to water deficit areas	PWD Ag.Eng.	1000	100	100	AD
AG/11	Deep ploughing to break sub surface hard pan to increase infiltration efficiency and improve ground water quality and check sea water incursion	DoA AG.Eng.	200	40.33	40	AD
AG/12	Reclamation of saline and alkaline soils	DoA	100	4.78	4.78	AD
AG/13	Promote minimum/no tillage during fallow period, compartmental bunding, contour farming, deep ploughing, mulching for all crops besides conducting awareness programmes and training	DoA PWD Ag.Engineering Dept.	200	12.34	12.34	Both

AG/14	Build Organic carbon content of soil with green manuring: Azolla, BGA, Bio- fertilizers, Bio-pesticides, Bio-Agents and compost developed from municipal solid waste	DoA	400	104.55	96.36	Both
AG/15	Bringing fallow land and degraded land back to cultivation	DoA Ag.Eng	500	0.059	0.059	AD
AG/16	Organic farming including horticultural crops	PKVY DoA	150	50.63	50.63	AD
AG/17	Research on conjunctive use of Irrigation water	TNAU	40	2	2	AD
AG/18	Increase the use of Micro Irrigation technology Viz., drip, Sprinkler, Rain gun, Mobile Sprinkler in dry land, Garden land and Horticultural farming system	TNAU DoA IAMWARM PMKSY Ag. Eng.	8000	1181.47	1181.47	MI
AG/19	Strengthening existing water harvesting structures and repairing and replacing the shutters in the irrigation tanks and drainage channels	DoA IAMWARM PMKSY Ag. Eng.	1000	60.62	60.62	AD
AG/20	Creation of additional farm ponds to capture the runoff water and utilize the harvested water	TNAU DoA	600	35.33	35.33	AD

	to critical stages of crop growth and to recharge the aquifers to improve the quality of irrigation water					
AG/21	Ensuring the livelihood of the farmers in non-delta districts having surface irrigation potential with piped irrigation network by providing collection wells at regulating structures to increase the cropping intensity with assured yield and employment opportunities	TNAU	3500	121.80	121.80	AD
AG/22	Development and execution of sustainable seed production and distribution network	TNAU DoA	200	206.07	206.07	AD
AG/23	Establishment of network of seed banks, food banks and cold storage to ensure supply at times of contingencies	TNAU DoA	750	736.94	21	AD
AG/24	GIS based village mapping for agro management system to enhance input use efficiency and overcome effect of climate change and increase farm productivity	TNAU	100	7.76	7.76	AD

	including horticulture crops					
AG/25	Integrated voice message on weather based agro advisories, market demand & price forecasting	TNAU DoA	75	49.65	21	AD
AG/26	Establishment of dedicated climate knowledge cell to monitor, fore warn and train farmers and officials of the department on management of situation arising out of extreme events	TNAU	160	151.49	90	AD
AG/27	Strengthening and popularizing the existing crop insurance programme	TNAU DoA PMFBY	800	642.91	642.91	AD
AG/28	Research project on comprehensive crop insurance products that would cover increasing extreme events	TNAU DoA	200	159	0	AD
AG/29	Development of vegetative shield for east coastal region against wind, cyclones, etc. Management and conservation of vegetative shield	GoTN DoH	250	38.33	38.33	AD & MI
AG/30	Development of technology for improving inland fishing; new breeds;	TNJFU, DFFDA, Reservoir fisheries development	1000	212.85	2.85	AD

	Popularization of technology.					
AG/31	Increasing fish production and fish farming area for rural livelihood through Inland Fisheries - fish culture in pens and cages, establishment of hatcheries	DFFDA, Reservoir fisheries development	38.44	37.63	37.63	AD
AG/32	Undertaking Repair and Renovation of Government Fish Seed Farms/ Hatchery to increase fish seed production for fish farming	DFFDA, Reservoir fisheries development	65	63.07	63.07	AD
AG/33	Improving inland fisheries for tank and its command areas under IAMWARM Project	TNAU DoA	8	8	8	AD
AG/34	To increase per hectare production and encourage new species advocating Culture of SPF <i>Litopenaeus vannamei</i>	TNJFU, DFFDA	5	6.90	6.90	AD
AG/35	Culture of Sea bass	DoF, DFFDA	1	1	1	AD
AG/36	Ensure year-round feed and fodder availability	TNAU DoAH TANUVAS, TCMPF	0.5	133.33	133.33	AD
AG/37	Ensure adequate animal housing and dedicated ponds for bathing in villages to protect livestock from extreme	TNAU DoA	1.6	18.5	18.5	AD

	heat					
AG/38	Intensify disease surveillance and develop forecasting of disease outbreaks for short- and long-term time frames	DoAH TANUVAS	2.4	47.33	44.90	AD
AG/39	Promote breeding with indigenous varieties to improve resilience to climate change	DoAH, SEVA, TNLDA, TANUVAS, TCMPF	2.2	2.2	2.2	AD
AG/40	Promote dairy development by training women in villages on animal care, animal disease reporting, and nutrition for optimizing milk production at household level of small and marginal farmers and enabling them to participate in milk cooperatives	Dairy Development Department	4.0	4.0	4.0	AD
TOTAL			23093.14	4641.993	3424.113	

Water Resources:

Table 2 Financial Allocation under each key strategy

Code	Activity	Source: Scheme/ Project	Total budget proposed (in crore) (2012-17)	Total budget allocated (in crore) (2012-17)	Total budget spent (in crore) (2012-17)	Type
WR/1	Undertaking rainwater harvesting measures along the hill slopes	PR&RD	1	1	1	AD
WR/2	Construction of Water harvesting structures such as check dams, recharge shafts, farm ponds, etc.	WRD NABARD	200	44	44	AD
WR/3	Repairing, renovating and restoring tanks and traditional water bodies	WRD PWD	15	10	10	AD
WR/4	Interlinking of Rivers, and Construction of Mini Reservoirs	PWD	50	53	53	AD
WR/5	Desilting & Widening of Channels and Drains, strengthening of embankments & removing water weeds from channels	WRD	100	96	96	AD
WR/6	Strengthening infrastructure to manage disaster	Respective departments	5	3	3	MI
WR/7	Interlinking of Rivers and Construction of Reservoirs	PWD	8637	17244	17244	AD
WR/8	Construction of anicuts and regulators	WRD	290	45.12	45.12	AD
WR/9	Construction of Water harvesting structures such as check dams, recharge shafts, farm ponds, etc.	WRD PWD NABARD	800	2920	2920	AD
WR/10	Desilting & Widening of Channels and Drains, strengthening of embankments &	WRD	750	11054	11054	AD

	removing water weeds from channels					
WR/11	Repairing, renovating, restoring tanks and traditional water bodies	WRD	433	1915.77	1915.77	AD
WR/12	Strengthening infrastructure to manage disaster	Respective departments	10	88	88	MI
WR/13	Construction and rehabilitation of tail end regulators	PWD	400	779	779	AD
WR/14	Desalination plants	WRD	100			AD
WR/15	Construction of Water harvesting structures - check dams farm ponds, etc.	WRD PWD NABARD	300	113	113	AD
WR/16	Desilting & Widening of Channels and Drains, strengthening of embankments & removing water weeds from channels	WRD	400	139.62	139.62	MI
WR/17	Repairing, renovating & restoring tanks and traditional water bodies	WRD	1	10.56	10.56	BOTH
WR/18	Strengthening infrastructure to manage disaster	Respective departments	70	89.88	89.88	MI
WR/19	Establish high resolution weather monitoring, river inflow monitoring, hydrograph monitoring, and early warning system for floods	TNAU PWD WRD	50	65	65	AD
WR/20	Assess water availability by region, assess current demand of water by sector and future demand by sector by factoring in Climate change for short,	TNAU IMTI WRD	2	2	2	AD

	medium- and long-term timelines					
WR/21	Monitor quality of water to understand the impacts of warming of the atmosphere and for providing remedies	WRD PWD NABARD	5	4	4	AD
WR/22	Identify vulnerable areas of ground water contamination by point sources of industrial, municipal solid waste landfills and agricultural pollutants	WRD	1	2	2	MI
WR/23	Map water availability, Minor surface water bodies, Aquifers in time and space, and Water use in conjunction with land use and land classification	TNAU IMTI WRD	2	3	3	AD
WR/24	Introduce pricing regulation for use of piped water for domestic use and drinking water	PWD	1	2	2	AD
WR/25	Undertake periodical census of medium & minor irrigation projects to check sustainability, detect dis-functionalities & implement remedial measures	WRD	3	2	2	AD
TOTAL			12626	34685.95	34685.95	

Forest & Biodiversity:

The following table shows the amount spent by the department on proposed activities during 2012-13 to 2016-17.

Table 3 Financial Allocation under each key strategy

Code	Activity	Source: Scheme/ Project	Total budget proposed (in crore) (2012-17)	Total budget allocated (in crore) (2012-17)	Total budget spent (in crore) (2012-17)	Type
FR/1	Participatory Forest Management or Joint Forest Management (JFM)	NTFP scheme/ NAP	200	200	200	AD
FR /2	Promotion of Industrial and Energy Plantation (PPP)	TAFCON TANTEA ARC DoE, GoTN	200	172.85	172.85	MI
FR /3	Promotion of Climate Resilient Agro and Farm Forestry (PPP)	TN State Government	200	192.03	192.03	BOTH
FR /4	Sandal wood: (a) On degraded forest area in sandalwood Belt; (b) On farmlands in sandalwood tract	NAP GoTN	50	41.2	41.2	AD
FR/5	Biodiversity Conservation: (both inside Protected Areas as well as in Reserved Forests) including Shola Forest	TBGP	200	180.50	180.50	AD
FR/6	Establishment of fodder banks in the Protected Areas as well as in other Reserved	TBGP NCA, Gol	50	46.91	46.91	BOTH

	Forests					
FR/7	Greening of villages and Establishment of Village Seed Banks	TBGP	10	167	167	BOTH
FR/8	Conservation of genetic resources by screening and preserving existing wild germplasm for developing climate resilient varieties	TBGP	5	3	3	AD
FR/9	Training and extension activities to develop institutional capacity for biodiversity conservation and ecosystem management	TBGP GoTN	5	2.23	2.23	AD
FR/10	Collection, conservation and documentation of in Nilgiris, Kolli hills, Kodaikanal (Shola Forests), Kalakkad-Mundathurai Tiger Reserve (KMTR) Conservation of genetic resources by screening and preserving existing wild germplasm for developing climate resilient varieties	TBGP, IDWH, GoI NBR, ABR	10	16.01	16.01	AD
FR/11	Strengthening the ex situ conservation facilities: Gene Banks	TBGP	5	3	3	AD

FR/12	R & D on orthodox and recalcitrant seeds cryopreservation for long term storage - Establishing Cryopreservation facilities	TBGP	5	3	3	AD
FR/13	Renewable power generation for powering the freezer facility	TBGP	5	2	2	MI
FR/14	Establishment of biodiversity corridors / species garden for education purpose	GoTN	5	5	5	AD
FR/15	Conducting regular assessment & monitoring of Coral reef as indicator species	GoMBRT	20	17.35	17.35	AD
FR/16	Coral rehabilitation using resilient & resistant native species	GoMBRT	50	40.5	40.5	AD
FR/17	Alternative livelihood for reef associated fishery dependent people	GoMBRT	50	40	40	BOTH
FR/18	Conservation of mangroves and associated biodiversity	GOI, GoTN	20	16.9	16.9	BOTH
FR/19	Mapping of floral and faunal biodiversity in State at a high spatial resolution incorporating GPS coordinates and on GIS platform	NBA, GOI	100	90	90	AD

FR/20	Creation of Peoples Biodiversity Register - BMC level (Panchayat)	NBA, GOI	50	10	10	AD
FR/21	Identification, conservation and protection of biodiversity of heritage sites (10 sites) and ecologically sensitive districts (9) as suggested by the Gadgil Committee.	NBA, GOI GoTN	100	27.83	27.83	AD
FR/22	Disseminate - includes devising access and benefit sharing mechanisms of resources and indigenous knowledge with communities dependent on the same	NBA, GOI	10	3	3	AD
FR/23	Identification of suitable fodder genotypes by evaluating existing germplasm- Germplasm collection and documentation	GOI, GoTN	10	9	9	AD
FR/24	Intensive evaluation of the collected forage germplasm suitable to the different ecosystem and testing for climate resilience- Screening of germplasm	GOI, GoTN	5	4	4	AD
FR/25	Large scale multiplication of seeds	NMPB, GOI	5	4	4	AD
FR/26	Large scale testing – field trials in different agroclimatic zones where degraded forests	GOI, NAP, GoTN	10	9	9	BOTH

	with invasive species are identified- Approx. 3 sites for each agroclimatic zones will be selected					
FR/27	Training, field review of AIS management: Procure partners; Training on management of AIS with field review of species (TNFD staff); Strategy and manual on management of AIS (in English and Tamil)	Protection of forest resources and consolidation, Gol	10	10	10	MI
FR/28	Survey, monitoring and reporting- Baseline survey of biodiversity in critical habitats prior to removal of ALS; Enter georeferenced data in biodiversity database/ GIS	Protection of forest resources and consolidation, Gol	10	8	8	AD
FR/29	Removal of AIS; Phased removal of Lantana, Prosopis from dry forest; Phased removal of wattle from Shola ecosystem in the hills	Protection of forest resources and consolidation, Gol	10	8	8	MI
FR/30	Monitoring biodiversity in critical habitats after removal of ALS; Monitor impact of fencing and removal of exotics from shoal and grassland habitats	Protection of forest resources and consolidation, Gol	10	10	10	AD
FR/31	Strengthening firefighting infrastructure to address Forest Fires	Protection of forest resources and	50	45	45	AD

		consolidation, Gol				
FR/32	Estimating mitigation potential of forest in Tamil Nadu	National Adaptation Fund, NAPCC, Forest & Biodiversity	10	9.5	9.5	MI
FR/33	Intensification of research on forest plant diversity conservation and utilization to identify climate resilient plants.	National Adaptation Fund, NAPCC, Forest & Biodiversity	10	7.95	7.95	AD
FR/34	Valuation of bio resources in 3 ecosystems; Coastal; Wetland; Forest	National Adaptation Fund, NAPCC, Forest & Biodiversity GOMBRT	10	10	10	AD
FR/35	Focused research on impact of climate change on coral reefs and associated biodiversity	National Adaptation Fund, NAPCC, Forest & Biodiversity Mission	5	4.21	4.21	AD
FR/36	Capacity building and dissemination activities	National Adaptation Fund, NAPCC, Forest & Biodiversity Mission	5	4	4	AD
FR/37	Creating awareness on climate change impact on forest to rural poor, farmers, farm labourers and people lives in forest fringes by training, field visits, and field demonstrations.	GoTN, NMSA, Tribal welfare and development	3	3	3	AD
FR/38	Creating awareness on climate change and resilient	State wetland authority	3	3	3	AD

	mechanism through forestry by appropriately training NGOs, self-help groups, etc.					
FR/39	Capacity building through seminars and trainings for scientists and researchers to meet the challenges of climate change		3	3	3	AD
FR/40	Capacity building through training to forestry field staff, managers	TNFA	3	3	3	AD
FR/41	Awareness building among all stakeholders in Gulf of Mannar Biosphere Reserve	GOMBRT	3	3	3	AD
FR/42	Capacity building of frontline conservation staff and community in Gulf of Mannar Biosphere Reserve	GOMBRT	3	3	3	AD
TOTAL			1528	1440.97	1440.97	<u> </u>

Coastal Area Management:

The following shows the amount spent on Coastal Area Management (during 2012-12 to 2016-17) to implement the listed activities in TNSAPCC (2012-17).

Table 4 Financial Allocation for each key strategy

Code	Activity	Source: Scheme/ Project	Total budget proposed (in crore) (2012-17)	Total budget allocated (in crore) (2012-17)	Total budget spent (in crore) (2012-17)	Type
CAM/ 1	Habitation shifting to safer areas		100	0	0	AD
CAM/ 2	Holistic integrated development of coastline of Tamil Nadu		100	2.29	2.29	AD
CAM/ 3	Access intensity & recurrence frequency of natural hazards		50	0	0	AD
CAM/ 4	Evaluation of individual & combined impacts of natural disasters due to climate change	SDRF	200	43.29	42.98	AD
CAM/ 5	Central coastal database centre establishment		50	0	0	AD
CAM/ 6	Institutional Arrangements strengthening		25	0.06	0	AD
CAM/ 7	ICZM demonstration projects		100	5.9	5.9	Both
CAM/ 8	Disaster preparedness- Decision support system (DSS) for disaster management	Distress Management Cell	100	67.6	67.6	AD
CAM/ 9	Revision of norms & implementation for Coastal zone infrastructure development,		200	210.3	210.3	AD

	waste management Awareness activities					
CAM/ 10	Protection wall construction in vulnerable coastal areas		300	243.67	223.19	AD
CAM/ 11	Study on impacts of climate change on coastal regions		25	0	0	AD
CAM/ 12	Design augmentation requirement/retrofitting of coastal protection works (sea wall, groynes)		300	4.01	4.01	AD
CAM/ 13	Identification & plantation of heat tolerant location specific mangrove species for afforestation in moderate and high erosion areas		50	0.15	0.15	MI
CAM/ 14	Tree cover increase along coast with appropriate trees		100	0.27	0.27	MI
CAM/ 15	Desiltation/creation for rainwater/river water drainage into sea		1000	79.27	18.62	AD
CAM/ 16	Strengthening resilience of fishing communities	State Scheme	20	46.31	23.56	AD
CAM/ 17	Strengthening resilience of coastal farming communities-sustainable agriculture		20	0	0	AD

CAM/ 18	Strengthening coastal communities and habitat improvement (rural)	IAY/PMA Y(G)	100	338.36	332.27	AD
CAM/ 19	Strengthening resilience of coastal city habitats		100	713.86	713.86	AD
CAM/ 20	Protective measures to arrest sea water intrusion & beach nourishment		100	30.33	0	AD
CAM/ 21	Coverage increase of monitoring of wells for water quality assessment		25	0	0	AD
CAM/ 22	Id & operationalisation of appropriate areas for new bore wells	National Hydrology Project	25	Funds being received as grant from Govt. Of India		AD
CAM/ 23	Soil mang. Moisture retention measures, continuous vegetation, infiltration, groundwater recharge & erosion reduction encouragement		50	0	0	MI
CAM/ 24	Reduction in extraction of groundwater through low power pumping machines (renewables)		75	0	0	MI
CAM/ 25	Id of areas and establishment of desalination plants		200	0	0	AD
CAM/	Artificial		200	0	0	AD

26	recharging of wells by RWH					
CAM/ 27	Assessment of baseline flora and fauna data on biodiversity in coastal zones		20	1.27	0.82	AD
CAM/ 28	Conservation/prot ection of marine biodiversity including GoM (coral reef/sea grass bed)		100	1.25	0.88	MI
CAM/ 29	Mangrove protection		75	1.56	1.26	MI
CAM/ 30	Estuary management		75	24.93	0	MI
CAM/ 31	Ensuring livelihood of fishermen		50	114.7	108.06	AD
CAM/ 32	Development of integrated SWM plan in coastal zone areas to avert water entering in the sea using new technology		160	0	0	AD
CAM/ 33	Implementation of additional cooling of wastewater from power plants by mixing with sewage & other technologies		100	0	0	AD
CAM/ 34	Reusing wastewater through biological treatment		200	0	0	AD
CAM/ 35	Study & monitoring of coastal pollution along coasts		25	1160.47	0.132	AD
TOTAL			4420	3089.85	1756.15	

Strategic Knowledge on Climate Change:

Table 5 Financial Allocation for each key strategy

Co de	Strategies	Source of Funding & Implementation	Total budget proposed (2012-17)(in crore)	Total budget allocated (2012-17)(in crore)	Total budget spent (2012-17)(in crore)	Type
KM/ 1	Establishing/Strengthening the State Climate Change Centre/Cell under NMSKCC (SCCC-NMSKCC) in the State of Tamil Nadu	Funding Source- DST SPLICE div., GoTN, TNAMB, NISE. Implementation- DoE (CCCAR), TNAMB, TEDA	7.5	3.12	0	AD
KM/ 2	Develop a scientific basis for a deeper understanding of climate change issues around the Globe	Funding Source- GCC, GIZ Implementation- GCC	5	0.09	0	AD
KM/ 3	Support Research and Development of innovations to address climate change impacts and vulnerabilities	Funding Source- GCC, GIZ, MoEF&CC, DST, DoBiotech (GoI), Centre, IMTI, IAMWARM, DWDA, CLIMADAPT, RAESO, GREDS, SG&SWRDC, NABARD, WALMI, Revenue Dept, AED, RD&PR, WRD, WALAMTARI, CSTEP, ISET Nepal, DHAN Foundation Implementation- Anna University CCCAR, GCC, SDMRI, CSMCRI, Annamalai University, Bharathidasan University, Madurai Kamaraj University, TNFCRI, IMTI, PWD, DHAN Foundation, DoH	4	4.28	0	AD
KM/ 4	Undertake Demonstration, Field implementation & Extension; Ground truth verification & Field Demo for choosing adaptation options	Funding Source- Centre & State Implementation- DoH, SDMRI, DHAN Foundation	5	3.16	0	AD
KM/ 5	Support regular monitoring of critical ecological parameters and urban landscape	Funding Source- IUCN India Implementation- SDMRI	5	0.08	0	AD
KM/ 6	Mainstream traditional	-	5	0	0	AD

	knowledge					
KM/7	Undertake capacity building initiatives to integrate steps to manage climate sensitive natural resources and mitigate climate change drivers, Training/Capacity building; Workshops/Seminars/ Consultation, Exposure Visit to areas where success stories pertaining to adaption to vagaries of climate change can be studied	Funding Source- GCC, GIZ, Centre & State, MoEF&CC, TNSLURB, IMTI, IAMWARM, DWDA, CLIMADAPT, RAESO, GREDS, SG&SWRDC, NABARD, WALMI, Revenue Dept, AED, RD&PR, WRD, WALAMTARI, CPHEEO, CMWSSB Implementation- GCC, DoH, CMFRI, DoF, DoE, IMTI, PWD Irrigation Mang. Training Institute, CCCAR, CMWSSB	5	16.77	0	AD
KM/8	Support creation of Monitoring and Evaluation (M & E) tools of various initiatives of the climate sensitive sectors	Funding Source- IMTI, IAMWARM, DWDA, CLIMADAPT, RAESO, GREDS, SG&SWRDC, NABARD, WALMI, Revenue Dept, AED, RD&PR, WRD, WALAMTARI Implementation- SDMRI, IMTI, PWD, DHAN Foundation	7.5	1.44	0	AD
KM/9	Implement CSIS through a knowledge portal to the end users	-	5	0	0	AD
Total			49	28.94	0	

A total amount of Rs. 28.94 crore has been allocated during the last 5 years for undertaking the activities proposed in the SAPCC1.

Enhanced Energy Efficiency and Solar Mission:

The table below presents the synopsis of the overall financial allocation and expenditure during TNSAPCC (2012-2017 for implementation of certain activities and sub-activities proposed under the SAPCC-1.

Table 6 Financial Allocation under each key strategy

Code	Activity	Source: Scheme/ Project	Total budget t prop osed (in crore) (2012- 17)	Total budget allocat ed (in crore) (2012- 17)	Total budget spent (in crore) (2012- 17)	Type

ES/1	Detailed Mapping and auditing of all existing public buildings in conformance with the Energy Conservation Building Code (ECBC)	ECBC capacity building programme (BEE, Ministry of Power and GoTN)	10	0.105	0.028	MI
ES/2	Incorporation of design features and consultancy services for new public building conformance with Energy Conservation Building Code (ECBC)		10	0	0	MI
ES/3	Implementation of energy efficiency measures in the existing buildings through retrofit	Scheme on demonstration projects by BEE (BEE, Ministry of Power and GoTN)	250	2.42	1.73	MI
ES/4	Incorporation of ECBC measures in all new Government buildings at construction stage		250	0	0	MI
ES/5	Adoption of Enhanced Energy Efficient generation including supercritical technology		0	NA	NA	MI
ES/6	Energy Efficient Street lighting (world class cities programme)	ESCO I (State)	250	0.6407	0.6407	MI
ES/7	Energy Efficient Street lighting (Rest of Urban Tamil Nadu)	ESCO I (State)	375	0.8478	0.6478	MI
ES/8	Energy Efficient Street lighting (Chennai)	KFW/ World Bank/ Own Fund: Greater Chennai Corporation (GCC)	125	401.79	401.79	MI
ES/9	Implementing energy Efficiency Improvements in the Small and Medium	NMEE (Central- BEE, MoP)	200	0.06	0	MI

		PEACE (State)		0	0	
ES/10	Awareness Generation programs on Energy Conservation and Efficiency	Central (BEE, MoP)	5	0.344	0.1671	MI
		PEACE (State)		0	0	
ES/11	Solar power generation program	Central Govt. schemes, REC scheme, Preferential Tariff scheme, Tender scheme	24000	10225.22		MI
ES/12	Offshore wind generation program (50 MW + 150 MW)		625	8330.79		MI
ES/13	On-shore wind generation program (5000 MW + 5000 MW)		30000			MI
ES/14	Solar home lights		900	912.37	388.5	MI
ES/15	Energizing streetlights with solar power		250	60.6		MI
ES/16	Biomass (1000 MW + 1000 MW)		4200	429.87		MI
ES/17	Co-generation (250 MW + 250 MW)		1113	9700+442	9700	MI

ES/2 1	Reduction of AT&C losses (Set of activities to reduce ATC losses of 18percent-15percent in 12th plan and 15percent-12 percent in 13th plan)	Inclusion of DISCOMs under PAT scheme R-APDRP PART-B (SUBSUMED UNDER IPDS) 1. MoP/Gol - 25% (Rs.710.30 Cr) 2. Remaining 75% (Rs. 2130.91Cr.) as under. a. M/s PFC - Rs. 1328.63 Cr. b. M/s REC - Rs. 722.06 Cr. c. Own funds - Rs. 80.22 Cr.	45000	0	0	MI
				766.44	2534.47	
ES/2 2	Transmission Infrastructure strengthening works	Transmission Infrastructure strengthening works (Greater Chennai strengthening)- 400 KV SS,230 KV SS,400 KV UG cable- JICA Transmission Infrastructure strengthening works (Rest of Tamil Nadu)- 400 KV SS,230 KV SS- JICA/ REC	24000	46.51	21.93	MI
				36.29	26.73	

		Transmission Infrastructure strengthening works (Network Improvement) - 765 KV,400 KV and lines		150	0	
				Tot= 232.8	Tot= 48.66	
ES/2 3	Distribution Infrastructure Strengthening works	Distribution Infrastructure Strengthening works: Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) Distribution Infrastructure Strengthening works: Integrated Power Development Scheme (IPDS)	10000	165.51	0	MI
				10.36	0.1574	
				Tot= 175.87		
ES/2 4	Feeder separation with HVDS project	DDUGJY	6000	125	125	MI
ES/2 5	Smart grid initiatives		5000	0	0	MI
ES/2 6	DSM (Demand Side Management) Activities	Distribution of CFL to hut service connections: State Govt. (UJALA scheme)	315	8.75	8.75	MI

ES/2 7	Preventive measures to mitigate climate change effects	(refer proposed activity)	360	0	0	MI
TOTAL			15543 8	32719. 22	13350. 46	

Sustainable Habitat Mission:

Table 7 Strategy-wise Budget Allocation

Code	Strategy/Actions	Proposed Budget 12th FYP (Rupees in crore)	Allocated Budget in crore INR	Amount Spent in crore INR	Type
SH/1	Implement ECBC norms in institutional/commercial and residential sectors	100	0.105	0.028	MI
SH/2	Integrate design alternatives to withstand impacts of CC (extreme rainfall, flooding, cyclones and storm surges and other disasters)	500	14,008.03	13,128.6	MI
SH/3	Develop new housing policy including CC aspects	50	—	—	AD
SH/4	Research and designing alternative construction materials like M. Sand, fly ash etc. to reduce the pressure on natural resources	50	734.21	734.21	AD
SH/5	Promote generation of disaggregated electricity (micro-grid) in villages as a community source	50	—	—	MI
SH/6	Develop policies/ New regulations for - Green management of solid waste and liquid waste within houses - Standards for waste disposal	100 10	—	—	MI
SH/7	Development in flood prone areas, protecting and resettling encroachments	13000	—	—	AD
SH/8	Implementation of compulsory plantation of trees in all sectors (Housing /Institutional) to reduce heat island effect	500	470.08	626.78	MI
	Total	2360	15212.43	14489.62	
Strategy 2: Providing CC resilient water supply systems					

	URBAN AREAS				
SH/9	Providing water supply scheme and 24 X 7 ready water supply in extended areas	1270	3718.74	1467.21	AD
SH/10	Revamping existing water supply schemes to avoid loss of water by laying new pipelines in place of damaged pipelines	8966	427.77	427.77	AD
SH/11	Regulate use of water through compulsory metering		—	—	AD
SH/12	Sewerage in extended areas of Chennai city	400	3404.77	1108.99	AD
SH/13	Plugging outfalls and improvement in core areas	170	—	—	AD
SH/14	Wastewater reclamation programme	750	283.07	69.24	MI
SH/15	Strengthening rainwater harvesting	100	358.94	358.94	AD
SH/16	Storage of surplus water during floods	500	—	—	AD
	RURAL AREAS				
SH/17	24 X 7 water supply	150	4084.97	4084.97	AD
SH/18	Sewerage in un sewerred areas	2000	—	—	MI
SH/19	Rainwater harvesting	694	700.97	780.97	AD
SH/20	Storage of surplus water during floods	626	—	—	AD
	URBAN & RURAL AREAS				
SH/21	Undertake regular water monitoring by establishing labs in all districts	400	0.24	0.23	Both
SH/22	Protection of water sources including traditional water bodies	1000	805.39	644.27	AD
SH/23	Increase storage capacity of water bodies / traditional water bodies	500	54.32	54.32	AD
SH/24	Reuse of grey water	100	410.16	60	AD
SH/25	Recharging of ground water	455	589.49	575.5	AD
	Total	18081	14838.83	9247.92	
Strategy 3: Urban and Rural development					
SH/26	Include CC adaptation measures in Master Plans, DDPs, CDPs, CMPs, CRP & etc.	100	—	—	AD
SH/27	Developing Satellite townships to decongest Cities (Urban)	10000	534.73	113.41	MI
	Total	10100	534.73	113.41	
Strategy 4: Health and sanitation (Urban and Rural)					
SH/28	Strictly enforce Panchayats Act & Corporation Municipal Act for giving priority for disposal of solid and liquid	50 50	3.73	3.73	AD

	waste to avoid mosquito breeding				
SH/29	Strengthen IDSP by • Instituting Rapid Response Cell at the District and Block levels • Including non-communicable diseases keeping in view the likelihood of heat stress and other impacts	180 108	0.5	0.5	Both
SH/30	• Undertake research to understand short- and long-term impacts of CC on health • Conduct training and awareness for different target audiences on CC and health and incorporate in the curriculum of medical education	20 60	–	–	AD
SH/31	Strengthen the integrated health management system at District and Block level	3850	–	–	AD
SH/32	Develop capacities for forecasting disease outbreaks	500	2.98	2.98	AD
SH/33	Ensure 100 percent sanitized and open defecation • Urban • Rural	2050 10000	659.5	256.64	AD
SH/34	Slum free cities programme	54873	54873	-	AD
	Total	41868	6736.17	4669.87	
Strategy 5: Waste Management (Urban and Rural)					
SH/35	Information, education and communication (IEC) for general public on • source segregation and disposal of waste & usage of plastic bags • Inclusion of CC impacts on health at all levels of education	50 50	223.53	55.58	AD
SH/36	Sustainable solid waste management (urban)	600	741.75	658.51	MI
SH/37	Sustainable solid waste management (rural)	3250	654.1	654.1	MI
SH/38	Identify the MSW disposal sites in all cities/and districts	100	–	–	MI
SH/39	Undertake source segregation through material recovery facility at disposal sites to avoid ground water pollution	500	–	–	MI

SH/40	Study to carry out composition of solid waste in different regions to finalise the solid waste management in the city Implement penalty for noncompliance of segregation of waste at source Attempt waste to energy initiatives like biomethanation etc., Penalty for littering in public places	100	2.75	2.75	MI
SH/41	Recycling of domestic and industrial wastewater (urban)	500	410.16	60	MI
	Total	5150	2032.29	1430.94	
Strategy 6: Energy					
SH/42	Formulate a policy to encourage LED and solar lighting in streets and buildings (subsidy, incentives etc.,)	50	6343.2	6343.2	MI
SH/43	Enforce labelling of domestic appliances for energy efficiency rating, capacity building on usage of BEE labelled appliances	100	9.86	9.17	MI
SH/44	- Replace all old pump sets with energy efficient pump sets - Promote use of energy efficient & solar pump sets across the State through subsidies including agriculture	1000 50	–	–	MI
SH/45	Assess the energy generation from SW in the state and recover energy in terms of CH ₄ from waste	100	3.85	3.85	MI
SH/46	Promote Energy Labelling for Rating of all buildings including residential	50	–	–	MI
SH/47	- Create awareness for alternate energy - Address constraints of alternate energy sources including cost (subsidies, collection & replacement of old parts, maintenance agreement with supplier etc)	50 100	0.41	0.23	MI
	Total	1500	6357.32	6356.45	
Strategy 7: Developing an efficient integrated transport system					
SH/48	Introduce Multi Model Transport System such as Metro Rail, Mass Rapid Transit Systems, Monorail, develop BRTS corridors	6500 200	732.89	732.89	MI
SH/49	Expansion of Mass Transit Public Transport-I	16000	–	–	MI
SH/50	Expansion of Mass Transit Public Transport-II	15000	495.74	352.52	MI
SH/51	Mass Public Transit System for second tier cities	50000	–	–	MI

SH/52	Implementation of CUMTA	1000	–	–	MI
SH/53	Introduce feeder services from all 371 metro stations	500	–	–	MI
SH/54	Create freight corridors for rails and roadways	15000	3967.28	3967.28	MI
SH/55	Create additional parking areas through MLCP/MLTWP	500	40.79	5.2	MI
SH/56	Impose traffic free areas in markets	100	31.08	31.08	MI
SH/57	Increase number of auto LPG dispensation stations in cities	100	–	–	MI
SH/58	Introduction of Congestion tax for private vehicles, Including GHGs gases in Green Tax	50	–	–	MI
SH/59	Low floor buses to support differently abled and senior citizens (patronising public transport)	1000	–	–	MI
SH/60	Mandating parking spaces for registering new cars	100	–	–	MI
SH/61	Convert all the public transport vehicles to alternate fuel in phased manner	1000	–	–	MI
SH/62	- Developing exclusive lanes for pedestrian - Promote cycling with good cycling paths, cycle parking facilities and link between cycling and public transport - Encourage car pooling - Introducing no-driving day for private vehicles	100 100 50 50	0.36	0.36	MI
SH/63	Increased subsidy/ reduced excise duty on hybrid vehicles and battery-operated vehicles	500	–	–	MI
SH/64	Improvement to all existing roads and maintenance at regular intervals	1000	15466.81	15370.81	AD
SH/65	Adoption of alternate/ advanced technology including mixing of plastic to ensure endurance to the roads	1000	760.8	760.8	MI
SH/66	World Class Arterial Roads program	3750	–	–	AD
SH/67	Integrated Urban Road Development program	10000	1389.14	1352.29	AD
SH/68	Organised parking (urban)	1000	–	–	MI
SH/69	City Bus Terminals	250	–	–	MI
SH/70	Inter-city bus terminals	250	–	–	MI

	Total	125100	22884.89	22573.23	
Strategy 8: Abating enhanced air and water pollution in a CC scenario					
SH/71	Improved quality monitoring of Air, Water, Noise pollutions by increasing monitoring locations in State	5	—	—	MI
SH/72	Monitoring Ground Water Quality	5	—	—	MI
SH/73	Providing UGSS with STP in all towns and CETPs	100	2831.03	818.16	MI
SH/74	Study of impacts of CC on air & water pollution	5	—	—	AD
SH/75	Revision of pollution standards Strict enforcement with penalty for violation of pollution standards Ensuring ZLD in industries	10 10 10	—	—	AD
SH/76	Awareness and Capacity Building/ Training programs for different target groups on impacts of CC and pollution	200	—	—	AD
SH/77	Measures to reduce Urban - Water pollution - Air pollution - Noise pollution	500 700 200	24.93	24.93	MI
SH/78	Measures to reduce Rural - Water pollution - Air pollution - Noise pollution	700 200 100	—	—	MI
	Total	2745	2855.96	843.09	
Strategy 9: Greening of Urban Spaces					
SH/79	Develop greenery/green belt to be made mandatory and inclusion in DCR	50	117.77	117.02	MI
SH/80	Conversion of OSR lands into parks	50	19.1	19.1	MI
SH/81	Stringent compensatory plantation for tree cutting, including refundable deposit	50	—	—	MI
SH/82	Study to identify suitable plant and tree species for urban greenery.	50	—	—	AD
	Total	200	136.87	136.12	
	Grand Total	207104	71589.48	60245.13	

The above table shows the amount spent on the proposed actions in the TNSAPCC . A total amount of Rs. 60245.13 crore (approx.) has been spent during 2012-17 out of the total proposed budget of Rs. 207104 crore (approx.).

ANNEXURE 8: DESCRIPTION OF PROPOSED ACTIVITIES FROM 2021-30

Sustainable Agriculture

The description of activities below is based on mitigation and adaptation options. The activities that are named “AG” are old activities proposed under TNSAPCC (2012-17) and will be continued for upcoming years as per agreement of the nodal departments and those named “AG/N” are newly proposed activities by the nodal departments for the upcoming years under Agriculture sector.

1. Research and development to improve the productivity of crops

AG/N/1: Development of nutritionally enhanced climate resilient premium quality rice varieties

- The main challenges from climate change to agriculture and food production are the more frequent and severe drought and floods, and higher pressure from insects and diseases
- Plant breeding has always addressed both abiotic and biotic stresses, and strategies of adaptation to climate changes may include a more accurate matching of phenology to moisture availability using photoperiod- temperature response; increased access to a suite of varieties with different duration to escape or avoid predictable occurrences of stress at critical periods in crop life cycles; improved water use efficiency; and a re-emphasis on population breeding to provide a buffer against increased unpredictability.

State specific Intervention: Methane emissions reduction by adjusted water management practices in rice cultivation

Aim of the Project: To generate revenue through trading of carbon offsets in the carbon markets

Climate Category: Mitigation and Adaptation

Proposed Activities:

- i. The project is a result-based financing tool to trade carbon-offsets in the carbon market
- ii. A Programme of Activities (PoA) will be created which will be registered through the CDM or a voluntary mechanism like the Gold Standard (GS), Verified Carbon Standard (VCS) etc.
- iii. In this project, 4 percent of the total land under rice cultivation in Tamil Nadu has been considered.
- iv. The carbon credits generated as a result of PoA will be traded in carbon markets to generate revenue

Climate Benefits:

- i. Reduction in water consumption for rice cultivation
- ii. Reduction cost and increased yield of rice cultivation
- iii. Reduction in methane emissions
- iv. Increase income of farmers

Direct & Co-Benefits:

- ✓ Climate resistant varieties would enhance agricultural production, even in a changing climatic scenario.
- ✓ Higher oil / protein content even under stress situation

- ✓ Cultivating shorter duration crops is an escape mechanism for the terminal season drought

AG/N/2: Enhancing maize productivity by identification and popularization of agro techniques.

- Maize is one of the important alternate crops in the Cauvery Delta Zone in the event of changing climate. The water availability for rice cultivation in *Kharif* season is becoming highly uncertain and hence, people prefer to go for an alternate crop.
- Due to the growth of the poultry industry, maize requirement as feed is also increasing. Hence, need to find technologies that will boost the yield of maize even under changing climatic conditions

Direct & Co-Benefits:

- ✓ In Tamil Nadu maize is grown in both rainfed and irrigated conditions and hence identification of improved cultivars specific to both the situations will enhance productivity under changing climatic condition
- ✓ Altering crop geometry will help in mechanization and would solve the problem of labour scarcity.

AG/N/3: Revitalization of millets for nutritional security and enhanced productivity

- Minor millets are considered as nutri cereals and are the crops best suited for water shortage conditions.
- As these crops are mainly grown under dry land condition, treating the seeds with suitable microbial inoculants will make the crop hardy against extreme weather events.
- It is also important to develop a package of practices for growing these crops under organic conditions as mainly these millets are utilized for making health foods for children.
- It is important to develop post-harvest facilities for increased use of millets.

Direct & Co-Benefits:

- ✓ Millets with high yield under varying climatic conditions will be available for uptake
- ✓ Climate resistant millet varieties would enhance the food security, even under changing climatic scenario.

AG/N/4: Enhancing pulses production in delta and non-delta districts

- Pulses are the main proteinaceous food.
- As these crops are mainly grown under dry land condition, treating the seeds with suitable microbial inoculants will make the crop hardy against extreme weather events.
- It is also important to develop a package of practices for growing these crops under organic condition as mainly pulses are utilized for making health foods for children.

Direct & Co-Benefits:

- ✓ Pulses with high yield under varying climatic condition will be available for uptake
- ✓ Climate resistant pulse varieties would enhance the food security, even under changing climatic scenario.

AG/N/5: GIS based village mapping for agro management system to enhance input use efficiency and overcome effect of climate change and increase farm productivity including horticulture crops

- GIS application in agriculture such as agricultural mapping plays a vital role in monitoring and management of soil and irrigation of any given farmland.
- GIS agriculture technology helps in improvement of the present systems of acquiring and generating GIS agriculture and resources data.

Direct & Co-Benefits:

- ✓ Creation of resource inventory
- ✓ Enhanced resource use efficiency.

AG/22: Development and execution of sustainable seed production and distribution network - Seed Multiplication Scheme of Paddy, Millets, Pulses, Oilseeds and Cotton

- To improve the economic status of the farmers by doubling the production and tripling the income. For Second Green Revolution Agriculture Department has formulated Various policies and strategies which includes sustainable seed production to achieve equitable, competitive and sustainable growth in Agriculture Crops

Direct & Co-Benefits:

- ✓ Quality seeds are available from the reliable sources to the farming community in time.

AG/23: Establishment of network of seed banks, food banks and cold storage to ensure supply at times of contingencies

- Seed play an important role in increasing the productivity.
- For getting the quality seeds and making the seeds available on time, it is important have a seed multiplication scheme for the major crops



Establishment of effective cold chain and food processing centres

Direct & Co-Benefits:

- ✓ Quality seeds are available from the reliable sources to the farming community in time.

AG/N/5: Special package for increasing the productivity of cotton

- Cotton is the world's most popular textile raw material. Package of productivity of cotton as a major fibre crop grown across the State will have to be standardised.

Direct & Co-Benefits:

- ✓ Productivity cotton will be improved

AG/N/6: Special package for increasing the productivity of sugarcane - Sustainable Sugarcane Initiative

- Sugarcane is a highly sensitive crop. Climate related stresses such as drought and moisture stress due to low rainfall, waterlogging due to high intensity excess rainfall and high or low temperatures. Package of practices for enhancing productivity of sugarcane will be standardised.

Direct & Co-Benefits:

✓ Popularizing climate resilient agro-techniques including Sustainable Sugarcane Initiative, increasing the area under drip irrigation, making crop insurance as mandatory and increasing the effectiveness of climate services.

AG/N/7: Special package for increasing the productivity of coconut

- Package of productivity of coconut, which are the major crops grown across the State will be standardised

State specific Intervention: Increasing the adaptive capacity of farmers through promotion of intercropping in coconut plantations

Aim of the Project: Aims to implement intercropping in coconut plantation and yield climate change benefits by enhancing adaptive capacity

Climate Category: Adaptation

Proposed Activities:

- i. Implement intercropping in coconut plantation in Tamil Nadu
- ii. The project timeline is assumed by 7 years as the results of intercropping can be witnessed only after a duration of 7 years

Climate Benefits:

- i. Improve resilience of the crop against biotic and abiotic disruptions
- ii. Protection from the impacts of climate change outcomes like increased flood intensity and soil nutrient depletion
- iii. Increase income of farmers

Direct & Co-Benefits:

- ✓ Productivity of coconut be enhanced.

AG/N/8: Establishment of pulses-based inoculants production unit for sustainable pulse productivity of Tamil Nadu

- Pulses are the crops that fix atmospheric nitrogen in the soil. For this special inoculants including Rhizobium will be used for preparing special inoculants

Direct & Co-Benefits:

- ✓ Productivity of pulses will be enhanced.

AG/N/9: Establishment of pilot water soluble fertilizer production unit for facilitating farmers for stage wise crop nutrition

- Government is promoting drip and sprinkler irrigation to economize water. Now a days the fertilizers and other crop nutrients are applied through irrigation water. For this water-soluble fertilizer should be made available

Direct & Co-Benefits:

- ✓ Fertilizer Use Efficiency will be enhanced.

AG/N/10: Diversified agricultural cafeteria with the State of art technologies for third generation

- To transfer the available technology to the farming community, diversified agricultural cafeteria with the State of art technologies for third generation is need of the hour

Direct & Co-Benefits:

- ✓ Adoption rate of the technologies by the farmers will be improved.

2. Mitigating the effect of extreme weather events

AG/26: Establishment of a dedicated climate knowledge cell to monitor, fore warn and train farmers and officials of the department on management of situations arising out of extreme events

- In the event of changing climate, the frequency of extreme weather events is expected to increase. To manage the situation, capacity of the farmers and other officials needs to be built. This could be achieved by establishing climate knowledge cell.

Direct & Co-Benefits:

- ✓ Capacity of the farmers and other officials increased for managing climate related risk.

AG/N/11: Remote sensing-based information for crop coverage, yield estimation and drought monitoring

- Remote sensing can significantly contribute to providing a timely and accurate picture of the agricultural sector, as it is very suitable for gathering information over large areas with high revisit frequency.
- Remote sensors provide means to collect data based on specific 'bio-physical' variables like cloud temperature to estimate rainfall. These data accompanying other ground-based data are used to create indices such as drought indices
- Remote sensing could also be used for yield estimation, that could be used for policy planning
- Remote sensing data is disseminated to farm level by institution linkage with farmers through KVKs, State Agricultural University, ICAR institutions, NGOs and extension functionaries and ICT tools. This information can be utilized at farm level for resource management.

Direct & Co-Benefits:

- ✓ Quick and accurate estimation of area and yield over a larger area

AG/N/12: Customized agro advisory services to the farmers

- There is a need to get specific advisories based on the existing future weather condition for easy decision making by the farming community

Direct & Co-Benefits:

- ✓ Maximizing the profit through appropriate decision
- ✓ Increase in yield
- ✓ Reduction in cost of cultivation

AG/25: Integrated voice message on weather based agro advisories, market demand & price forecasting

- Farmers who have low education level will get the right information through voice message. Moreover, they can repeatedly hear the messages at their convenience.

Direct & Co-Benefits:

- ✓ Effective dissemination of farm advisory and will help in practising response farming.

AG/27: Strengthening and popularising the existing crop insurance programme

- The State would continuously upgrade its contingency plans for the agriculture sector and impart training to extension officers and farmers accordingly.
- Under NAIS (National Agriculture Insurance Scheme), agricultural insurance is provided for the protection of agricultural farmer in case of lower productivity or crop failure, due to the incidents of weather variability and extreme climate change events.

State specific Intervention: Enhancing the climate resilience of farmers by coupling insurance and decision support system for irrigation planning

Aim of the Project:

- To implement develop a decision support system (DSS) to predict precipitation patterns in the State with high level of accuracy
- To couple crop insurance along with the development of DSS

Climate Category: Adaptation

Proposed Activities:

- Develop a DSS to predict precipitation patterns in the State and deliver the information to users
- Couple a weather-index based crop insurance along with the development of a DSS
- A total of 10 districts will be targeted under this project for rice cultivation
- Minimum size of the farm that will be included will be 1 hectare

Climate Benefits:

- Improve the adaptive capacity of farmers
- Reduction in the risk of crop failure
- Increased income of farmers
- The project will also help in reducing the rates of loan defaults by farmers

Direct & Co-Benefits:

- ✓ Reduced chances of crop failure
- ✓ Reduction in farmer distress due to crop failure

AG/28: Research project on comprehensive crop insurance products that would cover increasing extreme events

- Fort fixing the weather perils and pay out mechanism this component is needed.

Direct & Co-Benefits:

- ✓ Location specific crop insurance schemes will be available for execution.

AG/5: Extension strategies to popularize improved management practices to mitigate extreme weather events (ART and MLT)

- Capacity building and popularisation of climate resilient technologies are important to create awareness among the community

Direct & Co-Benefits:

- ✓ Adoption level of improved climate resilient technologies increased or will increase and there by crops' productivity increased under changing climatic condition

AG/N/13: Development of contingency plans for extreme weather events and implanting on the ground

- The State would continuously upgrade its contingency plans for the agriculture sector and impart training to extension officers and farmers accordingly.
- Under NAIS (National Agriculture Insurance Scheme), agricultural insurance is provided for the protection of agricultural farmer in case of lower productivity or crop failure, due to the incidents of weather variability and extreme climate change events.

Direct & Co-Benefits:

- ✓ Reduced chances of crop failure
- ✓ Reduction in farmer distress due to crop failure

3. Improving ground water recharge and countering sea water intrusion

AG/15: Recharging the aquifers using the abandoned open wells and defunct bore wells

- In the event of changing climatic conditions, extreme weather events such as drought and flood are common. High intensity rainfall in fewer rainy days are also expected. Under this situation, heavy runoff and soil erosion will occur. The runoff water could be effectively collected in the existing / abandoned wells which will aid in improving the water table.

Direct & Co-Benefits:

- ✓ Water table in the area will get improved
- ✓ More water will be available for crop production and the yield level of agriculture and horticulture crops will be improved

AG/9: Constructions of sub-surface dykes

- It a structure that is built in an aquifer with the intention of obstructing the natural flow of ground water, thereby raising the ground water level.

Direct & Co-Benefits:

- ✓ Water table in the area will get improved
- ✓ More water will be available for crop production and the yield level of agriculture and horticulture crops will be improved.

AG/29: Development of vegetative shield for east coastal region against wind, cyclones, etc.

Management and conservation of vegetative shield

- To reduce the ill effects of high tide and extreme events like Tsunami, it is important have a natural protection belt.
- A 'bio-shield' formed by planting a vegetation belt along coastlines would protect the coastal land area against future coastal storms, cyclones and tsunamis.
- The plantations could play a double role. While absorbing the force of severe storms and tsunamis, the 'bio-shield' could act as a 'carbon sink' by absorbing emissions of the greenhouse gas carbon dioxide.
- Another key recommendation is to help local communities build artificial coral reefs, among which fish could shelter and breed

Direct & Co-Benefits:

- ✓ Less damage to coastal region with vegetative barrier.
- ✓ Protect vulnerable coastlines from wave action because they hold the soil together and prevent **coastal** erosion

AG/10: Diversion of excess flood water at upper reaches to water deficit areas

- High intensity rainfall is expected under the changing climatic condition. Excess rainwater in the upper reach could be utilized for the water deficit areas in the low-lying region.

Direct & Co-Benefits:

- ✓ Area under irrigation will be increased. More water will be available for crop production and the yield level of agriculture and horticulture crops will be improved.

4. Soil conservation strategies

AG/13: Deep ploughing to break sub surface hard pan to increase infiltration efficiency; improve ground water quality; check sea water incursion

- Breaking the hard pan without inversion and with less disturbance of topsoil region is needed especially in the red soil region.
- There is a need to “Go Native” to Protect and Conserve Groundwater. By using native plants in our landscape, reducing chemical use, effective waste management will improve the water quality
- **Seawater intrusion** is the movement of **seawater** into **freshwater** aquifers due to natural processes or human activities. **Seawater intrusion** is caused by decreases in groundwater levels or by rises in **seawater** levels. The health of plants and fertility of soil can be negatively impacted if irrigated with saline groundwater. Once

saltwater intrusion occurs, the changes in the aquifer may be permanent or may take many years to recover

- Water Wisely. Reduce, Reuse, and Recycle will increase the area under irrigated agriculture.

Direct & Co-Benefits:

- ✓ Area under irrigation will be increased. Quality of water will be improved
- ✓ More water will be available for crop production and the yield level of agriculture and horticulture crops will be improved.

AG/12: Reclamation of saline and alkaline soils

- The excessive accumulation of *alkali* salts in the *soils* is injurious for plants growth It is necessary, therefore, to reduce the percentage of salts to optimum or normal level so that plants may grow luxuriantly in such *soils*. *To correct the alkaline soil, acidic material like peat mass or sulfur could be added to reduce the soil pH and then water drainage may be improved. prevent water evaporation by adding compost or a mulch of shredded leaves (which are very acidic) to wash away salts and chemicals.*
- Saline soils are formed whenever climate, soil and hydrological conditions favour accumulation of soluble salts in the root zone. Irrigation with salt-laden underground water and their indiscriminate use under inadequate drainage creates more salinity problems. Salt can be leached out of the root zone through good quality irrigation water or by heavy rainfall. Create good surface and internal drainage

Direct & Co-Benefits:

- ✓ Soil quality is improved
- ✓ Crop productivity is enhanced.

AG/20: Soil conservation and to arrest runoff: compartmental bunding, contour farming, deep ploughing, mulching

- In the event of changing climatic conditions, extreme weather events such as drought and flood are common. High intensity rainfall in fewer rainy days are also expected. Under this situation, heavy runoff and soil erosion will occur. Hence soil conservation is important to avoid the loss of nutritious topsoil.

Direct & Co-Benefits:

- ✓ Soil is protected from erosion and the soil quality is improved.

AG/14: Build Organic carbon content of soil with green manuring: Azolla, BGA, Bio-fertilizers, Bio-pesticides, Bio-Agents and compost developed from municipal solid waste

- In addition to providing nutrients and habitat to organisms living in the soil, organic matter also binds soil particles into aggregates and improves the water holding capacity of soil. In the event of changing climate, temperatures are expected to raise by 2 – 4 °C. Increase in temperature will enhance the microbial activity in the soil and will degrade the organic matter quickly to release the nutrients. Hence, organic matter content of the soil reduces quickly. This need to be built up by suitably adding green manure or other bio-inoculants.
- In the events of changing climate, new pests as well as minor pests are causing greater problems. This warrants frequent spraying of plant protection chemicals. To reduce the

toxic levels in the plant products, it is important to go with bio-pesticides as well as bio control agents.

- The greatest problem in most of the towns is solid waste management. If the degradable solid waste is segregated and decomposed properly, then it could be used as manure for crop production. In addition, the GHG emission could also be reduced. It would also reduce the requirement of landfill size for scientific disposal.

Direct & Co-Benefits:

- ✓ Soil productivity is enhanced and in turn crop productivity is also improved.
- ✓ Quality agricultural produces with less toxic levels will be available
- ✓ More manure is available through solid waste management which will improve the crop productivity.
- ✓ GHG emission is reduced from the waste sector

AG/15: Bringing fallow land and degraded land back to cultivation

- Cultivable wastelands that are located in the fringe areas of the forests are not cultivated regularly despite being fertile. Additionally, the undulated lands would require levelling and bunding. Poor farmers lack the investment required to make these lands cultivable. A few enterprising farmers now and then broadcast seeds of horse gram or redgram and harvest some grains depending on the season. Most households continue to remain poor despite owning fertile land. Some farmers cultivate these lands for a while and abandon cultivation after the bunds disappear due to runoff erosion. These lands completely depend on rainfall for cultivation as the traditional rainwater harvesting and storage structures cannot convey water to these lands due to their higher elevation. As a result, the land remained fallow over time, unprotected from overgrazing leading to soil erosion and deprived the farmers of their livelihood. Hence, suitable measures should be identified to bring back the degraded lands back to cultivation.

Direct & Co-Benefits:

- ✓ More land area will be available for cultivation and the productivity will be increased in turn and food security will be ensured.
- ✓ Soil erosion will be controlled, and the soil health will be maintained.

AG/16: Organic farming including horticultural crops

- There is emphasis on increasing the area under organic farming and to adopt best practices such as crop diversification, relay cropping, conservation tillage, bench terracing, vermi-composting, green manuring, cover cropping, mulching, agroforestry, etc. to reduce the use of fertilisers, as this would lead to a good soil health and reduction of green-house gas emissions in the atmosphere. There will be nutrient application based on soil health card and readings of leaf chart to avoid overuse of certain fertilisers and provide balanced nutrients to crop.

Direct & Co-Benefits:

- ✓ Reduction in greenhouse gas emissions and increasing carbon sink.
- ✓ Improved soil health.
- ✓ Agriculture and horticulture products with good quality and will fetch premium price and will increase the income of the farmers

5. Water conservation strategies

AG/17: Research on conjunctive use of Irrigation water

- Conjunctive use of surface and groundwater consists of harmoniously combining the use of both sources of water in order to minimize the undesirable physical, environmental and economic effects to optimize the water demand/supply balance.

Direct & Co-Benefits:

- ✓ More water available for crop production
- ✓ Mimeses the crop production risk in the event of climate change

AG/18: Increase the use of Micro Irrigation technology Viz., drip, Sprinkler, Rain gun, Mobile Sprinkler in dry land, Garden land and Horticultural farming system

- Micro-irrigation is the slow, frequent application of water directly to relatively small areas.
- A leading advantage of micro-irrigation is that non-beneficial evaporation is greatly reduced
- Ideal for terrain with problematic soils & water
- Saves labour cost

Promoting Micro irrigation to increase water use efficiency

Direct & Co-Benefits:

- ✓ More crop for every drop, early maturity, better quality & higher yield
- ✓ Increase in yield for more than 150 percent
- ✓ Mimeses the crop production risk in the event of climate change
- ✓ Saves water up to 70 percent and the saved water is used for expanding the area under irrigation



AG/19: Strengthening existing water harvesting structures and repairing and replacing the shutters in the irrigation tanks and drainage channels

- Water is a vital component that determines the full potential of agriculture sector of any State. Optimum development and efficient utilization of our water resources, therefore, assumes great significance. The practice of water harvesting in ponds / other structures and reusing the stored water for life saving irrigation of crops and for domestic purpose is important. Hence water harvesting structures should be repaired and properly maintained to hold more water without any seepage or percolation losses.

Direct & Co-Benefits:

- ✓ More water will be available for crop production and is assured even under changing climatic condition.

AG/20: Creation of additional farm ponds to capture the runoff water and utilise the harvested water during critical stages of crop growth and to recharge the aquifers to improve the quality of irrigation water

- A farm pond can capture runoff water, and it can provide water for livestock, household use, irrigation, firefighting, and orchard spraying. It can also offer fishing.
- Farm ponds have great potential to improve agricultural water security through the capture, storage, and provision of water for irrigation. Farm ponds can also supply a water source for frost protection, recharge groundwater, and provide a wide range of additional economic and environmental benefits
- Ponds can be filled by rainfall, as is common with farm that are sited at a low point and serve to collect runoff from the rest of the field. Alternatively, farm ponds can be filled with water lifted from underground sources, which can then be recycled. Ponds can also be filled by diverting canal water, offsetting water withdrawals during the dry season.

Direct & Co-Benefits:

- ✓ Farm pond provide water to start growing crops, without waiting for rain to fall. They provide irrigation water during dry spells between rainfalls.
- ✓ Bunds can be used to raise vegetables and fruit trees, thus supplying the farm household with an additional source of income and of nutritious food

AG/N/14: Solar driers and water pumping system for irrigation

- Solar dryers are equipment, generally of small capacity. Majority of the solar dryer designs, which are available, are used mainly for drying of various crops either for family use or for small-scale industrial production.
- Solar water pumps do not require any fuel or electricity to operate. ... Incurs low maintenance costs as solar water pumps have fewer moving parts as compared to a diesel-powered pump and thus, fewer chances of wear and tear

State specific Intervention: Installation of solar grid connected power plants in State horticulture and aquaculture farms to reduce consumption of electricity by water pumps

Aim of the Project: Involve private sector for financing 50 percent of the capital costs for installing 15 KW solar grid connected power plants in 10 horticulture farms on a pilot basis as planned by the Government of Tamil Nadu.

Climate Category: Mitigation

Proposed Activities:

- Involve private sector for financing 50 percent of the capital costs for installing solar grid connected power plants in the State
- Installation of energy meters to measure the energy production and consumption
- A total of 10 farms will be targeted through the project as per the plans of the government

Climate Benefits:

- Generation of 1,80,000 kWh of clean energy on an annual basis
- Estimated GHG savings of 168 tCO₂e per year
- Generate an annual revenue of INR 3, 28,390 by reducing the expenditure on electricity savings
- Generation of livelihoods during installation phase of power plants
- Increase in awareness levels about the benefits of solar power irrigation

Direct & Co-Benefits:

- ✓ Reduction in greenhouse gases

AG/21: Ensuring the livelihood of the farmers in non-delta districts having surface irrigation potential with piped irrigation network by providing collection wells at regulating structures to increase the cropping intensity with assured yield and employment opportunities

- As water scarcity is the most limiting factor for the non-delta regions, networking the collection wells through irrigation pipes so that water is equally distributed to enhance the crop production

Direct & Co-Benefits:

- ✓ Area under irrigation could be enhanced and the yield of crops could be improved.

8. Promotion of inland fishing and Brackish water Aquaculture

AG/30: Development of technology for improving inland fishing

- Introduction of culture technology for fast growing fishes viz., Amur Carp, Jayanthi Rohu, Genetically Improved Farmed Tilapia (GIFT) and Pangassius, dissemination of knowledge for its propagation and establishing hatcheries for these species.
- Effective brood stock management and replenishment through electronic tagging.
- Introduction of fish seed rearing in floating cages in water bodies.
- Adopting intensive cage farming in reservoirs.
- Creation of fish seed banks to ensure the availability of fish seeds throughout the year.

Direct & Co-Benefits:

- ✓ Fish production will be enhanced.

AG/31: Increasing fish production and fish farming area for rural livelihood through Inland Fisheries

- Adopting intensive cage farming in reservoirs.
- Encouraging farmers by providing subsidy for setting up offish/ prawn hatchery, fish culture in grow out ponds, feed mill and hygienic marketing infrastructure.
- Propagation of hatchery technology for the fast-growing fish species.
- Intensive fish culture in irrigation systems.
- Promoting fish culture in farm ponds.
- Expansion of fish culture area.
- Seed rearing in cages.
- Implementation of Blue Revolution schemes.
- Improving the infrastructure facilities for fish seed production both in Government and private sector.

Integrating fish culture in farm ponds/ multipurpose farm ponds with agriculture and allied sectors to provide additional income for farmers.

State specific Intervention: Integrated mangroves fishery farming system

Aim of the Project:

- To introduce integrated farming methods as a climate smart practice in the State to enhance the resilience of fisher community to climate change
- To convert saline areas that cannot be used for aquaculture into productive lands

Climate Category: Adaptation

Proposed Activities:

- i. Extensive earthen bunds will be constructed along the margin of the rivers/backwaters (marginal bunds)
- ii. Adequate number of sluice gates will be provided to regulate water level and to facilitate shrimp harvest
- iii. Suitable species of mangroves will be planted along the periphery of the marginal bunds to protect the bunds from damage due to heavy monsoon fall, waves, increase in water level and tidal surges
- iv. These integrated farming practices will be practiced in 120 individual units of 5 hectares each

Climate Benefits:

- i. Increase in the production of paddy and shrimps
- ii. Provide increased employment opportunities to the fisher community
- iii. Reclamation of land, improve soil quality and reduce coastal erosion as the organic farming will be implemented
- iv. Improve adaptive capacity of farmers
- v. Help in carbon sequestration and play a critical role in managing GHG emissions

Direct & Co-Benefits:

- ✓ Fish production will be enhanced.

AG/32: Undertaking Repair and Renovation of Government Fish Seed Farms/ Hatchery to increase fish seed production for fish farming

- Repair & renovation and creation of additional facility to Govt. Fish Seed Farm of Tamil Nadu to increase the fish production.
- Construction of new Govt. Fish Seed Farm.
- Development of quality brood stock with infrastructure facility for fish seed production.
- Establishment of MAGUR (Clarias Batrachus) Hatchery.
- Improvement of the existing trout hatchery farm.

Direct & Co-Benefits:

- ✓ Fish production will be enhanced.

AG/33: Improving inland fisheries for tank and its command areas under IAMWARM Project

- Popularization of technologies to improving inland fishing
- New breeds will be enhanced.
- FFDA, BFFDA, Reservoir fisheries development, fish culture in pens and cages, establishment of hatcheries.
- Fish seed is produced and supplied to the farmers.

Direct & Co-Benefits:

- ✓ Fish production will be enhanced.

AG/34: To increase per hectare production and encourage new species advocating Culture of SPF *Litopenaeus vannamei*

- There are about 1892 shrimp farms registered with CAA with the water spread area of about 3742 ha in Tamil Nadu.
- Financial assistance is given to small farmers to encourage the farmers to take up shrimp farming activities and thus increasing production.
- Aquatic Quarantine facilities are available for screening of brooders and post larvae.

AG/35: Culture of Sea bass

- Popularization of production technologies to improving brackish water aquaculture

Direct & Co-Benefits:

- ✓ Fish production enhanced.

7. Strategies for animal husbandry and dairy development sector

AG/36:Ensure year-round feed and fodder availabilityto meet fodder requirement in all possible ways. Unused lands in the villages could raise with leguminous fodder and the animal could be allowed for grazing

Direct & Co-Benefits:

- ✓ Fodder availability enhanced and the milk yield increased.

AG/37: Ensure adequate animal housing and dedicated ponds for bathing in villages to protect livestock from extreme heat

- Shelter is especially important for very young or old animals or animals that are in poor condition or sick.
- The best type of shelter during extreme heat protects the animals from the sun and allows for the cooling effect of wind.

Direct & Co-Benefits:

- ✓ Growth of the animal is better and milk yield is increased.

AG/38: Intensify disease surveillance and develop forecasting of disease outbreaks for short- and long-term time frames

- Animal disease forecasting is a management system used to predict occurrence or spread of disease and suitable methods to study disease using the epidemiological triangle i.e. Pathogen, environment and host.
- To minimize the impact of climate change on animal health and reduce the adverse effect of vector borne diseases, the State should carry out a study on impact of climate change in livestock and poultry population, ensure vaccination of farm animals against contagious diseases, deworming and early disease warning system, develop a breeding policy and use biotechnology to breed genetically climate resilient breeds of farm animals.
- Assistance to State for Control of Animal Disease (ASCAD) is a centrally sponsored scheme where centre shares 60 percent of cost of purchase of chemicals, vaccines, logistic items and 100 percent for trainings and seminars. Attempts should be made to minimize the occurrence of Foot & Mouth Disease (FMD), Black quarter, Classic Swine Fever (CSF), Haemorrhagic Septicaemia (HS) in livestock through timely

Vaccination, Sero-surveillance, free animal health camps and Mobile veterinary system.

Direct & Co-Benefits:

- ✓ Better control and prevention of diseases in animal.

AG/39: Promote breeding with indigenous varieties to improve resilience to climate change. High milk yielding exotic breeds are crossed with local indigenous breeds that have drought hardiness.

Direct & Co-Benefits:

- ✓ Growth of the animal is better and milk yield is increased.

AG/40: Promote dairy development by training women in villages

- Promote dairy development by training women in villages on animal care, animal disease reporting, and nutrition for optimising milk production at household level of small and marginal farmers and enabling them to participate in milk cooperatives.

Direct & Co-Benefits:

- ✓ Income of the farm women increases through better animal management.

8. Value addition and income generation

AG/N/15: Value addition to horticultural products (Neera, Moringa leaf powder, fruit processing)

- Value addition is a process of increasing the economic value and consumer appeal of a commodity
- Round the year as well as off season employment generation
- Surplus produces are effectively utilized.

Direct & Co-Benefits:

- ✓ Income of the farmers increased.

AG/N/16: Promotion of Integrated farming system for varied agro ecosystems

- Popularising the Integrated Farming System for wider adoption is needed as insurance against crop failures due to climate vagaries
- Identification of suitable components of IFS will help in maximizing the farm income under varied situation

Direct & Co-Benefits:

- ✓ Income of the farming community is increased and stabilized even under changing climatic conditions

Waste from one component of IFS is becoming input for other component and hence ensures waste recycling and thereby reduces the cost of cultivation.

State Water Mission

The description of activities below is based on mitigation and adaptation options. The activities that are named “WR” are old activities proposed under earlier TNSAPCC (2012-17) and will be continued in the coming years as per agreement of the nodal departments and those named “WR/N” are those activities which are newly proposed by the nodal departments.

WR/N/1 - Climate change adaptation programme in Cauvery Delta

Following activities will be taken up under this programme:

- a. This scheme will benefit an ayacut of about 4.50 lakh acres under Cauvery, Vennar, grand Anaicut canal systems and Lower Coleroon anaicut system in Thiruvuru, Nagapattinam and part of Thanjavur.
- b. Protection of coastal areas in the Cauvery Delta region
- c. Structures will be constructed to facilitate effective use of flood water through recharging ground water resources
- d. Preventing saline water ingress

WR/N/2 - Cauvery Modernisation Scheme Under the Accelerated Irrigation Benefits Programme (AIBP)

Following activities will be taken up under this programme:

- a. This scheme will undertake “Improvements and Rehabilitation of irrigation systems in Cauvery basin for efficient water Management”.
- b. This proposal aims at improving and rehabilitating the systems in the Cauvery Delta area such as Cauvery Sub-basin, Vennar Sub-basin, Lower Coleroon Sub-basin, Grand Anicut Canal Sub-basin and other systems of Kattalai High Level Canal Project, Lower Bhavani project, Noyyal Sub basin and certain other ground water recharge schemes.

WR/N/3 - Irrigated Agriculture Modernisation and Water- Bodies Restoration and Management (IAMWARM) Project

Following activities will be taken up under this programme:

- a. Under this project, modernization, rehabilitation and water management works were taken up in 5009 tanks located in 61 sub-basins spread over 26 Districts at a cost of Rs.2820.93 crore, benefiting an ayacut of 6.69 lakh hectare and about 5 lakh farmers.

State specific Intervention: Groundwater recharge through rejuvenation of irrigation tanks

Aim of the Project: To enhance the water use efficiency through ground water resources

Climate Category: Adaptation

Proposed Activities:

- I. Hydrogeological mapping of irrigation tanks and channels including potential for aquifer recharge and requirements of de-siltation and deepening of the structures; study of river flooding patterns
- II. Community engagement in maintenance of tanks and channels and monitoring of water flow during periods of flooding

Climate Benefits:

- I. Enhanced ground water levels.
- II. Increased availability in surface water.
- III. Control of flood impact.
- IV. Improvement in Agri-livelihood security.

WR/N/4 - Linking of Tamiraparani Karumeniyar And Nambiyar Rivers in Tirunelveli And Thoothukudi Districts

Following activities will be taken up under this programme:

- For inter-linking of Tamiraparani – Karumeniyar - Nambiyar rivers, by excavating a new flood carrier canal with a carrying capacity of 3,200 cusecs, from LS 6.5 km of existing Kannadian canal near Vellankuzhi Village to M.L.Theri near Thisayanvilai for a length of 75.175 km as per the revised alignment schedule is in progress. It is proposed to divert 2,765 MCFT of surplus flood water of Tamiraparani river.
- Water requirements of Sathankulam and Thisayanvilai Villages will be fulfilled.
- Ground water table in the vicinity of the project area will substantially be improved.

WR/N/5 – Desilting of dams and water bodies

Following activities will be taken up under this programme:

- Desilting in Vaigai, Pechipparai, Mettur, Amaravathy Reservoirs and Srivaikundam Anicuts will be taken up.
- This will increase the water holding capacity of the dam.
- Ground water recharge will also happen.

WR/N/6 – Desilting of Parappalar Reservoir

Following activities will be taken up under this programme:

- Desilting in Parappalar Reservoir will be taken up. The catchment area of the reservoir comprises huge hills with soil mounds and less vegetation cover with steep slopes. Due to this, the reservoir is more susceptible to siltation and the rate of sedimentation is quite high resulting in reduction of storage capacity by about 11percent.
- Desilting will increase the water holding capacity of the dam.
- Ground water recharge will also happen.

WR/N/7 – Desilting of Veeranam tank

Following activities will be taken up under this programme:

- This tank primarily fulfils the irrigation needs of the registered ayacut of 44,856 acres and in addition, it serves to augment the drinking water requirement of the Chennai city by supplying 78 cusecs of water depending upon the availability of water in the tank. Due to surplus flood inflows during monsoons, this tank silted up over a period resulting in considerable reduction in storage capacity.
- Desilting will increase the water holding capacity of the dam.
- Ground water recharge will also happen.

WR/N/8 – Dam Rehabilitation and Improvement Project (DRIP)

Following activities will be taken up under this programme:

- Under this project, 105 dams are proposed to be rehabilitated in the State. This includes 69 Water Resources Department dams and 36 TANGEDCO dams.
- In addition, catchment area treatment works will be taken up by the Agricultural Engineering Department in 2 reservoirs, viz., Krishnagiri and Kundah.

WR/N/9- Increasing Water Use Efficiency (WUE)

- a. Increasing water use efficiency is an important activity which will give multiple benefits and impacts. It will save irrigation water which is lost in a wasteful manner of release of water from irrigation projects.
- b. Continuous flow of water in canals leads to conveyance loss. Rotational system can be introduced to reduce number of days of flow in canals.
- c. Canal operational plans can be developed.
- d. More area will be brought under micro irrigation

State specific Intervention: Construction of rooftop water harvesting structures in government hotels

Aim of the Project: To support the State Government's efforts by constructing rooftop rainwater harvesting structures in government hotels

Climate Category: Adaptation

Proposed Activities:

- i. Assisting the Government of Tamil Nadu to formulate rooftop rainwater harvesting structures in government hotels
- ii. A total of 22 hotels have been identified to implement this project in collaboration with the government
- iii. The timeline of the proposed project is expected to be around 25 years

Climate Benefits:

- i. Improving adaptive capacity of population
- ii. Alternate use of harvested water in different activities will reduce the overall demand for water in the State

Forest & Biodiversity

The description of activities below is based on mitigation and adaptation options. The activities that are named "FR" are old activities proposed under TNSAPCC (2012-17) and will be continued for upcoming years as per agreement of the nodal departments and those named "FR/N" are those which are newly proposed activities by the nodal departments for the upcoming years under Forestry sector.

Strategy 1: Increasing the forest cover, both inside and outside notified forest areas through afforestation programmes as well as restoration of degraded forests

FR/ N/01: Increase the forest cover through massive afforestation programme in degraded forest lands of Tamil Nadu

Afforestation is necessary to combat the issues of global warming, soil erosion, pollution, and the maintenance of biodiversity and ecological balances. Trees acts as the natural air-purifiers and helps the environment as they use water and carbon-dioxide (CO₂) to convert it into organic matter (wood) and oxygen. Considering the need of afforestation in India, many governments, private and NGOs are engaged to create new forests through afforestation method to purify the environment, maximize the carbon capture, and control the soil erosion. Many trees are planted during the afforestation process. On one hand, it helps the environment by reducing the CO₂ level. On the other hand, the fruit bearing trees becomes the source of food for a large country like India.

FR/N/02: Increasing the green cover outside the forest area: Plantations in urban areas, industrial sites and recreational forestry

One-third of the geographical area should be under forest and tree cover as envisaged by the National Forest Policy (1988). In the State of Tamil Nadu, the scope for increasing the recorded forest area is very limited. Alternatively, to increase the forest and tree cover to one third of geographical area of the State, tree planting outside forest areas (TOF) needs to be taken up.

Over the years the air quality in the urban area has deteriorated and it may become a serious health hazard in the years to come. To counter it, there is a demand for increasing the green cover in urban areas. Tree plantations will be raised in the urban and surrounding areas under the Urban Forestry programmes with the objective of controlling the adverse effects of air, water and noise pollution and improving the aesthetic appearance of these areas. Vegetation plays a vital role in controlling pollution in urban and industrial areas as well as in land tracts, other than providing cooling of the heat island effect and sequestering Carbon as well. Urban greening is in many ways different from conventional planting in forest areas, as it requires special skills in nursery and planting, needs a selection of site-specific mixture of species, warrants longer periods of maintenance and aftercare, uses municipal watersheds not under the control of the forest department, applies multi-managerial system, and has to consider landscape design requirements.

State specific Intervention: Creation of forests in degraded/private lands

Aim of the Project: Improve the degraded lands in the State by increasing forest cover

Climate Category: Mitigation and Adaptation



Proposed Activities:

- i. The project will use the portions of degraded land along with private lands to increase the forest cover in Tamil Nadu
- ii. 380 hectares of area has been considered under the project
- iii. Acacia species has been identified for plantation.
- iv. It has been calculated that 1, 90,000 species would be required to cover the area under consideration.

Climate Benefits:

- i. Creation of carbon sinks
- ii. Maintenance of natural ecosystem
- iii. Provision of natural habitat for the biodiversity of the State
- iv. Generation of revenue from the sales of forest produce

FR/N/ 03: Promotion of social forestry, plantation in farmlands and current fallow, agroforestry and shelterbelt plantation

It is well known that the area of natural forests in Tamil Nadu has drastically declined in the recent years. Forest degradation has caused grave environmental problems, including reduction in rainfall. To manage the situation and to mitigate the ill effects of deforestation, trees need to be grown on non-forest land and afforestation and forest plantations need to be encouraged. Promoting social forestry including tree growing on homesteads, and other agro-forestry systems involving local people, rural communities and NGOs would be important to increase the green cover. Panchayat, revenue and other non-forest lands will be taken up for afforestation with suitable tree species under social forestry programme.

FR/N/ 04: Restoration of green cover in cyclone affected area.

Cyclones cause heavy damage to the green cover of the State. Gaja cyclone destroyed around one crore trees in Tamil Nadu. The cyclone hit area looks deserted. Hence, special programmes are launched by the Government of Tamil Nadu to restore the green cover in that area.



FR/N/ 05: Restoration of tropical dry evergreen forest (TDEF) in Nanmangalam reserved forest

Humans have altered the forests of urban regions drastically, thereby reducing the original forests to isolated fragments. Such fragments may contain remnants of the original vegetation. Nanmangalam Reserve Forest (NRF), located in the Metropolitan Chennai, Tamil Nadu, India, is an example of such a forest fragment, covering an area of 321 ha. A total of 449 angiosperm species belonging to 313 genera representing 83 families were recorded from NRF. Amongst the species, 79 percent were dicots and 21 percent were monocots. The most genera/species rich families were Fabaceae (37/69) and Poaceae (34/52). The species rich genera included *Cassia* (10), *Crotalaria* (7), *Eragrostis*, *Hedyotis* and *Phyllanthus* (6 each). Six endemic

species were recorded. This diversity amidst a rapidly expanding city has to be protected in order to enable the conservation agenda of urban areas.

FR/N/ 06: Raising Palmyrah palm plantation

Panaimaram (Palm tree) is the State tree of Tamil Nadu has been slowly vanishing from the landscape. Palmyra trees not only give economic benefits but also prevent soil erosion and help recharge the water table. Realizing the importance of Palm trees, Kovai Kulangal volunteers wanted to organize a drive to plant one lakh palm seeds to serve its full benefits in areas like riverbanks, pond bunds, forest borders, streams so as to arrest the depletion on water table. For this planting drive, people from other cities have come forward for supporting the cause. The scheme is under operation in Government and community land in Tamil Nadu for a period of five years from 2016-17 to 2020-21 sanctioned at a cost of Rs.1.38 crore and sanction was also accorded for an amount of Rs.25.00 lakh towards the implementation of the scheme during 2016-17 vide G.O.(MS).No.142, Environment and Forests (FR.-6) dated 29.11.2016.

FR/N/ 07: Mass production of seedlings of desired sandal clones through tissue culture technique

Naturally grown sandalwood trees are found in the Eastern Ghats of Vellore, Javvathi hills of Tiruvannamalai, Chitteri hill areas in Dharmapuri, Shervaroy, Bhodamalai and Kolli hills of Salem district, Pachamalai hill areas in Trichy and forest areas of Erode district. At present, meagre number of matured trees is available for extraction in these areas and a few hundreds of naturally grown sandalwood trees are there in Amirdhi and Kavaloor in Javvathi hills. Action is being taken to protect these trees from destruction and saved as mother trees for collection of seeds. Oil is available only in the sandalwood heartwood. Perfumeries, medicines, etc. are prepared from the sandalwood oil. Various types of beautiful artistic toys are manufactured from the heartwood. Further it has been utilized for devotional purpose. As the price of sandalwood oil is on the increase in the international market, sandalwood trees of Tamil Nadu were virtually destroyed by smuggling the sandalwood to the neighbouring States for years together. At present, small size seedling and saplings are found in patches in the naturally grown sandalwood areas. There is a possibility of harvesting sandalwood trees after 20 or 30 years, if they are protected well. To increase the sandal wood tree population, mass multiplication of desired sandal clones through tissue culture technique is being proposed.

FR/N/ 08: Raising teak plantations on Padugai lands

In Tamil Nadu, naturally grown teak trees and teak plantations are found in Sathyamangalam, Salem, Erode, Dharmapuri, Hosur, Theni, Madurai, Dindigul, Kanyakumari and Nilgiri areas. Extraction of trees including teak is not permitted in National Parks and Wildlife Sanctuaries. Felling of natural trees in RF has been banned to protect the environment and to cut teak for the supplying it to the temples for flag mast. The objective of the scheme is to create timber resources, to increase tree cover outside the Reserve Forests and to prevent soil erosion. Hence, teak plantations have been raised along the canal and river beds of Thanjavur, Dindigul, Madurai, Sivaganga, Thanjavur, Tiruvarur, Trichy, and Villupuram districts from the year 1956 and the trees that have aged over 30 years are being harvested every year as decided by the Government with a view to increase the revenue to the Government.

Strategy 2: Enhancing Biodiversity Conservation

FR/ 19: Collection, conservation and documentation of genetic resources in bioreserves for developing climate resilient varieties (Mapping of floral and faunal biodiversity at a high spatial resolution on GIS)

The main reasons for conserving PGRFA are to ensure the future adaptability of cultivars and wild populations; to preserve data and traits that ensure sustainable agriculture; to promote the

use of genetic resources in commerce and biotechnology; to conserve genetic diversity for cultural reasons. The potential and actual value of the different kinds of plants and their varieties is plant genetic resources (PGR). These resources play invaluable roles in different facets of life regardless of their source and origin. A large percentage of these resources have not been studied and are threatened by extinction due to the activities of earth dominant species. Thus, there is need to improve awareness of PGR. Conservation is the sustainable use of these resources to enable future generations benefit. They are utilized when they play roles that improve the wellbeing of humans. They can be sufficiently conserved through in situ and ex situ approaches. These are complementary and require an improved integrated approach. More so, there is need to understand varietal diversity to improve their utilization. A decentralized system should be in place to monitor the loss of existing PGR that have been evaluated. Focus should also be extended beyond existing crops and their wild and weedy relatives to cover all PGR on earth. Local efforts should be strengthened to play roles in conserving and utilizing these resources.

FR/ 14: Establishment of biodiversity corridors

Biodiversity corridors are areas of vegetation that allow animals to travel from one patch of native forest to another. A corridor provides shelter, food and protection from predators by imitating the structure and diversity of native vegetation. A study on the status and biotic pressure of corridors located in and around Mudumalai Wildlife Sanctuary and Sigur Reserve Forest of Tamil Nadu, Southern India was studied between December 1999 and March 2000. The primary objectives of the study were to assess the quality of these corridors in terms of vegetation structure and intensity of use by endangered animals with special reference to elephants and to quantify the dependence of the villagers on these corridors for fuelwood and cattle grazing. A total of 42 plant species were recorded in an area of 6.8 ha. Among them 57 percent of tree species was food items of elephants. *Anogeissus latifolia*, *Erythroxylum monogynum*, *Ziziphus mauritiana* and *Z. xylopyrus* was common species in all corridors. The ground cover was barren in most of the corridors. Grass, herb and weed was found in equal ratio in two corridors. Signs of lopping and wood cutting were found in 27 tree species recorded from all corridors. Among them, 15 species were food plants of elephants. The impact of human activity with reference to the extent of dependence on the corridors by villagers particularly intensity of lopping of trees was 35.3 D/ha. Wood cutting, cattle grazing, removals of cattle dung, electric fence, expansion of agricultural field and human settlements were observed to be a major threat in the five corridors. Elephants intensively used Masinagudi-Singara corridor. The greater attraction of elephants to this corridor is availability of Bamboo and perennial water sources. The Masinagudi-Moyar corridor was moderately used by elephants and in a similar fashion more. Such animal corridors should be identified and developed.

FR/N/ 09: Integrated development of wildlife habitats

The Cabinet Committee on Economic Affairs chaired by the Prime Minister Shri Narendra Modi has approved continuation of the Centrally Sponsored Umbrella Scheme of Integrated Development of Wildlife Habitats (CSS-IDWH) beyond the 12th Plan period from 2017-18 to 2019-20. The Scheme consists of Centrally Sponsored Scheme of Project Tiger (CSS-PT), Development of Wildlife Habitats (CSS-DWH) and Project Elephant (CSS-PE). The total outlay is Rs. 1731.72 crore as central share (Rs. 1143 crore for Project Tiger, Rs. 496.50 crore for Development of Wildlife Habitats and Rs.92.22 crore for Project Elephant) from 2017-18 to 2019-20. A total of 18 tiger range States, distributed in five landscapes of the country would be benefitted under the Project Tiger scheme. Similarly, for other two schemes, the coverage is entire country in case of Development of Wildlife Habitats (DWH) and 23 elephant range States for Project Elephant. It would foster wildlife conservation in general with specific inputs for tiger in Project Tiger area and elephant in Project Elephant area. Besides immense environmental benefits and effective implementation of tiger conservation inputs in and around tiger reserves

under Project Tiger, wildlife conservation inputs in Protected Areas & nearby areas under Development of Wildlife Habitats and Elephant conservation inputs in Project Elephant areas, the schemes would result in overall strengthening/ consolidation of tiger, elephant and wildlife conservation in the country. The schemes would address the human wildlife conflict effectively. Besides, the communities opting for voluntary relocation from the Core/Critical Tiger Habitat (6900 families) would be benefitted under Centrally Sponsored Scheme of Project Tiger (CSS-PT) and 800 families under Centrally Sponsored Scheme of Development of Wildlife Habitat. These schemes would generate employment opportunities resulting in economic upliftment of people in and around tiger reserves/ Protected Areas besides leading to reduction in natural resource dependency with substitution by clean energy use. It will generate direct employment of about 30 lakh mandays annually which shall include many local tribes besides non-tribal local workforce. People living in vicinity would also get indirect benefits. Local populace would get opportunities to serve as guides, driver, hospitality personnel and in other ancillary jobs. These schemes would foster imparting various skills towards making people self-dependent through various eco-development projects, thereby enabling them to go for self-employment. These schemes would result in resource generation through tourist visits, thereby fostering in securing tiger source areas and other areas important for wildlife conservation, besides being helpful in sustaining life support systems as well as ensuring the food, water and livelihood security. The implementation of the schemes would be done through the respective States in designated Tiger Reserves, Protected Areas and Elephant Reserves.

FR/N/ 10: Eco restoration and conservation of Pallikaranai Marshland

The Pallikaranai marshland is a unique freshwater swamp located within the Chennai metropolitan area. This wetland is situated in Perungudi, Pallikaranai and Thoraipakkam villages of Kancheepuram District.



Then Hon'ble Chief Minister of Tamil Nadu had directed to protect this marshland during 2002. Accordingly, the Government is pursuing action for 5 years to the tune of Rs.15.75 crore. Out of which an amount of Rs.9.17 crore were spent for the year 2011-12 to 2015-16 and this scheme was implemented at a outlay of Rs.1.48 crore for 2016-17. This scheme continued during 2017-18. Conservation Authority of Pallikaranai Marshland has been constituted to monitor all the activities. An area of 690.65 ha is under the control of Tamil Nadu Forest Department. Restoration activities like habitat improvement, protection, research, monitoring, publicity and awareness has been undertaken under the scheme. The activities will continue from 2018-2019 to 2022-2023 at a cost of Rs.165.68 crore under National Adaptation Fund for Climate Change.

FR/N/ 11: Conservation and management of Mangroves

In India, mangroves occur on the West Coast, on the East Coast and on Andaman and Nicobar Islands (see Map and Table), but in many places they are highly degraded. According to the Government of India (1987), India lost 40 percent of its mangrove area in the last century. The National Remote Sensing Agency (NRSA) recorded a decline of 7 000 ha of mangroves in India within the six-year period from 1975 to 1981. Some suggested actions for conservation and management of mangroves include the following:

- people's involvement in mangrove management on public lands and related benefits;

- programmes to raise people's awareness of the importance of mangroves, e.g. through films, exhibitions, newspapers, magazines, posters, stickers, brochures, banners, seminars, nature camps, birdwatching, study tours in the mangrove forests, establishment of mangrove parks in the mangrove areas close to towns, and the celebration of Mangrove Conservation Day, with essay competitions, debates and drawing competitions;
- incentives for sustainable management of mangroves on private and village community land;
- enforcement of environmental protection laws;
- research on problems related to pests and diseases and on appropriate management of the mangrove ecosystem;
- restoration and rehabilitation of degraded mangrove areas.

FR/N/ 12: Gulf of Mannar Biosphere Reserve protection

The Gulf of Mannar Biosphere Reserve covers an area of 1,050,000 hectares on the south-east coast of India across from Sri Lanka. It is one of the world's richest regions from a marine biodiversity perspective. The 117 hard coral species have been recorded in the Gulf of Mannar. In 1986, a group of 21 islets lying off the Tamil Nadu coast between Thoothukudi and Dhanushkodi was declared the Gulf of Mannar Marine National Park. The park and its 10 km buffer zone were declared a Biosphere Reserve in 1989. Marine biodiversity in coastal area are higher than in open sea because of the availability of greater range of habitats near the coast. On the other side, the loss of marine diversity and the threats are also higher in coastal areas because of conflicting use of coastal areas and relatively dense population. In order to ideally conserve the marine biodiversity, the conservation of habitat and seascape diversity must be integrated.

Strategy 3: Livelihood enhancement of forest dependent communities

FR/ 13: Conservation, development and sustainable management of medicinal plants

Western Ghats of Tamil Nadu are rich in medicinal plants. However, over exploitation of medicinal plants from forests could lead to depletion of these natural resources. There is a need for ex-situ conservation of medicinal plants to ensure sustainable supply of medicinal plants from areas outside natural forests. The forest department will continue to create opportunities for women empowerment in forest fringe villages by providing necessary training and know-how for cultivation and harvest of important medicinal plant species. Economically important species in demand will be raised and sold to needy agencies. The National Medicinal Plants Board is also supporting the State's endeavour in conservation of medicinal plants.

FR/N/ 14: Enrichment of Non-Timber Forest Product Resources in Forest Areas

The vast natural resources of India's forests, including non-timber forest products (NTFPs), such as medicinal and aromatic plants, leaves, fruits, seeds, resins, gums, bamboos, and canes, offer employment that provides up to half the income of about 25 per cent of the country's rural labour force. However, poor harvesting practices and over-exploitation in the face of increasing market demand are threatening the sustainability of these resources, and thus the livelihoods of forest-dependent tribal communities. This article analyses the role of NTFPs in livelihoods-improvement initiatives and considers recent initiatives intended to enhance their conservation and sustainable management. It recommends policies to optimise the potential of NTFPs, both to support rural livelihoods and to contribute to India's social, economic, and environmental well-being.

Strategy 4: Wildlife protection

Protected areas in Tamil Nadu cover 7073 sq.km, which is 30.92 percent of the State Forest area. There are 15 wildlife sanctuaries, 4 tiger reserves, 4 elephant reserves, 15 bird sanctuaries, 5 National Parks. The Arignar Anna Zoological Park is in Vandalur near Chennai spreading over an extent of 602 Ha. Since its establishment, this zoological park has emerged as a successful ex-situ conservation complex and a captive breeding centre for many endangered wildlife species like White Tiger, Lion Tailed Macaque and Nilgiri Langur.

Tiger being the top carnivore, the importance of its conservation lies in the fact that the presence of this predator is an indicator of the overall health of an ecosystem. Various measures to conserve Tigers and their habitats have been taken up by the Forest Department in the four Tiger Reserves viz., Kalakad- Mundanthurai Tiger Reserve in Tirunelveli district, Anamalai Tiger Reserve in Coimbatore and Tirupur districts, Mudumalai Tiger Reserve in Nilgiris district and Sathyamangalam Tiger Reserve in Erode district.

Tamil Nadu is one among the leading States implementing Project Elephant, pursuing scientific management and habitat conservation. Aiding for works relating to habitat conservation and protection including fire prevention, eco-development, improvement of water sources, tourism development, mitigating human wildlife conflicts and improvement of infrastructure facilities in the Tiger and elephant Reserves is required.

FR/N/ 15: Surveillance of forest and wildlife area through drone technology

Conservation drones are remote-controlled devices capable of collecting information from difficult-to-access places while minimizing disturbance. Although drones are increasingly used in many research disciplines, their application to wildlife research remains to be explored in depth.

FR/N/ 16: Drought relief measures

There was failure of both South-West and North-east monsoons during the year 2016-17 and there was 50 percent shortfall of rains in most of the districts of Tamil Nadu. Due to prevailing acute drought condition, there is water scarcity in all rivers, canals, streams in the Reserve Forest and Protected Areas. Due to this, percolation ponds, water holes, Check dams have dried, and fodders are not available in these areas. Because of this, the wild animals are likely to stray into the nearby patta lands, agricultural fields and in villages in search of water and food and thereby it leads to man-animal conflict in the form of crop and property damage, animal death due to heavy hit by vehicles and human death. There were 35 human deaths, 78 Elephant Deaths and 7 Tiger Deaths that were reported during the year 2016-17. Considering the drought situation in Tamil Nadu, Special Field Inspection was conducted in all Protected Areas and Reserved Forest Areas. Based on this, the Conservator of Forests, Virudhunagar, Madurai, Coimbatore, Dharmapuri, Dindigul, Vellore, Tirunelveli, Trichy and Villupuram Circles have sent drought relief proposals for the following works for an amount of Rs. 5.00 crore.

- Supply of Water through tanker lorries into the water troughs in the Forests
- Creation of new water holes.
- Maintenance of water holes, percolation ponds and check dams.
- Desilting of percolation ponds.
- Sinking of borewell with motors energized by solar power.,
- Fire control measures due to severe drought situation.
- Driving menacing animals into the deep forests with the help of Anti- poaching watchers to prevent man animal conflicts.

Strategy 5: Lower strata diversification

FR/ 26: Large scale field testing of different forest species for lower strata diversification in different agroclimatic zones

Vertical classification of vegetation in a forest showing the tree, shrub and herbaceous layers and the forest floor. Stratification in the field of ecology refers to the vertical layering of a habitat; the arrangement of vegetation in layers. It classifies the layers of vegetation largely. The canopy is the top layer that covers most of the forest. The middle level is called the understory, and the bottom level is called the forest floor. Giant trees called emergents poke through the top of the canopy. A layer of small, shade loving trees, bushes, and vines grow in the understory. It is important to identify the most suitable species for the lower strata in different forest ecosystems over Tamil Nadu.

FR/N/ 17: Creation of fodder resources and improvement of wildlife habitats

With a view to restrict the elephant movement within the forests, activities like raising green fodder bank inside the Reserved Forest areas, providing salt licks to meet the micro nutrient requirements of the elephants, creation of water holes, construction of check dams and percolation ponds to meet their water demand in summer season have been undertaken. The Government have sanctioned Rs.20.87 crore for implementation of this scheme for a period of five years from 2011-12 to 2015-16. During 2014-15, this scheme was implemented at a cost of Rs.4.17 crore. It continued with an outlay of Rs.2.74 crore during 2015-16. The scheme is proposed to continue during 2017 – 2022 also.

Strategy 6: Management of Forest fires and alien invasive species

FR/ 29: Programmes for removal of Lantana and Prosopis from dry forest

Lantana is one of the world's worst weeds of South American origin that threatens native biodiversity of forest ecosystems across India. It was introduced into India as a garden ornamental and or a bio hedge plant in the early part of the 19th century and now it has virtually invaded all the tropical and subtropical regions of India. Although attempts have been made to control Lantana by physical, chemical and biological methods, there is no success either in its control or the prevention of its spread. No effective management strategy is yet available for the containment of this obnoxious alien weed. Based on critical assessment of the biological and ecological attributes of Lantana that enabled it to overcome all the existing management practices, we have developed a new management strategy. The new strategy involves (i) its removal by cut rootstock method, (ii) weeding of saplings from beneath the trees used for perching by generalist birds that disperse the seeds throughout their home range and from surface drainage channels originating from the area covered by such trees and (iii) ecological restoration of weed-free landscapes, preferably to the grass-land, or forest communities according to the needs of stakeholders to prevent reinvasion of the same species or secondary invasion by another alien species.

The forest department took the decision to remove the Prosopis Juliflora as the plants have started affecting the growth of the other plants in the forests because the species suck out huge quantities of water for its growth. During the drought period, the impact used to be extremely worse. "It is also not conducive as a fodder crop for the wild animals since its leaves are thorny. Due to its presence to an extent of about 80 per cent of the reserved forest areas spread over 970 ha in Amaravathi and Udumalpet ranges, there is no other option but to cut down these plants"

FR/ 29: Programme for phased removal of wattle from Shola ecosystem in the hills

Wattle is popularly known as seemai karuvellam or prosopis juliflora, not many people know that there is another exotic species of trees slowly invading the shola forests in Palani hills and the Nilgiris. Scientists from the Institute of Forest Genetics and Tree Breeding (IFGTB) are mapping

out the spread of wattle trees (*Acacia mearnsii*) and the extent to which it has invaded the above-mentioned forests.

IFGTB's geo-informatics department has begun working on a three-year project to map the spread of wattle trees in Palani hills and the Nilgiris. Wattle trees were planted by the forest department across forest regions and hills in late 1950s and early 1960s to cater to the need for tanning barks.

"Till the 1990s, the trees were harvested regularly and aggressively to cater to the leather industry's demands. But once leather factories moved to the use of chemical dyes, the department stopped harvesting them. "As a result, these huge trees which produce thousands to lakhs of seeds, which get dispersed with the help of animals, began spreading easily, at the cost of other trees". Hence, they need to be controlled and eradicated in a phased manner.

FR/N/ 18: Awareness creation and capacity building on forest fire control as well as escaping from the forest fires

Fire is a natural part of both forest and grassland ecology and controlled fire can be a tool for foresters. Hazard reduction or controlled burning is conducted during the cooler months to reduce fuel build-up and decrease the likelihood of serious hotter fires. Forest fires always start by one of two ways - naturally caused or human caused. Natural fires are generally started by lightning, with a very small percentage started by spontaneous combustion of dry fuel such as sawdust and leaves. On the other hand, human-caused fires can be due to any number of reasons. Awareness needs to be created for the control of forest fires and dos and don'ts when there is forest fire.

Strategy 7: Research component in Forestry sector

FR/ 32: Estimating mitigation potential of forest in Tamil Nadu

Trees play an important role in the removal of carbon dioxide from the atmosphere. Through photosynthesis, carbon dioxide is taken in by trees and stored as carbon in the trunk, branches, leaves and roots. Carbon is also stored in the soil and indeed this is a major sink for carbon in the forest. Decay of the organic material eventually releases the CO₂ back to the atmosphere, and providing the forests are sustainably managed, it is taken up by replacement trees, thereby maintaining a balance in the carbon budget. The release of CO₂, however, can be delayed through the harvesting of trees as they mature if the wood is used for construction, furniture and other end uses that prolong its life. Sustainable forestry is positively contributing to the carbon sequestration and is an important management tool in combating climate change.

FR/ 34: Valuation of bio resources in Forest ecosystem

Biological resources are life generated materials and processes which are naturally and sustainably renewable and biodegradable. As such, biological resources fulfil man's essential, fundamental needs: food, feed, bioactive molecules, fuel, shelter, fibre, bioremediation etc. They play a key role in present and future socio-economic evolutions. Hence, Valuation of bio resources in Forest ecosystem is an important activity that is suggested in the plan.

FR/N/ 19: Sustainability of afforestation activities using carbon financing options

Compensating developing countries for reducing emissions from deforestation under forthcoming climate change mitigation regimes are receiving increasing attention. These reduced carbon emissions are converted as credits and traded on international carbon markets. Even moderate decreases in deforestation rates could generate huge benefit annually for tropical forest conservation. Providing enough incentives while only rewarding deforestation reductions, addressing risks arising from forest degradation and international leakage, and ensuring permanence of emission reductions are important elements of carbon trading. In addition to climate mitigation, these generated funds could help achieve substantial co-benefits for biodiversity conservation and human development.

FR/N/ 20: Impact of climate change on coral reefs and associated biodiversity

Marine and coastal ecosystem of Tamil Nadu support livelihood activities such as fishing, shrimp farming, salt pans, shipping and tourism. Livelihood activities and conservation of mangroves, coral reefs, mud flats, sand dunes, estuarine wetlands, salt marshes, sea grass meadows etc. are symbiotically related. These ecosystems are under pressure as a result of high population growth, unsustainable development, over exploitation of natural resources, loss of habitat, loss of biodiversity, pollution, and climate change. Therefore, there is an imperative need to conserve, protect and restore coastal and marine ecosystems, to ensure resilience and provision of ecosystem services.



Climate change is the greatest global threat to coral reef ecosystems. Scientific evidence now clearly indicates that the atmosphere and ocean are warming, and that these changes are primarily due to greenhouse gases derived from human activities as temperatures rise, mass coral bleaching happens. Additionally, carbon dioxide absorbed into the ocean from the atmosphere has already begun to reduce calcification rates in reef-building and reef-associated organisms by altering seawater chemistry through decreases in pH. This process is called ocean acidification. Climate change will affect coral reef ecosystems, through sea level rise, changes to the frequency and intensity of tropical storms, and altered ocean circulation patterns. When combined, all these impacts dramatically alter ecosystem function, as well as the goods and services coral reef ecosystems provide to people around the globe.

Strategy 8: Capacity building on climate change for integrating CC in forest ecosystem governance

FR/ 39: Seminars and trainings for scientists and researchers to meet the challenges of climate change

Climate change is expected to create problems that were not experienced before. Hence, the scientists and researchers need to be trained and their capacity need to be built in managing the forest ecosystem.

FR/N/ 21: Capacity building programmes to JFM groups, Farmers in fringe villages, NTFP collectors, Forest officials and other stakeholders on sustainable forest management

Capacity building programmes also need to be organized for the JFM groups, Farmers in fringe villages, NTFP collectors, Forest officials and other stakeholders on sustainable forest management.

FR/43: Eco-restoration and conservation of wetlands

The State Government is committed to protect the Pallikaranai marshland which is a unique freshwater swamp located within the Chennai Metropolitan area. Conservation Authority of Pallikaranai Marshland has been constituted to monitor all the activities. An area of 690 ha is under the control of Tamil Nadu Forest Department. Restoration activities like habitat improvement, protection, research, monitoring, publicity and awareness need to be done.

Wetlands ensure proper functioning of water cycle by providing critical feeding, nesting and breeding habitat. Wetlands are a major source of livelihood. They act as important carbon sinks, nutrient transformer and a repository of rich genetic material. Wetlands are also an important attribute of our cultural heritage. India is also a signatory to the Ramsar Convention on Wetlands.

The total Wetland area in Tamil Nadu is about 9,02,524 Ha comprising 6.92 percent of the geographical area of the State. At present there are 15 wetlands which have been notified as wildlife sanctuaries under Wildlife Protection Act, 1972 for protection of Wildlife including birds.

FR/44: Community wasteland development programme

Development of wastelands mainly in non-forest areas aimed at checking land degradation, putting such wastelands of the country to sustainable use & increasing bio-mass availability especially that of fuelwood, fodder, fruits, fiber & small timber. Government of India is taking up this colossal task through its integrated wasteland development project scheme (IWDP) by revitalizing & reviving village level institutions & enlisting people's participation. It is people's own programme which aims at giving them actual decision-making powers in terms of project implementation & fund disbursement. It is one programme which is making sincere efforts towards the empowerment of the people so that a sense of collective responsibility can be evolved among them.



FR/45: Development of wildlife sanctuaries

Tamil Nadu has been pioneering in conservation of wildlife and protected area management. Overall 30.92 percent (7073 sq. km) of the State's forest area is under protected area against the norm of 25 percent. In all 5 National parks, 15 Wildlife sanctuaries, 15 bird sanctuaries, 2 conservation reserves and 4 Tiger Reserves have been established in the State. The State is having unique distinction of having 3 Biosphere Reserves known for rich and unique biodiversity. The Western Ghats are one of the 25 global hotspots and one of the 3 mega centers of endemism in India. Four Elephant Reserves are located within the landscape of Tamil Nadu.

FR/46: Establishment of advanced institute of wildlife conservation and tribal welfare school

Tamil Nadu is rich in its floral and faunal diversity and is a pioneering State in terms of conservation measures carried out. However, the State faces various issues in wildlife conservation, i.e., human wildlife conflict, threats of extinction of endangered species, inadequate handling of wildlife crime investigations, inadequate capacities for wildlife monitoring, climate change impact on marine species and its ecosystem, etc., Some of these problems could be addressed by effective research and investigation inputs. Therefore, the need to focus on wildlife research becomes pertinent



FR/47: Forest communication – Roads

Tamil Nadu is rich in its floral and faunal diversity and is a pioneering State in terms of conservation measures carried out.

FR/48: Project elephant

Elephant is the largest terrestrial mammal of India. Elephant being wide ranging animal requires large areas. The requirement of food and water for elephants are very high and therefore their population can be supported only by forests that are under optimal conditions. The status of elephant can be the best indicator of the status of the forests. Tamil Nadu is one among the leading States implementing Project Elephant, pursuing scientific management and habitat conservation. Project Elephant scheme is implemented in four Elephant Reserves. These Elephant Reserves have no separate legal status. This scheme is being implemented to protect the elephants and improve their habitats. The scheme also includes payment of compensation to farmers for the crop damages and loss of human lives caused by human wildlife conflict and further to take necessary steps to minimize such conflicts.



FR/49: Project Tiger

Tiger being the top carnivore, the importance of its conservation lies in the fact that the presence of this predator is an indicator of the overall health of an ecosystem. Various measures to conserve Tigers and their habitats have been taken up by the Forest Department in the four Tiger Reserves viz., Kalakad- Mundanthurai Tiger Reserve in Tirunelveli district, Anamalai Tiger Reserve in Coimbatore and Tirupur districts, Mudumalai Tiger Reserve in Nilgiris district and Sathyamangalam Tiger Reserve in Erode district. The scheme provides assistance for works relating to habitat conservation and protection including fire prevention, eco-development, improvement of water sources, tourism development, mitigating human wildlife conflicts and improvement of infrastructure facilities in the Tiger Reserves.

FR/50: Women empowerment and medicinal plants

The traditional knowledge of medicinal plants has mostly diminished in the present generation. Medicinal plants are an integral part of the Indian heritage. Medicinal Plant resources are dwindling and threatening both, health care practices and livelihoods of the local communities. Taking stock of the situation, the Tamil Nadu Forest Department has taken steps to implement schemes for conservation, development and sustainable management of medicinal plants. The scheme of Conservation, Development and Sustainable Management of Medicinal Plants is being implemented through Forest Department with the assistance from National Medicinal Plants Board, New Delhi. Western Ghats of Tamil Nadu are rich in Medicinal Plants. However, over exploitation of medicinal plant from forests could lead to depletion of these natural resources. There is a need for ex-situ conservation of medicinal plants to ensure sustainable supply of medicinal plants from areas outside natural forests. The forest department will continue to create opportunities for women empowerment in forest fringe villages by providing necessary training and know-how for cultivation and harvest of important medicinal plant species. Economically important species in demand will be raised and sold to needy agencies. The National Medicinal Plants Board is also supporting the State's endeavor in conservation of medicinal plants.

Coastal Area Management

The description of activities below is based of mitigation and adaptation options. The activities that are named “CAM” are old activities



proposed under TNSAPCC (2012-17) and will be continued for upcoming years as per agreement of the nodal departments and other set of activities are named as “CAM/N” that are newly proposed by the nodal departments for the upcoming years under coastal area management sector.

CAM/10- Artificial reef deployment for protection of Vaan Island; Coral and seagrass rehabilitation in GOM; Biodiversity survey in GOM to update status of coastal habitats; and eco development activities

The decrease and whitening of fragile marine ecosystems pose a great threat to the biodiversity as well as the livelihood of the region owing to their ecosystem services. Therefore, conservation measures must be opted for, in order to reclaim the natural habitats or create a similar ecosystem which can support the organism's dependent of the functioning of the same. Artificial reefs are installed in the coastal habitats, in order to increase the fish and invertebrate population in wild and which will also act as an alternative fishing ground, relieving pressure of over-fished reefs. Such projects are a part of work conducted by Central Marine Fisheries Research Institute (CMFRI) and Suganthi Devadason Marine Research Institute (SDMRI).

CAM/26- Strengthening Rainwater Harvesting

Seawater intrusion is a problem faced by coastal communities, making the water unfit for domestic use. The movement of seawater into freshwater can be a result of both decrease in groundwater or increase in seawater levels. The impacts involve salinization of lower levels of coastal aquifer and when freshwater is rapidly pumped out, the height of freshwater in the aquifer lowers, thereby saltwater comes out of the source. In order to cope up with the issue, rainwater harvesting at household level must be given priority and importance and the same has been operationalised by Rural Development and Panchayati Raj (RD&PR) department.

CAM/31- Ensure Livelihood of Fishermen

The coastal range of Tamil Nadu supports numerous fishing communities, that are directly dependent on marine resources for their survival and livelihood. Range of natural hazards and the issue of sea level rise restrict their livelihood opportunities and makes them vulnerable to impacts of climate change. Therefore, livelihood alternatives can be introduced along with financial support and settlements for better resilience to hazards and economic losses due the same. Such activities are taken up by the Fisheries Department and Gulf of Mannar Biosphere Reserve Trust (GoMBRT).

CAM/N/1- Protection of Koswari and Appa Islands in GOM from erosion

Erosion is a major threat to coastal regions as well as islands, more so in the islands, as they hold a unique floral and faunal diversity. With sea level rise as a determinant outcome of climate change, these small pockets of land must be protected through the application of soft infrastructure. These islands in Gulf of Mannar (GoM) are also important hotspots for tourist population and their sustenance will determine the economic return to individuals involved in tourism sector. The project is a Green Climate Fund sponsored project for the State of Tamil Nadu

CAM/N/2- Integrated Coastal Zone Management(ICZM)

An ecosystem-based approach for sustainable utilisation of coastal resources as well as conservation and protection of the same is what constitutes the Integrated Coastal Zone Management. The vast coastal range of the State other than providing ecosystem services, is highly vulnerable to the impacts of climate change. The projects funded by World Bank are taken by the Department of Environment (DoE) to address this issue.

CAM/N/3- Preparation of ICZM Plan including Coastal processes studies for Shoreline management for Cuddalore-Thoothukudi Tamil Nadu

The coastal districts of the State with varied population and geographical dynamics are studied in the Integrated Coastal Management for continuous monitoring of weather phenomenon as well as strategies to cope up with the same. For the same purpose coastal zone Maps are also produced for individual districts to have individual as well as holistic view of the State and the subsequent sectors. The concerned project be funded by World Bank/ MoEF&CC and will be prepared by NCSCM.

CAM/N/4- Addressing coastal erosion in identified sectors using soft engineering methods at selected locations in Nagapattinam district

Coastal erosion being a major threat to coastal districts of the State also brings about other challenges for the residing community, like loss of land resources, salt-water intrusion, degradation in crop productivity, increased vulnerability to submergence. These can be mitigated through the support of soft engineering methods, like geotubes plantation of indigenous or mangrove species, that would help bind the land, restoration of seagrass bed, which also acts as barrier to strong sea winds. The concerned project has been proposed to Ministry of Environment, Forest and Climate Change (MoEF&CC) under ICZM phase II and would be conducted and implemented by Public Works Department (PWD) after receiving funds.

CAM/N/5- Establishment of Sea Turtle Conservation Centre in Nagapattinam

Nagapattinam is a hatching site for Olive Ridley Turtles, a marine species of greater importance, as it establishes a fundamental link in marine ecosystem and thereby helps in maintaining a healthy coral reef and seagrass bed ecosystems. Climate change can pose as a major deterrent for the growth of sea turtle population, as the warmer temperatures disrupts normal sex ration and their foraging grounds. The project aims towards establishment of a conservation camp in order to protect the nesting sites, the eggs/hatchlings from human and/or domestic or wild animals and collection of eggs and translocation to hatcheries. This project has been proposed to MoEF&CC under ICZM phase II and would be conducted and implemented by DoE/ Forest Department after receiving funds.

CAM/N/6- Proposal for funding support to conservation and management of Gulf of Mannar Marine National Park & Gulf of Mannar Biosphere Reserve

Gulf of Mannar homes the world's richest concentration of marine species, which is under extreme threat due to habitat fragmentation, over-harvesting of marine resources and anthropogenic pollution. The conservation and management of such bio-rich zones can be initiated through a sustainable community led coastal area conservation involving soft engineering strategies. The outcome will be beneficial both for the existing biodiversity as well as community livelihood. This project has been proposed to MoEF&CC under ICZM phase II and would be conducted and implemented by DoE/ Forest Department after receiving funds.

CAM/N/7- Eco restoration of Sacred groves in Cuddalore and Nagapattinam Districts

Sacred groves are a vast repository of traditional knowledge on local biodiversity, which has potential of a way through for conservation and protection of the existing biodiversity. The ecological values provide a strong relationship between biophysical ecosystem and socio-economic institutions, with strong cultural relations that binds all together. These are important to be preserved and maintained for future purposes and the project also aims towards capacity building of knowledge transfer of these scared groves. The project is to be carried out by MSSRF in the coastal districts of Tamil Nadu. The project has been proposed to MoEF&CC under ICZM phase II and will be carried out by M S Swaminathan Research Foundation (MSSRF) after receiving funds.

CAM/N/8- Monitoring of coastal and transitional waters of Tamil Nadu under ICZM

Owing to the natural vulnerability in coastal regions, the monitoring of coastal and transitional waters is intrinsic part of Integrated Coastal Zone Management. Real time monitoring of onset of cyclonic depression, landfall and dispersion of cyclone is to be monitored to facilitate Disaster management. The project aims at continuous monitoring of coastal parameters and capacity building of local communities, to be carried out by the Institute of Ocean Management, Anna University and Department of Environment. The project has been proposed to MoEF&CC under ICZM phase II and will be carried out by Institute for Ocean Management (IOM) after receiving funds.

CAM/N/9- Integrated Solid Waste Management for Municipal Solid Wastes of Keelakarai Municipality

Solid waste generation and disposal pose a greater threat to the coastal ecosystems and the marine resources. An Integrated management system must be established for proper handling of solid waste and restrict their mixing and accumulation in freshwater. This initiative is proposed to MoEF&CC under ICZM phase II, to be implemented by DoE/ Commissionerate for Municipal Administration (CMA) after receiving funds.

CAM/N/10- Construction of Micro-compost centre for Municipal Solid Waste Management of Kayalpattanam Municipality

Solid Waste Management being a common issue in coastal regions and the local communities residing in such regions can be treated locally by the help of composting methods. Temperature in the State is always high owing to its tropical location and that can be utilised for treating solid waste. Household level or community level compost centres can be established in order to accumulate and manage the waste and generate compost naturally, which can later be used for agricultural purposes. This initiative is proposed to MoEF&CC under ICZM phase II, to be implemented at local levels by DoE, with the help of respective CMA after receiving funds.

CAM/N/11- Construction of Vermi-Shed at Compostyard in Nagapattinam

The issue of extensive generation of domestic waste product can be settled by treating the waste products through vermiculture. The temperature in coastal areas also supports the vermiculture process, which will be beneficial to tackle the issue as well as generating compost for further use in agro-practices. This initiative is proposed to MoEF&CC under ICZM phase II, to be implemented at local levels by DoE, with the help of respective CMA after receiving funds.

CAM/N/12- Construction of 2 Micro Compost Centres in Sannathi street, Vedaranyam Municipality

Investment in Compost centres have proved to be an efficient intervention when it comes to manage domestic or community generated waste products. On the one hand, the composting initiative will restrict the intermixing and accumulation of waste in water bodies or marine ecosystems and on the other hand, the same waste can be converted into compost and utilised for agricultural practices. The project has been proposed to MoEF&CC under ICZM phase II and will be implemented by CMA under DoE after receiving funds.

CAM/N/13- Solid Waste Management in selected fishing harbours in Tamil Nadu

Water pollution through improper handling of domestic and industrial wastewater release is the main cause of water pollution in coastal areas. The impacts are detrimental, like decreased survival rate of marine species, degradation of coral reefs and seagrass beds. The inter-mixing of polluted water with seawater can also result in reduced carbon sequestration of the ecosystem. Therefore, an organised Solid waste management unit or strategy can be adopted by the coastal districts and respective municipalities by monitoring the release of water into sea. The project has been proposed to MoEF&CC under ICZM phase II will be implemented under DoE after receiving funds.

CAM/N/14- Proposal for Faecal Sludge Management in Coastal Towns in Tamil Nadu

The issue is related to disposal of Faecal Sludge pose a threat to marine ecosystem as they interfere with the natural water quality, suitable for marine life growth and survival. A management plan to check the concentration of faecal matter and related micro-organisms in the domestic wastewater before its release in river channels is to be implemented. The project has been proposed to MoEF&CC under ICZM phase II and will be implemented by CMA under DoE after receiving funds.

CAM/N/15- Establishment of Sewage treatment facility in Mandapam

Sewerage is an issue that is accompanied with rapid urbanisation in the Coastal regions. Due to ill-management of sewerage and drainage system, the city experiences urban flash floods, which causes intermixing of sewerage and sea water, thereby modifying the natural marine conditions. The project is being proposed to MoEF&CC under ICZM phase II and will be implemented by Tamil Nadu Water Supply and Drainage Board (TWAD) after receiving funds.

CAM/N/16- Hatchery Production and Sea Ranching

The Olive Ridley sea turtles are important species in the environmental food chain and provides varied ecosystem services like supporting the mangroves and seagrass bed ecosystem. There is an urgent need to protect, conserve and enhance their population viability, which can be administered by supporting the hatching of turtle eggs, on spot or externally under similar conditions. The project has been proposed to MoEF&CC under ICZM phase II will be implemented under DoE after receiving funds.

CAM/N/16B- Hatchery Production and sea Ranching

As marine resources are depleting, there is an urgent need to implement resources are depleting, there is an urgent need to implement appropriate management measures to sustain the fish production. Hence, in this project it is proposed to sea ranch two commercially important species viz., *Penaeus monodon* (Block Tiger Shrimp) and *Rachycentron canadum* (Cobia) and one ecologically important species *Fenneropenaeus indicus* (Indian Prawn). This project has been proposed under ICZMP phase II and the total Project cost is 10.50 crores

CAM/N/17- Capacity building for integrated coastal zone management of Tamil Nadu

Capacity building to local fishing communities, dissemination of climate change knowledge and coping strategies are essential components of Integrated Coastal Zone Management. The strategies imbibed will support livelihood and increase resilience to climate change hazards. Activity specific Capacity building programmes are to be initiated and implemented at a sectoral or departmental level for better outcomes. The project has been proposed to MoEF&CC under ICZM phase II will be implemented under DoE along with Environmental Information System (TN ENVIS), IOM and Centre of Advanced Study in Marine Biology (CASMB), Annamalai University after receiving funds.

CAM/N/18- Preparation of local level Coastal Zone Management Plan in 1:5000 scale

District Specific Coastal Zone Management Plan to be prepared for specific district and community related issues. The project has been prepared by DoE through Institute of Remote Sensing (IRS), Anna University after receiving funds.

CAM/N/19- Promoting community-based mangrove restoration and conservation

Tamil Nadu has pockets of Mangrove vegetation along its coastline. The ecosystem delivers an array of ecosystem services, most importantly acts as a bio shield during cyclonic events, thereby protecting the inland areas. The ecosystem services also benefit the local community and their involvement in the conservation and protection of the same will bear better results. Community involvement will also generate livelihood options for the locals. The project proposal has been submitted to Department of Forest (DoF), which will be taken up by MSSRF, funded by MoEF&CC and DoF, Tamil Nadu.

CAM/N/20- Promoting Integrated Mangrove Fishery Farming System

The Pichavaram mangrove system hosts 67 species of fishes belonging to 51 genera and 33 families, indicating the richness of the concerned ecosystem. The detritus of mangroves acts as a feeding ground for fishes and that can be utilised for economic benefits. Plantation of mangroves will increase the breeding ground of the fish species and in a way, result in a biologically diverse zone. The project is still in proposal stage, to be implemented by MSSRF with funding support from MoEF&CC.

CAM/N/21- Integration of Tropical Dry Evergreen forest (TDEF) tree plantation with water management and livelihood enhancement

Plantation is the best possible soft engineering strategy that can be adopted in the coastal regions. They aid in carbon sequestration, enhance groundwater level, through their binding nature and provide habitat for other organisms. Proposal to be prepared by MSSRF for Green Climate Fund (GCF) Project to MoEF&CC.

CAM/N/22- Assessment of microplastics in coastal areas, estuaries and lakes in Tamil Nadu, to consider remedial and management actions for the improvement of environmental quality and benefit of socio-economic systems

Occurrence of microplastics in the environment is an intricate global issue with environmental, economic and health implications. Global production of plastic has increased over the past several decades on account of their lightweight, high durability, strength and low cost. Plastic is often the dominant type of pollutant in the aquatic environments. The plastics in the environment start to break down. Sunlight, wind, rain, and other natural factors play their roles in this process. The broken-down plastic particles get swept by rain into lakes, rivers, estuaries, and other large bodies of water. The quality of natural assets like the ocean and water bodies is degraded by plastic pollution; this negatively influences the socio-economic systems by changing the environmental quality which has health implications for future generations. Microplastics can also alter the physical conditions of the marine habitats. On sandy beaches, they can affect the permeability and temperature of the sediments when they settle on the matrix, with consequential effect for fauna which are temperature dependent for sex determination like the reptiles. Not only do the toxins in plastic affect the ocean but acting like sponges they soak up other toxins from outside sources before entering the ocean and water bodies. As these chemicals are ingested by animals (specifically the fauna that make up the fishery resources) in the ocean and water bodies, this is indirectly affecting the humans. Reports show that chemicals from microplastics can end up in human breast milk, urine and stool when humans consume products from the ocean, such as fish or sea salt. In India, studies and reports on microplastics are very limited in extent and number, and pollution due to microplastics has gained importance in recent years and therefore the present study is proposed to assess the microplastics pollution in the coastal areas, estuaries and lakes in Tamil Nadu. The results of this study would help to collect baseline data on the status of microplastics in selected coastal areas, estuaries and lakes of Tamil Nadu, based on which appropriate remedial and management actions can be considered. This project will be carried out between 2019-2021.

CAM/N/23- Establishment of a genetic garden of halophytes and halophyte farm

Saltwater intrusion is a major issue in coastal areas hampering agriculture and livelihood of coastal communities. The issue can be resolved by enhanced production of salt-tolerant varieties or halophytes in natural environment. There needs to be research on the viability of halophytes, their acceptance and economic benefits to the local communities. Therefore, a genetic garden with varied species of halophytes can be established for their performance check and capacity building of the farmers. Project proposal has been submitted by MSSRF, with funding sources yet to be identified.

CAM/N/24- Integration disaster resilience and marine bio resources enhancement through artificial reef

The coral reefs and their ecosystem services are always in threat due to increased anthropogenic intrusion as well as climate change. The Reefs support a varied range of organisms, which needs conservation. Considering the issues, artificial reefs are installed in the coastal habitats, in order to increase the fish and invertebrate population in wild and which will also act as an alternative fishing ground. The artificial reefs will also deliver the ecosystem service of providing resistance during storm surges and acts like a barrier to high velocity waves, as an intrinsic part of Disaster Management. Proposal for the respective project has been submitted by MSSRF to DoF.

CAM/N/25 - Promoting Fisher Friendly Mobile Application

The Application is aimed towards the fishing community, which can be used to disseminate information of fish stock rich area and early warning of cyclones and storm surges. The concerned activity will be taken up by MSSRF in the State.

CAM/N/26- Pilot testing of cultivation of saline tolerant varieties of paddy in the coastal saline soils

Saltwater intrusion is a major issue in coastal areas hampering agriculture and livelihood of coastal communities. The issue can be resolved by enhanced production of salt-tolerant varieties or halophytes in natural environment. There needs to be research on the viability of halophytes, their acceptance and economic benefit to the local communities. Therefore, a genetic garden with varied species of halophyte can be established for their performance check and capacity building of the farmers. Proposal to be prepared by MSSRF.

CAM/N/27- Shore Protection in Coastal ranges

Shore protection can be of two types, hard and soft engineering. Hard engineering involves any physical construction to restrict the entrance of seawater in inland areas like sea wall, groynes, etc. whereas soft engineering would involve plantation of trees that would naturally act as a barrier to strong surges and high velocity winds. The project involves the protection of shore in different districts by construction of RMS walls taken up by DoF.

CAM/N/28- Avert enhanced coastal erosion due to climate change and protect the coastal zone

- The project involves construction of fish landing centres at Chinnathurai & Eraviputhenthurai villages in Kanyakumari by Department of Fisheries. The project is taken up by DoF with funding support from National Bank for Agriculture and Rural Development (NABARD).
- Construction of Additional Groynes at Eraviputhanthurai village in Kanyakumari District and construction of fish landing centres in Pozhikarai, Kesavanputhenthurai and Pallamthurai in Kanyakumari District. The additional groynes work financially supported by National Agricultural Development Project (NADP) is taken up by DoF and is in a progress stage.
- Construction of short Groynes at Neerodi, Vallavilai and Marthandamthurai. By Department of Fisheries. Tenders for the project has been floated and work is under Progress
- Extension of existing groynes for 200 m at Mela Kadiyapattinam and Keezha Kadiyapattinam village and Dredging of bar mouth and basin area at Chinnamuttom Fishing Harbour in Kanyakumari District. Construction of short groynes 7 nos. at Chinnavilai village. Protection works to restore the coast to facilitate the berthing of fishing vessels/crafts at Thatheyupuram, Edappadu, Karunyapuram, Kottilpadu, Mandaikadupudhur, Periyavilai, Chinnavilai villages in Kanyakumari district. Providing Additional Leeward Breakwater and Protection works to restore the coast to facilitate the berthing of fishing vessels/crafts at Singaravelar Colony. Extension of Main Breakwater for 100m and Construction of Additional Quay wall along the Main Breakwater at Colachel Fishing Harbour along with Extension of Main Breakwater for 150m and Additional berthing facilities at Erayumanthurai side in Thengapattinam Fishing Harbour in Kanyakumari District is being planned. The project Detailed Project Report (DPR) has been submitted by DoF, which will be funded under the National Fisheries Development Board (NFDB).
- Protection works to restore the coast to facilitate the berthing of fishing vessels/crafts at Midalam, Mel Midalam, Helan Nager along with Construction of Fish Landing Centre at Puthenthurai village in Kanyakumari District. The project DPR has been submitted by DoF, which will be funded under the Fisheries and Aquaculture Infrastructure Development (FIDF).

- Construction of fish landing centres, Aruvikarai village, temporary bar mouth opening at Aattrangarai in Ramanathapuram district, extension of groynes to protect shores from erosion Periyathalai in Thoothukudi district and provision of infrastructure shoreline facilities, in the fishing villages of Ramanathapuram district and construction of protection wall to safeguard the fishing villages from sea erosion at Thangachimadam in Ramanathapuram district. The project DPR has been submitted to NABARD & FIDE for Funding by DoF.

CAM/N/29- Strengthen resilience of coastal communities in view of projected climate change

The local coastal communities are the most vulnerable section of the State as they face the preliminary impacts of any natural coastal hazards. Their poor economic condition makes them more vulnerable to such incidences. Therefore, there is a need to develop strategies that can be adopted by the local communities in order to adapt to the wrath of climate change, like shift to more resilient agricultural practice. The project DPR has been submitted by DoF, to be funded from State Budget.

CAM/N/30- Disaster Management Risk Project

Disaster Risk Reduction or Disaster Preparedness is an important aspect when it comes to coping up with the unprecedented climate hazards. There is a need for formulation of a sector specific Disaster Management Plan that can be implemented at community level for increased resilience to any disasters. The project is under consideration by State Ground Water Board (GWB).

CAM/N/31- Shoreline Management

The Project under Gulf of Mannar Biosphere Reserve Trust (GoMBRT) proposes comprehensive study in all the islands and protection measures for shoreline erosion, involving studies on wave dynamics and bathymetry along with assessment of Island status and mapping. A total of 21 islands would be studied including 2 submerged ones. The concerned Project is to be implemented by GoMBRT with financial support from State or Central Body.

CAM/N/32- Conservation Management

Conservation Management includes an array of activities. It involves Coral rehabilitation, maintenance and monitoring of degraded reefs around 7 islands (3 Islands in Vembar Group; 2 Islands in Kilakarai Group & 2 Islands in Mandapam Group), for which concrete frames/fish houses are being installed covering 2 sq.km. each year. Mangrove rehabilitation and maintenance in Mandapam, Kilakarai & Tuticorin Ranges. Survey and assessment of Seaweed diversity and abundance for baseline data and monitoring around GoM and area ranging from Rameshwaram to Tuticorin. Construction of anti-poaching sheds and watch towers in Mandapam & Kilakarai Group of Islands along with camping facilities, boats and communication network. Perambulation by patrolling teams using Smart phone and suitable applications. The activities are taken up by GoMBRT.

CAM/N/33- Coastal Livelihood Management

The proposed initiative would include Eco development activities for coastal communities, by supporting the existing Eco-Development Committees (EDC) of GoMBRT, where 252 EDCs are already present from Rameshwaram to Tuticorin and further funds will be utilised to strengthen the same. It would also involve a demonstration of seaweed cultivation mainly the Native species and its implementation through the EDCs. The activities are overviewed by GoMBRT.

CAM/N/34- Eco-tourism

GoMBRT will involve in providing infrastructure facilities like jetties for island and mainland, shelter sheds and other similar support in 1 island of both Ramanathapuram Tuticorin District. Also, the development of coral diversity zone (Corallarium), each of 0.25 sq.km. area in 2 selected islands for eco-tourism which would include maintenance and monitoring.

CAM/N/35- Institutional arrangements, knowledge base and capacity building for Conservation of Specialised Marine Ecosystem

Institutional arrangements would involve capacity building of frontline forest staff in snorkelling and SCUBA diving and other enforcing agencies in biodiversity identification. The activities will be conducted by GoMBRT.

Strategic Knowledge for Climate Change

The description of activities below is based on mitigation and adaptation options. The activities that are named “KM” are old activities proposed under earlier TNSAPCC (2012-17) and will be continued for upcoming years as per agreement of the nodal departments and other set of activities are named as “KM/N” which are newly proposed by the nodal departments for the upcoming years under energy sector. In Knowledge Management sector, all the activities are newly proposed with code “KM/N”.

KM/1- Create an enabling institutional framework for developing CSIS and disseminating strategic knowledge on climate change:

KM/1(a)-Establishing/Strengthening the State Climate Change Centre/Cell under NMSKCC (SCCC-NMSKCC) in the State of Tamil Nadu”

Strengthening of State Climate Change Centre/Cell is an activity of great relevance in order to enhance the activities relevant to Knowledge Management in the State. A unified body is required, solely for research on climate change impacts on various sectors involving natural resource procurement, trends of temperature change, awareness of various adaptation and mitigation strategies to cope up with the unprecedented consequences of climate change and dissemination of climate change knowledge amongst all the levels of society

Benefits & Co-Benefits-

1. Awareness creation at grass root level
2. Better preparedness for any climate induced natural disaster
3. Better and precise prediction of climate trends through enhanced research

KM/1(b)-Market Committee Staff, agricultural marketing, agri-business staff and farmers

In order to efficiently work on agricultural marketing and business, there needs to be informed working capital. The department is involved in providing training at each level of their process cycle, starting from the farmers, the intermediaries, end line users and implementing body.

Benefits & Co-Benefits-

4. Efficient Agri-business opportunity in the State
5. Livelihood generation at local level
6. Efficiency in farming techniques or climate smart agriculture for reduced vulnerability of the sector and subsequent economy

KM/N/1-State level campaign on climate literacy with focus on water conservation Water is a scarce resource in the State, because of the increased issue of salt-water intrusion in inland water bodies. In order to cope with the issue, there needs to be creation of awareness amongst

communities opting for agriculture to efficiently use and conserve freshwater. New strategies on climate resilient agriculture, water use efficiency, increased productivity can be disseminated amongst agricultural practitioners through trainings and support, in order to carry out their income generation activity.

Benefits & Co-Benefits-

1. Climate hazard and vulnerability awareness amongst vulnerable communities
2. Increased water use efficiency through awareness creation and knowledge dissemination
3. Promoting water resilient and climate smart agricultural practices

KM/N/2- Setting up of climate studio at centre for climate change and adaptation research, Anna university, as part of the Capacity Building Programme for Climate Change Adaptation

Proposal for a singular body working on climate change related to knowledge and capacity building. A research institute is mandatory to be involved for the same, owing to the immense knowledge repository. Students, working professionals and common people will directly be benefitted by this channelization of climate change causes and impacts information.

Benefits & Co-Benefits-

1. Capacity building at institutional level for public awareness
2. Extensive research on climate change adaptation strategies
3. Improved monitoring and evaluation of climate parameters of respective sectors in the State

KM/N/3- Providing training to farmers on Integrated farming system Tamil Nadu ranks 8th in “All India most rural populous State”, with agriculture as the main source of livelihood. This is heavily hampered by climate change phenomenon like sea level rise, saltwater intrusion, drought and cyclones. In order to combat the negative impacts of climate change and sustain livelihood, farmers are being trained for an integrated farming system. A breakthrough, where the farmer is less dependent on individual crop and has more adaptive capacity in terms of more resilient crop culture/species. This would also include the sustainable management of water resources and use of supplements that are non-toxic to the natural environment.

Benefits & Co-Benefits-

1. Awareness on Climate Smart Agricultural Practices
2. Enhanced productivity through awareness of organic farming
3. Water efficient agriculture
4. Livelihood generation components

KM/N/4: Training farmers on Organic farming cultivation practices

Organic farming is the most practiced in eco-vulnerable regions, which are regularly affected by climate change phenomenon. Horticulture provides a greater share of economic benefit to the State and farmers are to be trained to adapt to unprecedented weather phenomenon. Greenhouse construction are an important part of this strategy.

Benefits & Co-Benefits-

1. Enhanced crop productivity
2. Decreased soil and water pollution through the use of chemical fertilisers and pesticides
3. Reduced dependability of farmers on conventional farming methods
4. Water efficient agricultural practice for environmental sustainability

KM/N/5- For the years 2019-20 to 2021-22, 11 new crops (8 annual crops and 3 annual crops) are notified under Horticulture.

New crop varieties notified under Horticulture would increase the area under productivity as well as evolve new opportunities for farmers that will promote their economic growth. As the new varieties will be more climate-resilient, it will also ensure their sustenance and better adaptability against erratic weather instances. The strategy will also minimise the dependence of farmers on monocrop. Hence there will be increase in area coverage and a greater number of farmers will be benefitted.

Benefits & Co-Benefits-

1. Decreased dependability on monocrop for sustenance of livelihood
2. Enhanced Livelihood generation
3. Increased Food security at Local and State level

KM/N/6: Proposal to bring an area of 8.62 Lakh ha. under Micro Irrigation in both Agricultural and Horticultural Crops in Tamil Nadu by 2017-2022

Micro irrigation aiming at Agricultural and Horticultural practices using sprinklers and drip in order to minimise the use of water resources. In the present situation of scarce water resources, economic activities like these must undertake water conservation strategies.

Benefits & Co-Benefits-

1. Water efficient Agriculture and Horticulture Practices
2. Livelihood generation
3. Enhanced food security with increased productivity

KM/N/7- MIDH - NHM is increasing the productivity of Horticultural crops through Hi- Tech practices

With the increase in productivity of horticulture crops, the issue of food security will be addressed to an extent. The use of Hi-Tech practices will ensure the resilience and quality of the crops grown. This may involve water conservation methods, application of organic fertilisers & pesticides.

Benefits & Co-Benefits-

1. Increased awareness of research and strategy development for sustainable agriculture/ horticulture
2. Increased crop resilience towards climate hazards
3. Food security at Local and State Level

KM/N/8- Studies on the impacts of coral-competing sponges on coral community structure and associated biodiversity in the reef areas of Gulf of Mannar, South eastern India

Coral reefs are unique ecosystem existing in the Gulf of Mannar region and extensive research is needed to study their behaviour and life cycle. This will help to protect them from harmful impacts of increased sea surface temperature as well as from competition exerted by other co-species surviving on similar resources as the corals.

Benefits & Co-Benefits-

1. Sustenance of vulnerable species and ecosystem
2. Enhanced provision of ecosystem services provided by coral reefs like storm protection, maintenance of nursery grounds for economically important fish species, livelihood of local fishermen, tourism and others

KM/N/9- Studies on the status of Post-Bleaching Stressors that affect the Recovery of Corals in Tuticorin group of islands, Gulf of Mannar

Coral bleaching refers to the whitening of corals due to various stress like change in temperature, light or nutrient conditions, which expels the symbiotic algae living in their tissue. Bleaching due to increased temperature and intrusion of toxic water into such pristine habitats are of great concern in the Gulf of Mannar region and thereby, various research activities are conducted in order to study the effects of coral bleaching. Main objective of the study would be to identify the core stress components and strategies to minimise the same, for better recovery of corals, in terms of their rejuvenation and subsequent conservation

Benefits & Co-Benefits-

1. Protection and Conservation of Coral reefs
2. Increased awareness on coral reef benefits and protection strategies

KM/N/10- Ecosystem-based Climate proofing watershed in Nammiyampattu and Kanamalai panchayat of Jawadhu hills of Tiruvannamalai district Tamil Nadu

During the phase of increased visible impacts due to climate change, strategies must be taken up that are able to withstand the consequences, thereby, making the strategy more climate-relevant or climate-proofed. Water is highly stressed as a result of the temperature change regime and to meet the need of growing population for an extended period, ecosystem services must be utilised for procurement of water resources. Ecosystem based climate proofing of watersheds would include Rainwater Harvesting and run-off management structures like check dams, percolation ponds, farm ponds, Water Absorption Techniques (WATs), recharge shafts in order to improve the moisture content of the watershed.

Benefits & Co-Benefits-

1. Efficient and resilient water sources
2. Enhanced water supply for agriculture and domestic use
3. Enhanced agricultural productivity due to increased moisture retention by land

KM/N/11- Agro-advisory to farmers using NICE platform to adapt Climate Change in Telangana and Tamil Nadu

Climate Smart Agriculture is being adopted heavily amongst rural farming communities in order to cope up with Climate Change phenomena. The strategies would involve selection of appropriate crop and their varieties, and the use of integrated farming systems. The Network for Information on Climate (Ex) Change (NICE) is an android application that would help in gathering validating and disseminating knowledge for improving the resilience of farming communities towards impacts of Climate Change. The application is being developed under the project Climate Change Knowledge Network in India Agriculture (CCKN-IA), along with GIZ and Ministry of Agriculture and Farmers Welfare (MANAGE), GoI.

Benefits & Co-Benefits-

1. Enhanced resilience of farming community
2. Food security through Integrated Farming System
3. Livelihood Sustenance of farming communities

Enhanced Energy Efficiency and Solar Mission

The top five actions that the Tamil Nadu Electrical Inspectorate wants to take in the next five years in the energy sector are enlisted below:

- To Mandate periodic Energy Audit for High Tension Electrical Installations in the State.
- To Notify and implement Tamil Nadu Energy Conservation Building Code for Commercial Buildings.
- To adopt State specific Energy Conservation Building Code for Residential developments.
- To increase awareness creation among Students and General public on Energy Conservation and Efficiency
- To implement Energy Efficiency measures in about 300 numbers of Government schools in the State

The description of activities below is based on mitigation and adaptation options. The activities that are named “ES” are old activities proposed under TNSAPCC (2012-17) and will be continued for upcoming years as per agreement of the nodal departments and those named “ES/N” are activities newly proposed by the nodal departments for the upcoming years under energy sector.



ES/11: Solar power generation program

- Solar photo voltaic park Power Project at Kadaladi, Ramanathapuram District (500MW- Rs2350 crore -cost of project) with Energy Storage device (150MW (30 percent of 500MW) @ Rs 13 per MW – Rs 1950 crore)
- Renewable Energy Storage device at Basin Bridge – 3x30 MW @ Rs 13 crore per MW
- Renewable Energy Storage device at 20 Distribution load centres across Tamil Nadu- 20 locations x 30MW Per location @ Rs13 crore per MW

State specific Intervention: Promotion of solar home lighting systems at village/community level

Aim of the Project: Aim to promote effective and large-scale implementation of solar home lighting in Tamil Nadu

Climate Category: Mitigation

Proposed Activities:

- i. Installation of solar lighting systems in rural households in Tamil Nadu
- ii. A total of 100 households have been used to start it as a pilot project as large-scale adoption of this strategy requires investments from State Government as well as private sector
- iii. The project timeline is assumed to be 25 years

Climate Benefits:

- i. Reduction in GHG emissions
- ii. Health benefits due to reduction in the use of kerosene lamps
- iii. Improve Indoor air quality
- iv. Generation of carbon credits if the solar home lighting systems



ES/25: Smart grid initiatives

Under Chennai Smart City project, it is proposed to implement Smart meters for 1.41 lakhs consumers in T. Nagar ABD area and 86 crore funds has been allocated by Smart City High Powered Project Sanctioning Committee (HPPSC), TUFIDCO, GoTN against the total project cost of Rs.120 crore and remaining amount of Rs.34 crore will be borne by TANGEDCO. The following tenders were initiated for the above works:

- IT Hardware & software tender: Tender for IT hardware & software for an amount of Rs. 10 crore have been approved and P.O will be issued shortly.
- Smart meter tender: Awaiting approval for Smart meters specification from Competent Authority for an amount of Rs.110 crore to float the tender.

TANGEDCO is proposing to implement Smart meters for 45 lakhs consumers in Chennai city for an amount of 4000 crore.

ES/22: Transmission Infrastructure strengthening works

UDAY (HT strengthening Works): 48 Nos. of new 33/11 KV SS, 78 Nos. of Power Transformers augmentation, 2990 KM of new 33/22/11 KV lines and strengthening of 18920 KM of existing 33/22/11 KV lines.

ES/N/1: School Energy Efficiency Programme on replacement of inefficient appliances with Energy Efficient Appliances in schools

The activity will involve the retrofitting of inefficient appliances like lights and fans with energy efficient lights and fans and it is targeted to be completed in 300 schools in the State Government

ES/N/2: School Awareness programme through Eco clubs

Target of 500 schools will be achieved through this school awareness programme.

ES/N/3: Capacity building programme for SMEs on Demand Side Management (DSM)

TN has large number of MSMEs and had been an early mover when compared to other States. However, the technology adoption by MSMEs has been slower especially when it comes to energy efficiency and management. While the PAT scheme has been implemented in the cement sector in the State, more awareness and capacity building for MSMEs and incentives to have energy efficiency may be needed.

ES/N/4: Capacity building programme for Financial Institutions / ESCOs

It was proposed to conduct 2 numbers of capacity building workshop for financial institutions like banks and NBFIs and 1 capacity building workshop for ESCOs on financing Energy Efficiency projects. Out of the proposed workshops, One capacity building workshop for Financial Institutions was conducted in Chennai during FY 2018-19

ES/N/5: Energy Conservation Awareness for General Public

Awareness programmes will be organised for the general public on various energy conservation measures.



Energy Conservation awareness campaign

ES/N/6: Notification of TNECBC for Commercial Buildings in the State with the support of TNECBC cell and for training

During 2018-19 and 2019-2020, 25 training days covering 1-day, 2-day, 3-day and 4-day training programme on ECBC 2017 has been conducted in different locations in the State namely Chennai, Coimbatore, Madurai, Tanjore, Namakkal, Krishnagiri, Chengalpet and ponneri

ES/N/7: Notification of TNECBC for Residential Buildings in the State with the support of TNECBC cell

It is proposed to notify TNECBC for Residential Buildings in the State with the support of TNECBC cell.

ES/N/8: Model Energy Efficient village programme

Under this activity, a village will be selected to be converted into model energy efficient village by replacing existing inefficient electrical equipment/ appliances with BEE star rated appliances including household bulbs, street lights, fans, water pumps refrigerators etc.

ES/N/9: Solar Technician Training

In order to generate employment and make available a trained technical work force for the solar energy sector, Solar Technician Training (Surya Sakthi Thiran Membattu Payrichi) will be imparted to 5000 persons at an estimated cost of Rs. 13.5 crore in 2016-17. This training is designed to equip the youth with employable skills. The pilot phase of the first batch of the training programme has already commenced.

ES/N/10: Effective utilisation of fly ash in view of climate change

1. Based on the MOE & F / GOI notification dated 14.09.1999 and subsequent amended notification dated 03.11.2009 & 25.01.2016, 20 percent of the entire Dry fly ash generated is being allotted to the Small Scale units (SSI units) - Fly ash brick, block and tile manufacturers under the priority category after confirmation of their existence & genuineness, based on the Inspection reports received from field.
2. In order to dispose off the 80 percent share of generated Fly ash without disposing as slurry into the ash dyke by incurring cost towards wet sluicing, e-auctioning / e-tender mode of ash disposal has been resorted to in TANGEDCO's Thermal Power Stations based on CMD's instructions dt.16.07.2016.
3. Also, approval has been obtained for adoption of "Book building Method" by TANGEDCO as followed by M/s. NTPC Ltd., based on its Fly Ash policy 2015 and also for fixing up of discovered price ranging between floor price and ceiling price in

TANGEDCO 's tenders for disposal of Dry Fly Ash in Mettur – I & II, North Chennai – I & II and Tuticorin Thermal Power Stations.

4. E-auction tenders have been floated for the 80 percent quantity (35.35 Lakh MT per annum) for two years in respect of the above Thermal Power Stations and work awarded to the successful tenderers and the expected revenue augmentation to TANGEDCO is about Rs.264.88 crore for two years.
5. Earlier, the Heads of various departments viz., Municipal and Water supply Department, PWD, Railways etc., were addressed for beneficial utilization of Dry / wet ash for their construction and land filling works etc., Moreover, awareness programmes on best utilization of Fly ash bricks were also conducted by TANGEDCO and State Pollution Control Board which has now created demand for Fly ash based products in the construction Industry – Cement companies, Ready – mix Plants, Bricks, blocks, tiles & paver blocks etc.,
6. The effective utilization of fly ash in Dry and wet form by TANGEDCO has minimized the Pollution level as per the TNPCB / NGT norms.

ES/N/11: Kundah Pumped Storage Hydro Electric Project (4*125 MW) in Nilgiris District

Kundah Pumped Storage Hydro-Electric Project (4x125MW) in Nilgiris District is proposed to meet the peak power demand of the State Grid with a view to provide quality & reliable power supply by flexible operation of State grid which will facilitate continued development of Tamil Nadu.

Under Kundah Pumped Storage Hydro-Electric Project (500 MW), the existing TANGEDCO's 'Porthimund' and 'Avalanche – Emerald' reservoirs in Nilgiris district will be utilised as the 'Upper' and 'Lower' reservoirs respectively. An underground powerhouse is proposed to house 4 units of 125MW each, which can be reached by means of an underground Tunnel.



This Kundah Hydro Electric Project is a Pumped Storage Hydro-Electric Project. The surplus energy available during off-peak time to be utilised for pumping water from the lower reservoir to the Upper reservoir and the same water will be utilised for generation during peak time. Being hydro generation, this project is pollution free and a green energy project. Pre-development works such as Main Access Tunnel for 1000m, Cable Cum Ventilating Tunnel for 500m, Approach roads to all Components and Power Supply point at all portals, to a value of about Rs. 135 crore have been already done at project site. All the statutory clearances have been obtained including for forest land diversion. GOTN approvals for all the three Phases have been obtained vide G.O.Ms.No.133, dt.03.12.2008, G.O.Ms.No.50, dt.29.04.2013 & G.O.Ms.No.44, dt.20.06.2014.

Transformer Cavern Right-side slashing in Kundah SHEP

The project is being developed in three phases at a total value of Rs.1850 crore. Rural Electrification Corporation has sanctioned a loan of Rs.1450 crore as Rupees term loan on 26.08.2014. Tenders for EPC Packages–I & II (Civil & Hydro Mechanical Works) have been awarded to M/s Patel Engineering Limited, Mumbai for values of Rs.346 crore and Rs. 321 crore

respectively on 15/02/2018. The sites for the above work were handed over to the EPC contractor M/s Patel Engineering Limited, Mumbai on 05.03. 2018. The tender for awarding E&M works of all the 4 Units are under process. For Package-III of Phase –I, Phase-II & Phase-III relating to Electro-Mechanical works (E&M) retender was opened on the 28.03.2019 and further evaluation of Technical bids in under process.

Brief status of work under progress:

Work completed under Non-EPC Contract before issue of EPC Contract:

Execution of certain works such as Main Access Tunnel (1000m), cable cum ventilation Tunnel (500m) and Approach roads have been completed before issue of the above EPC contracts.

Progress in Package IEPC Contract:

The balance Mining work in 'Main Access Tunnel' (284.0 m) and 'Cable Cum Ventilation Tunnel' (369 m) have been completed so far, over and above the length completed under non-EPC contract. Additionally Driven Inspection Tunnel (ADIT) to Tail Race Surge Chamber (480 m), ADIT to Tail race Tunnel (267 m), Adit to Power house Top (95 m) ,ADIT to pressure shaft bottom (286.5 m) and Pilot Tunnel for Transformer Cavern (138 m) , Pilot Tunnel for Power House Cavern (156 m) , ADIT to Tail Race Surge chamber crown top (126 m), Adit to Power House Bottom (111.70)and Surge Chamber cavern Pilot excavation (53.2) Transformer Cavern slashing Right Side – (92m), Transformer Cavern slashing left Side –(137.4) ,Tail Race Surge Chamber Slashing Right side 58.5m and Left Side- 58.50m each , also have been completed so far. Tunnelling works in Tail Race Tunnel at U/s Heading (224.5 m), Tail Race Tunnel at D/s Heading (216.5m), are under progress.

Progress in Package II EPC contract:

Adit to HRT - 1st & 2nd Benching completed. Open excavation, Shotcrete works completed and false portal (7.5m) Completed. Earth Tunnel excavation (40m) in progress. Head Race Tunnel Surge Shaft – site formation under progress, Gantry crane foundation work completed. Gantry Crane erection in progress. Excavation of Lower horizontal portion of Pressure shaft – PS5(43 m) has been completed. Pressure shaft PS-5 excavation- lower horizontal portion along downstream side for 41.0m and Inclined portion pilot for (PS 5) 6.0m, Pressure Shaft PS4 lower Horizontal portion 16.4m are under progress.

Package	Engineering Progress (%)	Physical Progress (%)	Financial Progress %
I	19%	17.03%	16.93
II	6%	2.4	4.7

The project is expected to be commissioned by 2022-2023.

Sustainable Habitat

As far as Transport Department is concerned, the following suggestions may be incorporated in connection with the reduction of pollution:

- To encourage mass public transportation system wherever possible
- It has been suggested that the vehicles which are 15 years old, may be off the road in cities in order to reduce pollution in the cities
- A time limit may be given to all transport vehicles plying in Chennai city to switch over to CNG/LPG and electric vehicles (E-Vehicles). Priority may be given to register the vehicle by concession of tax
- Steps may be taken to discourage individuals who own more vehicles by collecting additional lifetime tax

The description of activities below is based on mitigation and adaptation options. The activities that are named “SH” are old activities proposed under TNSAPCC (2012-17) and will be continued for upcoming years as per agreement of the nodal departments and those named “SH/N” are newly proposed by the nodal departments for the upcoming years under Sustainable Habitat.

SH/1- Implement ECBC norms in institutional/commercial and residential sectors

The objective of the Energy Conservation Building Code (ECBC) is to bestow minimum requirements for the energy-efficient design and construction of buildings. The Government has constituted a technical committee for evolving technical guidelines for adoption by building planning authorities while issuing approval for building plans and an Empowered committee to advice and evolve policy decision for the implementation of the ECBC in buildings with a connected load of 100kW and above in Tamil Nadu. Accordingly, the draft amendment to the Energy Conservation Building Code has been completed to suit the local climatic condition prevailing in the State of Tamil Nadu as per the ECBC 2007. Technical committee meetings comprising of various department officials were conducted on 03.08.2012, 18.10.2012, 11.12.2012 and 21.05.2013 to evolve the TNECBC. The Ministry of power launched ECBC 2017 during June 2017. Based on ECBC 2017, TNECBC has been revised and the technical committee inputs were received during the meeting held on 27.03.2018 followed by the Empowered committee meeting on 09.11.2018. The Empowered Committee has directed to study the implementation model in the neighbouring States of Karnataka, Andhra Pradesh, Telangana and to conduct a stakeholder meeting to understand the impact of the ECBC implementation process.

SH/2- Integrate design alternatives to withstand impacts of CC (extreme rainfall, flooding, cyclones and storm surges and other disasters)

Design of green buildings can reduce the impact of contribution to climate change. The Government is focusing on design alternatives like structure's planning, design, construction, operations and end-of-life recycling or renewal, while considering energy, water, indoor environmental quality, materials selection and location. These design alternatives help to withstand the impacts of climate change.

SH/7- Development in flood prone areas, protecting and resettling encroachments

The State is taking key initiatives to avoid flood stagnation water in urban areas during rainy season. People living in slum areas are prone to annual flooding. Relentless rainfall in urban regions severely affects the slum areas and families residing there. The government is taking up steps to resettle these people to a safer place by providing them liveable tenements with basic facilities. People living in the slums located on objectionable lands are resettled to tenements in integrated townships with basic and social infrastructure. The encroached sites are then cleared and reinstated to their original use. TNSCB has so far rehabilitated 12,675 families by providing housing along with the one-time shifting allowance of Rs.5,000 to the slum families, who were living on the banks of Adyar and Coovum Rivers. TNSCB has also proposed to rehabilitate the slum families who are living on the waterways in other towns and cities of Tamil Nadu under funding assistance of World Bank and ADB along with the livelihood support.

SH/8- Implementation of compulsory plantation of trees in all sectors (Housing /Institutional) to reduce heat island effect

Trees help in removal of harmful pollutants from the atmosphere. Apart from removal of atmospheric pollutants, trees also help in reducing the heat island effect by passive cooling of environment. Urban regions are facing heat island effect because of the removal of green cover. The government is taking efforts towards urban afforestation by taking up schemes like compulsory tree plantation schemes in all sectors. DTP has planned to plant more trees in lesser area and at least 10,000 tree saplings per Town Panchayat will be planted and it is aimed to plant 5,00,000 trees per year in all the 528 Town Panchayats.

SH/9- Providing water supply scheme and 24 X 7 ready water supply in extended areas

Government of Tamil Nadu is making all efforts to ensure that every household has access to water with assured supply and quality. Water supply includes augmentation of existing water supply, replacement of age-old pipelines, development of water treatment plants, compatible water metering and installation of SCADA (Supervisory Control and Data acquisition) at water treatment plants for water conservation. The government is focusing to provide 24x7 water supply and provision for access to safe and adequate drinking water to every household in the urban local body. The government has taken up various water supply projects by getting financial help from various external agencies and under various Government schemes in order to improve the water supply situation in the State. The water supply schemes are implemented by the urban local bodies with the objective of achieving the drinking water supply norms. To meet out the water scarcity, more focus is given to recycle the water and minimize the consumption. To increase the water table, rejuvenation of the defunct bore wells, Rainwater Harvesting and desilting the Ooranis, ponds have also been implemented in Town Panchayats. The Town Panchayat Executive Officers are advised to identify the defunct bore wells and to rejuvenate with wastewater at various methods. In coastal area 125 R.O Plants have been erected.

SH/10-Revamping existing water supply schemes to avoid loss of water by laying new pipelines in place of damaged pipelines

Revamping of existing water supply works help to avoid leakage of water so as to avoid wastage of water, ensure adequate water supply to people and make water supply schemes functional. Revamping works are being carried out by the government wherever there is damage in water supply pipelines, valves or pump sets in order to enhance the supply to the designed level.

SH/12- Sewerage and Septage Management

In order to cater to the demands of increasing urbanisation, the Government is implementing various underground sewerage schemes to all the needy urban local bodies in a phased manner.

This would help in improving the environment through proper drainage and maintaining the ecosystem integrity. In future Septage Management is proposed to be implemented in remaining Town Panchayats and will be completed before 2025.

SH/14- Waste Water Reclamation Programme

In order to achieve sustainable drinking water supply, 'recycling and reuse' is the only way forward. The Government of Tamil Nadu has been a pioneer in secondary treatment of wastewater. The State is taking key initiatives for wastewater reclamation that involves conversion of wastewater into water that can be reused for other purposes like irrigation of gardens or replenishing groundwater (groundwater recharge). With growing population, the demand for water is increasing at an alarming rate. For proper water management, wastewater can be used for many industrial and domestic purposes because it protects the environment and uses the resource in a more sustainable manner.

SH/19- Rainwater Harvesting Structures

The concept of rainwater harvesting structure is to understand the importance of rain by tapping rainwater at the place where it falls. Rain is the primary source of water. Storage of rainwater helps to control water crisis. The government has taken key initiatives to implement measures to make sure that the rain falling over a place is tapped through proper water harvesting techniques for recharging the ground water aquifers and for direct use of rainwater. CMWSSB is taking steps to create awareness and offering technical assistance free of cost to the residents to promote rainwater harvesting techniques. CMWSSB has made Rainwater Harvesting structures mandatory in all buildings for providing water and sewer connections.

SH/21- Undertake regular water monitoring by establishing labs in all districts

Water testing laboratories are established to achieve the goal of providing safe drinking water supply to the citizens. Provisions for testing of all the basic water quality parameters (chemical and bacteriological) and for effective observation and monitoring of water supply sources are available in these laboratories. It is proposed to further increase the activities of water testing laboratories by monitoring more samples, up-gradation of existing district level laboratories, providing training to grass root level functionaries and supply of testing kits.

SH/22- Protection of water sources including traditional water bodies

Increase in urbanisation rate and water pollution is putting enormous stress on the quantity and quality of surface and ground water. Water conservation and management aims to reduce the water scarcity crisis. For effective water conservation, the government has started taking steps to protect the water sources including traditional water bodies that can help to meet the increasing demand of water. Protection of water sources including traditional water bodies can increase the availability of water supply during water scarcity crisis.

SH/24- Reuse of Grey Water

Reuse of grey water helps to reduce the household water usage by using the water in bathrooms, for flushing, car washing and gardening purposes. In April 2017, CMWSSB made an announcement that it is not going to provide new water and sewerage connections to buildings that lack the facility of separating the black water from grey water and not reusing the grey water. It is expected 15 percent of the Chennai's future water requirement can be met from reusing of grey water. The decision to make reuse of grey water mandatory has been taken up to achieve sustainable water security mission.

SH/25- Recharge of Ground Water

Increase in demand of water has given rise to implementation of more water management techniques to achieve efficient utilisation of water. If ground water is exploited more than its natural replenishment, it results in water shortage situation because of declining ground water levels. Recharge of ground water has become increasingly important to replenish natural ground water reserves. The government is taking key measures to store surplus water to meet water demand in times of shortage and implementing artificial ground water recharge.

SH/27- Developing Satellite townships to decongest Cities (Urban)

Urban planning involves the concept of Satellite Township that refers to a smaller metropolitan area located close to a bigger metropolitan area. In today's scenario where suburban sprawl looms large, satellite cities act as a solution to the problem. Satellite cities have their own self-contained economies and services. Well planned urbanisation should establish that the urban areas have good quality of life. Satellite towns play a major role in reducing suburban sprawl. TNHB has undertaken Satellite townships initiatives - Thirumazhisai Satellite Township and Uchappatti – Thoppur Satellite Township.

SH/33- Ensure 100 percent sanitized and open defecation

Elimination of open defecation is essential for improving cleanliness and ensuring healthy living for all citizens. Tamil Nadu has achieved the status of open defecation free in both rural and urban regions under Swachh Bharat Mission. With the rapid increase in urbanisation, State might lose the current "Open Defecation Free" status. In order to maintain the status in the coming years, the government is continuing its effort to maintain 100 percent coverage of sanitary toilet facility under Swachh Bharat Mission by providing IHHL for households with land and community toilets for households without land. Surveys are being done to collect basic details of sanitation of households. The government is also facilitating scientific processing of solid waste generated to create a healthy environment.

SH/34- Slum free cities programme

The increase of migration rate from rural to urban areas has resulted in the increase of slums. The slum free cities programme aims to provide the provision of tenements with basic infrastructure for all urban slum families in the State and to make cities and towns slum free by 2023. The government has identified that 13.91 lakh families require tenements to achieve the status of Slum Free Cities before 2023. The "Housing for All" Mission is being implemented in the State which focuses to provide housing at an affordable cost to various sections of society by managing and pushing developments through planned inclusions and balanced growth. The State has proposed to rehabilitate the slum families who are living on the waterways in other towns and cities of Tamil Nadu under funding assistance of World Bank and ADB along with the livelihood support.

SH/36-Sustainable solid waste management (urban)

Swachh Bharat Mission emphasizes on Solid Waste Management to keep the town clean and garbage free with sustainable scientific processing and disposal of the daily collected garbage. Plastic ban process is being followed as per the announcement in the Assembly on 05.06.18 to take necessary action to ban the plastic. Activities such as Decentralized Micro compost center, Windrow composting, vermi composting, establishment of Resource Recovery Centers, Bio methanation plants, Bio mining and other processing facilities are encouraged for processing of MSW. Items which can be recyclable and resalable are collected and sold to potential vendors. Regarding Solid Waste Management, removal of Legacy waste is under progress using Bio-mining method in 24 Town Panchayats and based on the success it will be extended to other

Town Panchayats also. By 2025, 528 Town Panchayats will be free from Legacy waste and retrieved the land from legacy waste. Continuous awareness programmes are given to the public to minimize the waste generation and training will be given to the Residential Welfare Associations to treat the bulk waste in the collection point itself.

SH/37- Sustainable solid waste management (rural)

Management of solid waste in rural regions is very important to reduce the adverse impact on public health and environmental pollution. The objective of solid waste management is to reduce the amount and toxicity of material entering the waste flow, reuse as much material as possible, waste recycling and residue disposal in a scientifically sound way. The effective management of waste in environmentally sound manner will reduce methane emission. Methane is the one of the major contributors for Global Warming and Climate change. Swachh Bharat Mission Gramin focuses on Solid Waste Management to keep the rural areas clean and garbage free with sustainable scientific processing and disposal of the daily collected garbage.

SH/39- Undertake source segregation through material recovery facility at disposal sites to avoid ground water pollution

Waste disposal sites contain toxic substances which are likely to contaminate ground water. Setting up of material recovery facility (MRF) at disposal sites for source segregation can help to avoid ground water pollution. The Government is taking steps to establish resource recovery centre in many places to ensure proper solid waste management.

SH/62- Developing exclusive lanes for pedestrian. Promote cycling with good cycling paths, cycle parking facilities and link between cycling and public transport, encourage carpooling and Introducing no-driving day for private sector

The Government of Tamil Nadu identifies the need to provide a clean, green, and healthy way of moving or commuting—it's public—walking and cycling. Majority of the population is dependent on vehicles and public transport for day to day travel. Walking lanes and cycling paths can help to reduce congestion and pollution. The roads are created not only for vehicles and public transport, but also for pedestrians and cyclists.

SH/64- Improvement of all existing roads and maintenance at regular intervals

Roads play a vital role into economic development. Both climatic and vehicle use impacts result in deterioration of roads. Maintenance activity of roads is important to derive the expected performance throughout their design life period. The government is taking initiatives to increase the efficiency and effectiveness of road asset management. A timely and preventive maintenance strategy of roads reduces rebuilding cost and routine maintenance of bridges enhances its life span. Beside this, routine maintenance of vulnerable locations will facilitate easy flow of surface water during monsoon thus reducing the damage to the riding surface.

SH/68- Organised parking (urban)

With rapid urbanisation, there is an intense growth of the vehicle population in urban areas. Because the length and width of the roads remains same and some portions of the roads are being occupied by the parked vehicles, there is a resultant traffic congestion which becomes a nuisance to the public. Better urban planning includes the concept of organised parking to avoid congestion. The Smart City program is structured to assist the government to create streets and public spaces which meet the standards of upcoming smart cities. The concept of organised parking helps to achieve the goal of Smart City program.

SH/79- Development of green parks

The government is giving greater emphasis on development of green parks. Parks are being developed in a holistic manner with more green coverage. The government is taking measures for developing action plan to progressively increase green cover. Green parks are being developed in a people friendly manner that is being made accessible to all. All the parks are being developed under AMRUT have been graded and are being developed to include compound wall, walking track, furniture, public toilets, energy efficient lights and open-air gyms.

SH/N/1- Promoting Energy Efficiency in the economy, notably in industry, transportation, buildings and appliances

The Chief Minister's Solar Powered Green House Scheme was launched in 2011-12. It is a flagship scheme which fulfils the housing requirement of rural poor people along with Solar Powered Home Lighting System and thereby promoting green energy. The scheme is highly beneficiary oriented with whose solar powered lighting

ANNEXURE 9: SUMMARY OF PROPOSED ACTIVITIES FROM 2021-30

Sustainable Agriculture

Sl. No.	Code	Activity	Scheme	Nature	Type	Proposed Budget (2021-30) in INR crore	Amount likely from existing central scheme (2021-30) in INR crore	Amount likely from State Budget (2021-30) in INR crore	Gap Funding	Implementing Department
Strategy 1: Research and development to improve the productivity of crops										
1	AG/N/1	Development of nutritionally enhanced climate resilient premium quality rice varieties	State scheme	RD	AD	5.12	0	5.12	0	TNAU / Dept. of Agri
2	AG/N/2	Enhancing maize productivity by identification and popularization of agro techniques	NMSA	CB	AD	200	100	40	60	TNAU / Dept. of Agri
3	AG/N/3	Revitalization of millets for nutritional security and enhanced productivity	State Scheme	CB	AD	3.756	0	3.756	0	TNAU / Dept. of Agri
4	AG/N/4	Enhancing pulses production in delta and non-delta districts	NADP	IP	AD	1.06	1.06	0	0	TNAU / Dept. of Agri
5	AG/N/5	Special package for increasing the productivity of cotton	NFSM DoA	IP	AD	200	40	60	100	TNAU / Dept. of Agri
6	AG/N/6	Special package for increasing the productivity of sugarcane - Sustainable Sugarcane Initiative	NFSM DoA	IP	AD	100	60	20	20	TNAU / Dept. of Agri
7	AG/N/7	Special package for increasing the productivity of coconut	Coconut Development Board	IP	AD	200	100	40	60	Dept. of Horticulture
8	AG/N/8	Establishment of pulses-based inoculants production unit for sustainable pulse productivity of Tamil Nadu	NADP	RD	AD	6	4	0	2	TNAU

9	AG/N/9	Establishment of pilot water soluble fertilizer production unit for facilitating farmers for stage wise crop nutrition	NADP	PILOT	AD	100	60	20	20	DoA
10	AG/24	GIS based village mapping for agro management system to enhance input use efficiency and overcome effect of climate change and increase farm productivity including horticulture crops	State NFSM NMSA	RD	AD	400	200	100	100	TNAU / Dept. of Hort. And plantation crops / DoA
11	AG/22	Development and execution of sustainable seed production and distribution network - Seed Multiplication Scheme of Paddy, Millets, Pulses, Oilseeds and Cotton	TANII	IP	AD	1000	0	600	400	DoA
12	AG/23	Establishment of network of seed banks, food banks and cold storage to ensure supply at times of contingencies	IAMWARM NADP NABARD	IP	AD	3500	2000	800	700	TNAU / DoA.
13	AG/N/10	Diversified agricultural cafeteria with the State of art technologies for third generation	NADP	PILOT	AD	14	10	0	4	TNAU
Strategy 2: Weather mitigation and Mitigating the effect of extreme weather events										
14	AG/26	Establishment of dedicated climate knowledge cell to monitor, fore warn and train farmers and officials of the department on management of situation arising out of extreme events	State and Central	RD	AD	100	20	20	60	SDMA
15	AG/N/11	Remote sensing-based information for crop coverage, yield estimation and drought monitoring	NADP	RD	AD	10	6	0	4	TNAU
16	AG/N/12	Customized agro advisory services to the farmers	TNAU NMSA	IP	AD	20	6	4	10	TNAU
17	AG/25	Integrated voice message on weather based agro advisories, market demand & price forecasting	GKMS	CB	AD	400	200	100	100	TNAU / DoA / Dept. of marketing / KVK / NGOs
18	AG/27	Strengthening and popularising the existing crop insurance programme	PMFBY / NAIS / WBCIS	CB	AD	3350	2400	400	550	DoA

19	AG/28	Research project on comprehensive crop insurance products that would cover increasing extreme events	NMSA Climate Change Adaptation in Rural Areas of India (CCARAI) Programme	RD	AD	800	400	200	200	TNAU DoA
20	AG/5	Extension strategies to popularize climate resilient management practices to mitigate extreme weather events (ART and MLT)	State scheme	CB	MI	600	0	200	400	KVK / DoA
21	AG/N/13	Development of contingency plans for extreme weather events and implanting on the ground	Central Govt.	IP	AD	3000	1500	500	1000	TNAU / DoA
22	AG/7	Climate proofing with Integrated Farming Systems: Popularising the Integrated Farming System for wider adoption	NABARD NMSA Rainfed area development	CB	AD	2200	1000	1000	200	TNAU / DoA / Veterinary Dept.

Strategy 3: Improving ground water recharge and countering sea water intrusion

23	AG/8	Recharging the aquifers using the abandoned open wells and defunct bore wells	NABARD NMSDA	IP	AD	540	200	40	300	Dept. of Agri. Engg. / Dept. of water resources
24	AG/9	Constructions of sub-surface dykes	PMGY	IP	AD	1200	600	200	400	TWAD/Dept. of Agri. Engg. / Dept. of water resources
25	AG/29	Development of vegetative shield for east coastal region against wind, cyclones, etc. Management and conservation of vegetative shield	NMSA CCARAI	RD	BOTH	800	400	100	300	TNAU / Dept. Environment / SDMA
26	AG/10	Diversion of excess flood water at upper reaches to water deficit areas	Central Govt.	IP	AD	4800	3000	1000	800	Dept. of Agri. Engg. / Dept. of water resources

Strategy 4: Soil conservation strategies

27	AG/11	Deep ploughing to break sub surface hard pan to increase infiltration efficiency and improve ground water quality and check sea water incursion	NMSA State	IP	BOTH	400	200	1000	100	Dept. of Agri. Engg. / Dept. of Agri.
28	AG/12	Reclamation of saline and alkaline soils	NADP NMSA	IP	AD	200	60	100	40	Dept. of Agri.
29	AG/13	Promote minimum/no tillage during fallow period, compartmental bunding, contour farming, deep ploughing, mulching for all crops besides conducting awareness programmes and training	HADP NABARD	IP	AD	600	200	200	200	Dept. of Agri. Engg. / Dept. of Agri. /KVK /NGOs
30	AG/14	Build Organic carbon content of soil with green manuring: Azolla, BGA, Bio- fertilizers, Bio-pesticides, Bio-Agents and compost developed from municipal solid waste, Production and distribution of Green manure seeds, bio-fertilizers, vermi-composting	Tamil Nadu Amma Bio-Fertilizers Scheme	IP	BOTH	1400	400	600	400	Dept. of Agri.
31	AG/15	Bringing fallow land and degraded land back to cultivation through Integrated wasteland development Programme	NABARD State NADP	IP	AD	800	200	400	200	Dept. of Agri. / Forestry Dept.
32	AG/16	Organic farming including horticultural crops	NHM PKVY	IP	AD	700	400	100	200	Dept. of Agri. / Dept. of Hort. And plantation crops / Dept. of organic certification
Strategy 5: Water conservation strategies										
33	AG/17	Research on conjunctive use of Irrigation water	State	RD	AD	20	0	10	10	TNAU
34	AG/18	Increase the use of Micro Irrigation technology Viz., drip, Sprinkler, Rain gun, Mobile Sprinkler in dry land, Garden land and Horticultural farming system	PMKSY, CAD	IP	MI	20000	16000	2000	2000	Dept. of Agri. / Horti. / Agri Engg.
35	AG/19	Strengthening existing water harvesting structures and repairing and replacing the shutters in the irrigation tanks and drainage channels	RWH scheme	IP	AD	2000	600	1000	400	Dept. of Water resources/ Agri. Engg.

36	AG/20	Creation of additional farm ponds to capture the runoff water and utilise the harvested water to critical stages of crop growth and to recharge the aquifers to improve the quality of irrigation water	Incentivization Scheme for Bridging Irrigation Gap (ISBIG)	IP	AD	2000	1000	400	600	Dept. of Water resources/ Agri Engg.
37	AG/N/14	Solar driers and water pumping system for irrigation	NADP Ag. Eng.	IP	MI	300	200	40	60	Dept. of Water resources/ Agri Engg.
38	AG/21	Ensuring the livelihood of the farmers in non-delta districts having surface irrigation potential with piped irrigation network by providing collection wells at regulating structures to increase the cropping intensity with assured yield and employment opportunities	National Food Security Mission	IP	AD	10000	6000	2000	2000	Dept. of Water resources / Dept. of Agri. / Dept. of Human resources
Strategy 6: Promotion of inland fishing and Brackish water aquaculture										
39	AG/30	Development of technology for improving inland fishing; new breeds; Popularization of technology.	DFFDA, NEC, NFDB	RD	AD	5000	3000	1000	1000	TNJFU / Dept. of Fisheries
40	AG/31	Increasing fish production and fish farming area for rural livelihood through Inland Fisheries Reservoir fisheries development, fish culture in pens and cages, establishment of hatcheries	DFFDA, NEC, NFDB	IP	AD	200	100	60	40	Dept. of Fisheries / DFFDA
41	AG/32	Undertaking Repair and Renovation of Government Fish Seed Farms/ Hatchery to increase fish seed production for fish farming	DFFDA, NEC, NFDB	IP	AD	300	160	80	60	Dept. of Fisheries
42	AG/33	Improving inland fisheries for tank and its command areas under IAMWARM Project	IAMWARM	IP	AD	20	20	0	0	Dept. of Fisheries
43	AG/34	To increase per hectare production and encourage new species advocating Culture of SPF <i>Litopenaeus vannamei</i>	DFFDA, NEC, NFDB	IP	AD	30	10	10	10	TNJFU / Dept. of Fisheries
44	AG/35	Culture of Sea bass	DFFDA, NEC, NFDB	RD	AD	10	6	4	0	Dept. of Fisheries
Strategy 7: Animal husbandry and dairy development										
45	AG/36	Ensure year-round feed and fodder availability	State	IP	AD	2	0	2	0	Revenue Dept. / Dept. of Agri.

46	AG/37	Ensure adequate animal housing and dedicated ponds for bathing in villages to protect livestock from extreme heat	State	IP	AD	10	0	5	5	Dept. of Animal Husbandry / Dept. of water resources
47	AG/38	Intensify disease surveillance and develop forecasting of disease outbreaks for short- and long-term time frames	ASCAD	RD	AD	20	10	0	10	Dept. of Animal Husbandry
48	AG/39	Promote breeding with indigenous varieties to improve resilience to climate change	State	RD	AD	10	0	10	0	Dept. of Animal Husbandry
49	AG/40	Promote dairy development by training women in villages on animal care, animal disease reporting, and nutrition for optimising milk production at household level of small and marginal farmers and enabling them to participate in milk cooperatives	Women self-help group	CB	AD	40	10	10	20	Dept. of Animal Husbandry, dairy and fisheries
Strategy8: Value addition and income generation										
50	AG/N/15	Value addition to horticultural products (Neera, Moringa leaf power, fruit processing)	NHM	IP	AD	120	80	20	20	TNAU
51	AG/N/16	Promotion of Integrated farming system for varied agro ecosystems	TNAU DoA	IP	AD	4000	2000	1000	1000	DoA
TOTAL						71731.94	42903.06	15523.88	13305	
Note: AD-Adaptation related; MI-Mitigation related; PA-Policy Action; RD- Research and development; IP- Investment Project; CB- Capacity Building										

State Water Mission

Code	Activity	Name of on-going/ new schemes from which funds can be accessed.	Nature	Type	Proposed Budget (2021-2030) in crore INR	Amount likely from existing central scheme / Funding agency (2021-30) crore INR	From state budget (2021-30) in crore INR	Gap Funding	Implementing Agency
WR/N/1	Climate change adaptation programme in Cauvery Delta	ADB TN State	IP	AD	1560	1092	468	0	PWD TNAU
WR/N/2	Cauvery Modernisation Scheme Under the Accelerated Irrigation Benefits Programme (AIBP)	AIBP CWC	IP	AD	11420	8000	2000	1420	PWD
WR/N/3	Irrigated Agriculture Modernisation and Water-Bodies Restoration and Management (IAMWARM) Project	World Bank	IP	AD	2820	2820	0	0	Agriculture, Horticulture, Agricultural Engineering, Agri-Marketing Board, Animal Husbandry, Fisheries and TNAU and WRD, PWD
WR/N/4	Linking of Tamiraparani Karumeniyar And Nambiyar Rivers in Tirunelveli And Thoothukudi Districts –	AIBP, National water Development Agency of Gol,	IP	AD	1000	872	0	128	PWD

	for flood management and increasing the irrigation area	CWC							
WR/N/5	Desilting of Dams and Water Bodies - Desilting of Vaigai, Pechipparai, Mettur, Amaravathy Reservoirs and Srivaikundam Anicut for increasing the area under irrigation	AIBP	IP	AD	11.86	4	2	4	WRD, PWD
WR/N/6	Desilting of Parappalar Reservoir to increase the command area	AIBP	IP	AD	39	10	10	19	WRD, PWD
WR/N/7	Desilting of Veeranam tank for providing drinking water to Chennai and surrounding area	NWM	IP	AD	80	0	40	40	WRD, PWD
WR/N/8	Dam Rehabilitation and Improvement Project (DRIP)	WRD, TANGEDCO World Bank	IP	AD	1490.98	600	400	490.98	WRD, PWD
WR/N/9	Increasing water use efficiency	NWM, PMKSY	IP	BOTH	600	200	200	200	WRD and DoA
WR/N/10	Capacity building to various stakeholder including Officials, Irrigation engineers, field	State IAMWARM	CB	AD	20	6	4	10	TNAU IMTI

	level staff on maintenance of irrigation system and increasing the water use efficiency								
TOTAL					19041.8	13604	3124	2313.84	
Note: AD- Adaptation related; MI- Mitigation related; PA- Policy Action; RD- Research and development; IP- Investment Project; CB- Capacity Building									

Forest & Biodiversity

Sl. No.	Code	Activity	Scheme	Nature	Type	Proposed Budget (2021-30) in INR crore	Amount likely from existing central scheme / External funding (2021-30) in INR crore	Amount likely from State Budget (2021-30) in INR crore	Gap Funding	Implementing Department
Strategy 1: Increasing the forest cover, both inside and outside notified forest areas through afforestation programmes as well as restoration of degraded forests										
1	FR/N/1	Increase the forest cover through massive afforestation programme in degraded forest lands of Tamil Nadu	MTPP, NAF	IP	MI	200	160	20	40	Forest Department
2	FR/N/2	Increasing the green cover outside the forest area: Plantations in urban areas, industrial sites and recreational forestry	NAF	IP	MI	80	30	20	30	Forest and Agri Department
3	FR/N/3	Promotion of private social forestry, plantation in farmlands and current fallow, agroforestry and shelterbelt plantation	Tamil Nadu Afforestation project	CB	BOTH	20	10	6	4	Forest and Agri Department
4	FR/N/4	Restoration of green cover in cyclone affected area	IFMS	IP	BOTH	40	20	10	10	Forest Department
5	FR/N/5	Restoration of tropical dry evergreen forest (TDEF) in Nanmangalam reserved forest	Nature Conservation scheme	IP	BOTH	50	20	20	10	Forest Department
6	FR/N/6	Raising Palmyrah palm	RPP	IP	MI	6	0	2.76	3.24	Horticulture Department

		plantation								
7	FR/N/7	Mass production of seedlings of desired sandal clones through tissue culture technique	RSP	RD	AD	20	0	10	10	Forest Department
8	FR/N/8	Raising teak plantations on Padugai lands	RTP	IP	MI	70	0	70	0	Forest Department
Strategy 2: Enhancing Biodiversity Conservation										
9	FR/19	Mapping of floral and faunal biodiversity in State at a high spatial resolution incorporating GPS coordinates and on GIS platform	Biodiversity conservation and greening project scheme, JICA	RD	AD	400	400	0	0	Forest Department, Biodiversity Authority of Tamil Nadu, Forest College
10	FR/14	Establishment of biodiversity corridors	Western Ghats Development programme JICA	IP	AD	200	200	0	0	Forest Department, Biodiversity Authority of Tamil Nadu, Forest College
11	FR/N/9	Integrated development of wildlife habitats	Centrally sponsored	IP	AD	200	120	80	0	Forest Department
12	FR/N/10	Eco restoration and conservation of Pallikaranai Marshland	Wetland conservation and development NAFCC	IP	AD	400	330	0	70	Forest Department, Dept. of Environment
13	FR/N/11	Conservation and management of Mangroves	CMM	IP	AD	40	20	0	20	Forest Department, Dept. of Environment

14	FR/N/12	Gulf of Mannar Biosphere Reserve protection		IP	AD	20	17.4	0	2.6	Forest Department, Dept. of Environment
Strategy 3: Livelihood enhancement										
15	FR/N/13	Conservation, development and sustainable management of medicinal plants	NMPB	IP	AD	20	6.72	3.28	10	Forest Department
16	FR/N/14	Enrichment of Non-Timber Forest Product Resources in Forest Areas	TN State	IP	AD	10	0	6.2	3.8	Forest Department, JOINT forest Management Group
Strategy 4: Wild life protection										
17	FR/N/15	Surveillance of forest and wildlife area through drone technology	TN State	RD	AD	10	0	7.68	2.32	Forest Dept. (Remote Sensing)
18	FR/N/16	Drought relief measures	HADP, TN State	CB	AD	20	4	12	6	Forest Department, JOINT forest Management Group
Strategy 5: Lower strata diversification										
19	FR/26	Large scale field testing of different forest species for lower strata diversification in different agroclimatic zones	State scheme	RD	BOTH	20	0	6	14	Forest Department, Dept. of Environment
20	FR/N/17	Creation of fodder resources and improvement of wildlife habitats	CFRIWH	IP	BOTH	50	40	0	10	TNAU, Forest Department
Strategy 6: Management of Forest fires and alien invasive species										

21	FR/29	Programmes for removal of Lantana and Prosopis from dry forest	State scheme	PILOT	MI	10	2.6	2	5.4	Forest Department
22	FR/29	Programme for phased removal of wattle from Shola ecosystem in the hills	State scheme	PILOT	MI	10	2.8	2	5.2	Forest Department
23	FR/N/18	Awareness creation and capacity building on forest fire control as well as escaping from the forest fires	IFMS	CB	AD	10	4	2	4	TNAU, Forest Department, Dept. of Environment
Strategy 7: Research component in Forestry sector										
24	FR/32	Estimating mitigation potential of forest in Tamil Nadu	SFRI	RD	MI	20	6	6	8	TNAU, Forest Department,
25	FR/34	Valuation of bio resources in Forest ecosystem	SFRI	RD	AD	20	4	6	10	Dept. of Environment
26	FR/N/19	Sustainability of afforestation activities using carbon financing options like REDD+	SFRI	CB	AD	20	6	4	10	TNAU, Forest Department,
27	FR/N/20	Impact of climate change on coral reefs and associated biodiversity	SFRI	RD	AD	10	4	4	2	TNAU, Forest Department, Dept. of Environment
Strategy 8: Capacity building on climate change for integrating CC in forest ecosystem governance										
28	FR/39	Capacity building through seminars and trainings for scientists and researchers to meet the challenges of climate change	State scheme	CB	AD	10	0	6	4	TNAU, Forest Department

29	FR/N/2 1	Capacity building programmes to JFM groups, Farmers in fringe villages, NTFP collectors, Forest officials and other stakeholders on sustainable forest management	State scheme	CB	AD	10	0	6	4	TNAU, Forest Department, Dept. of Environment
30	FR/N/2 2	Eco restoration and conservation of wetlands	GoTN/GOI	CB	AD	69.96	40	20	9.96	Forest Department, Dept. of Environment
31	FR/N/2 3	Community wasteland development programme	GoTN/GOI	CB	AD	89.92	60	20	9.92	Forest Department, Dept. of Environment
32	FR/N/2 4	Development of wildlife sanctuaries	GoTN/GOI	IP	AD	91.94	60	20	11.94	Forest Department, Dept. of Environment
33	FR/N/2 5	Establishment of advanced institute of wildlife conservation and tribal welfare school	GoTN/GOI	RD	AD	88.66	60	20	8.66	Forest Department, Dept. of Environment
34	FR/ N/26	Forest communication - Roads	GoTN/GOI	IP	BOTH	59.42	30	20	9.42	Forest Department, Dept. of Environment
35	FR/ N/27	Project elephant	GoTN/GOI	IP	AD	79.04	50	20	9.04	Forest Department, Dept. of Environment
36	FR/ N/28	Project tiger	GoTN/GOI	IP	AD	116.80	80	30	6.80	Forest Department, Dept. of Environment
37	FR/ N/29	Water conservation and canopy improvement	GoTN/GOI	IP	BOTH	222.54	150	60	12.54	Forest Department, Dept. of Environment
38	FR/ N/30	Women empowerment and medicinal plants	GoTN/GOI	CB	AD	20.16	10	6	4.16	Forest Department, Dept. of Environment
TOTAL						2834.44	1773.52	527.92	533	
<i>Note: AD-Adaptation related; MI-Mitigation related; PA-Policy Action; RD- Research and development; IP- Investment Project; CB- Capacity Building</i>										

Coastal Area Management

Code	Activity	Name of ongoing/ new scheme from which the fund can be accessed	Nature	Type	Proposed budget in INR crore during (2021-30)	Amount likely from existing central scheme (2021- 30) in crore	Amount likely from state Budget (2021- 30) in crore	Implementing Dept.	Remarks (if Any)
CAM/10	- Artificial reef deployment for protection of Vaan Island; Coral and seagrass rehabilitation in GOM; Biodiversity survey in GOM to update status of coastal habitats; and eco development activities - Shore protection along coastal stretch and construction of groynes and additional groynes	NAFCC, NABARD, NADP	IP	AD	86.93	86.93	-	DoE	Continuation of old activity
CAM/26	Strengthening Rainwater Harvesting	MGNREGS	IP	AD	1434.50	-	1434.50	RDPR	Continuation of old activity
CAM/31	Ensure Livelihood of Fishermen		IP	AD	13.28			GoMBRT	Continuation of old activity
CAM/N/1	Protection of Koswari and Appa Islands in GOM from erosion	GCF	IP	AD	196	196	-	DoE	

CAM/N/2	Integrated Coastal Zone Management	ICZM	IP	AD	612	-	612	DoE	
CAM/N/3	Preparation of ICZM Plan including Coastal processes studies for Shoreline management for Cuddalore-Thoothukudi Tamil Nadu	NCSCM	PA	AD	26.04	-	26.04	DoE	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/4	Addressing coastal erosion in identified sectors using soft engineering methods at selected locations in Nagapattinam district		IP	AD	51	51	-	PWD	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/5	Establishment of Sea Turtle Conservation Centre in Nagapattinam		IP	AD	2	2	-	DoF	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/6	Proposal for funding support to conservation and management of Gulf of Mannar Marine National Park & Gulf of Mannar Biosphere Reserve		IP	AD	18.37	18.37	-	DoF	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/7	Eco restoration of Sacred groves in Cuddalore and Nagapattinam Districts	CPREEC	IP	BOTH	7	7	-	MSSRF	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/8	Monitoring of coastal and transitional waters of		IP	AD	3.85	3.85	-	IOM	Proposed to MoEF&CC

	Tamil Nadu under ICZM								under ICZMP Phase II
CAM/N/9	Integrated Solid Waste Management for Municipal Solid Wastes of Keelakarai Municipality		IP	MI	2.98	2.98	-	CMA	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/10	Construction of Micro-compost centre for Municipal Solid Waste Management of Kayalpattinam Municipality		IP	MI	2.11	2.11	-	CMA	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/11	Construction of Vermi Shed at Compostyard in Nagapattinam		IP	MI	4.76	4.76	-	CMA	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/12	Construction of 2 Micro Compost Centres in Sannathi street, Vedaranyam Municipality		IP	MI	2.99	2.99	-	CMA	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/13	Solid Waste Management in selected fishing harbours in Tamil Nadu		IP	MI	8	8	-	DoF	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/14	Proposal for Faecal Sludge Management in Coastal Towns in Tamil Nadu		IP	MI	28	28	-	CMA	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/15	Establishment of Sewage treatment facility in Mandapam		IP	MI	34.5	34.5	-	TWAD	Proposed to MoEF&CC under ICZMP Phase II

CAM/N/16	Hatchery Production and Sea Ranching		IP	AD	10.5	34.5	-	DoF	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/17	Capacity building for integrated coastal zone management of Tamil Nadu		CB	AD	2.32	2.32	-	TN ENVIS, IOM with DoE & CAS MB	Proposed to MoEF&CC under ICZMP Phase II
CAM/N/18	Preparation of local level Coastal Zone Management Plan in 1:5000 scale	Coastal Disaster Risk Reduction Project	PA	AD	2.72	2.72	-	DoE/IRS	Project sanctioned through IRS, Anna University, funds not received
CAM/N/19	Promoting community-based mangrove restoration and conservation		CB	BOTH	2	1	1	DoE	Submitted proposal to TN DoF for CSR support, proposals to be prepared
CAM/N/20	Promoting Integrated Mangrove Fishery Farming System		CB	BOTH	1.2	0.6	0.6	DoF	Proposal to be prepared
CAM/N/21	Integration of TDEF tree plantation with water management and livelihood enhancement	GCF	IP	AD	80	40	40	MoEF&CC (DoE)	Proposal to be prepared
CAM/N/22	Assessment of microplastics in coastal areas, estuaries and lakes in Tamil Nadu, to consider remedial and management actions for		IP	AD	0.812	-	0.182		

	the improvement of environmental quality and benefit of socio-economic systems								
CAM/N/23	Establishment of a genetic garden of halophytes and halophyte farm	-	IP	AD	2	-	-	MSSRF	Proposal to be prepared
CAM/N/24	Integration disaster resilience and marine bio resources enhancement through artificial reef		PA	AD	6	-	6	DoF	Submitted proposal to TNFD. Proposal to be prepared For CSR
CAM/N/25	Promoting Fisher Friend Mobile Application	-	CB	AD	-	-	-	MSSRF	Under Consideration
CAM/N/26	Pilot testing of cultivation of saline tolerant varieties of paddy in the coastal saline soils		PILOT	AD	1	-	-	MSSRF	Proposal to be prepared
CAM/N/27	Shore Protection in Coastal ranges		IP	AD	63.74	-	-	DoF	
CAM/N/28	Avert enhanced coastal erosion due to climate change and protect the coastal zone	NABARD	IP	AD	20	-	-	DoF	Project Completed

	Avert enhanced coastal erosion due to climate change and protect the coastal zone	NADP		AD	33.40	-	-	DoF	Work in Progress
	Avert enhanced coastal erosion due to climate change and protect the coastal zone			AD	232	-	-	DoF	Tenders under scrutiny
	Avert enhanced coastal erosion due to climate change and protect the coastal zone	NFDB		AD	1137.4	-	-	DoF	DPR submitted
	Avert enhanced coastal erosion due to climate change and protect the coastal zone	FIDF		AD	338	-	-	DoF	DPR submitted
	Avert enhanced coastal erosion due to climate change and protect the coastal zone			AD	68.6	-	-	DoF	DPR submitted
CAM/N/29	Strengthen resilience of coastal communities in view of projected climate change		CB	AD	94	-	-	DoF	DPR submitted
CAM/N/30	Disaster Management Risk Project		IP	AD	77.94	-	-	SDMA	Under Consideration
CAM/N/31	Shoreline Management		IP	AD	16	-	-	GoMBRT	
CAM/N/32	Conservation Management		IP	AD	19.16	-	-	GoMBRT	
CAM/N/33	Coastal Livelihood Management		CB	AD	12	-	-	GoMBRT	

CAM/N/34	Eco-tourism		IP	AD	18.3	-	-	GoMBRT	
CAM/N/35	Institutional Arrangements, Knowledge base and Capacity building for Conservation of Specialised Marine Ecosystem		CB	AD	2.7	-	-	GoMBRT	
Total					4776.1	2120.95	505.63		
<i>Note: AD-Adaptation related; MI-Mitigation related; PA-Policy Action; RD- Research and development; IP- Investment Project; CB- Capacity Building</i>									

Strategic Knowledge for Climate Change

Code	Strategy	Name of ongoing/ new scheme/Body from which the fund can be accessed	Nature	Type	Proposed budget during 2021-30 (in lakh)	Amount likely from existing central scheme (2021-30) in Lakhs	Amount likely from state Budget (2021-30) in Lakhs	Implementing Department	Remarks (if Any)
KM/1	Create an enabling institutional framework for developing CSIS and disseminating strategic knowledge on climate change	NMSKCC	PA	AD	4.6			DoE	Funded by DST SPLICE division to DOE

KM/N/1	State level campaign on climate literacy with focus on water conservation	NABARD	CB	AD	1.02	1.02	0	CCCAR (DoE)	Climate literacy campaign launched and completed during July 2018
KM/N/2	Setting up of climate studio at Anna university as part of the Capacity Building Programme for Climate Change Adaptation	GIZ	CB	AD	5.52	5.52	0	CCCAR (DoE)	
KM/N/3	Training to farmers on Integrated farming system	NMSA	CB	AD	6	3.6	2.4	DoH	
KM/N/4	Training farmers on Organic farming cultivation practices	NMSA	CB	AD	1	0.6	0.4	DoH	
KM/N/5	11 new crops (8 annual crops and 3 annual crops) are notified under Horticulture, for the years 2019-20 to 2021-22	Centre and State	IP	AD	159.42	79.71	79.71	DoH	
KM/N/6	Proposal to bring an area of 8.62 Lakh ha. under Micro Irrigation in both Agricultural and Horticultural Crops in Tamil Nadu by 2017-2022	PMKSY	IP	MI	98.46	59.076	39.384	DoH	
KM/N/7	MIDH - NHM: increasing the productivity of Horticultural crops through	MIDH- NHM	PILOT	Both	0.26	0.156	0.104	DoH	

	Hi- Tech practices								
KM/N/8	Studies on the impacts of coral-competing sponges on coral community structure and associated biodiversity in the reef areas of Gulf of Mannar, Southeastern India	DST (Gol)	RD	AD	0.54			SDMRI	Ongoing Project (Dec 2018-Nov 2021)
KM/N/9	Studies on the status of Post-bleaching stressors that affect the Recovery of Corals in Tuticorin group of islands, Gulf of Mannar	GoMBRT	RD	AD	0.15			SDMRI	Ongoing Project (Apr 2018-Mar 2021)
KM/N/10	Ecosystem based Climate proofing watershed in Nammiyampattu and Kanamalai panchayat of Jawadhu hills of Tiruvannamalai district Tamil Nadu	GIZ	IP	BOTH	3.19			DHAN Foundation	Ongoing Project (Apr 2018-Sep 2019)
KM/N/11	Agro-advisory to farmers using NICE platform to adapt Climate Change in Tamil Nadu	GIZ	CB	AD	0.71			DHAN Foundation and District Administration Tiruvannamalai	Ongoing project (July 2018-June 2019)
Total					280.87	149.68	121.99		
<i>Note: AD-Adaptation related; MI-Mitigation related; PA-Policy Action; RD- Research and development; IP- Investment Project; CB- Capacity Building</i>									

Enhanced Energy Efficiency and Solar Mission

Code	Activity	Name of ongoing/ new scheme from which the fund can be accessed	Nature	Type	Proposed Budget (2021-30) in crore	Amount likely from existing central scheme (2021-30) in crore	Amount likely from state Budget (2021-30) in crore	Implementing Department	Remarks (if any)
ES/1	Detailed Mapping and auditing of all existing public buildings in conformance with the Energy Conservation Building Code (ECBC)	ECBC Capacity Building programme	IP	MI	0.7	0.7	0	BEE & TNEI	Yet to be released
ES/3	Implementation of energy efficiency measures in the existing buildings through retrofit		IP	MI	1.7	1.7	0	BEE & TNEI	50 Lakhs has been approved by BEE. Yet to be released.
ES/7	Energy Efficient Street lighting (Rest of Urban Tamil Nadu)		IP	MI	10	0	10	CMA	
ES/9	Implementing energy Efficiency Improvements in the	NMEE	PA	MI	1.7	0.5	51.7	BEE & TNEI, MoP	

		PEACE (State)		MI	50			Dept. of Industries and Commerce	
					Tot= 51.7				
ES/10	Awareness Generation programs on Energy Conservation and Efficiency	PEACE (State)	CB	MI	50	0	50	Dept. of Industries and Commerce	
ES/11	Solar power generation program	- Solar photo voltaic park Power Project at Kadaladi, Ramanathapuram District. (500MW- Rs2350 crore -cost of project) with Energy Storage device (150MW (30% of 500MW) @ Rs 13 per MW – Rs 1950 crs). - Renewable Energy Storage device at Basin Bridge – 3x30 MW x Rs 13cr per MW - Renewable Energy Storage device at 20 Distribution load centres across Tamil Nadu- 20 locations x 30MW Per location @	IP	MI	8600			TANGEDCO	Proposal seeking grants 1419MW (UNDER EXECUTION) for a total investment of Rs.6385.50 crore
					2340				
					15600				

		Rs13 cr / MW			(Total-26540)				
ES/12	Offshore wind generation program (50 MW + 150 MW)		IP	MI	4800			TANGEDCO	400MW (UNDER EXECUTION) for a total investment of Rs.2400 crore
ES/13	On-shore wind generation program (5000 MW + 5000 MW)		IP	MI					
ES/20	Grid connected Renewable Energy Generation – Hydro Electric Projects	Kollimalai Hydro Electric Project (1x20 MW) Sillahalla Pumped Storage Hydro-Electric Project-Stage-I (1000MW) Kundah Pumped Storage Hydro Electric Project	IP	MI	563.33 10571.13 3083.2 Tot=14217.67	7108.85	7108.85	Rural Electrification Corporation Limited And Tamil Nadu Infrastructure Development Board	

ES/21	Reduction of AT&C losses (Set of activities to reduce ATC losses of 18percent-15percent in 12th plan and 15percent-12 percent in 13th plan)	R-APDRP PART-B	IP	MI	3067.4	766.85	2300.55	MoP REC	R-APDRP (SUBSUMED IPDS): PART-B UNDER All expenditure will be reimbursed by MoP/Gol, M/s PFC and M/s REC as Loans on submission of R-APDRP Part-B Closure Reports. On successful completion and reduction of AT&C losses in the project area less than 15 percent on a sustained basis for 5 years commencing one year after the completion of Part-A works, 50 percent of project cost (Rs. 1420.60 Cr) will be converted from loan into grant in 5 equal tranches in successive years. Total allocated funds including release before 2012-13 and after 2016-17 is Rs. 178846 Lakhs.
ES/22	Transmission Infrastructure strengthening works		IP	MI	4003	4003	0	JICA REC	Transmission Infrastructure strengthening works (Greater Chennai strengthening)- 400 KV SS,230 KV SS,400 KV UG cable- JICA

									Commissioned work to the value of Rs.1870.47. Transmission Infrastructure strengthening works (Rest of Tamil Nadu)- 400 KV SS,230 KV SS- JICA/ REC Commissioned work to the value of Rs.2672.46 Transmission Infrastructure strengthening works (Network Improvement)- 765 KV,400 KV and lines Work under progress, some of the project are in tender stage. UDAY (HT strengthening Works): DPR submitted to M/s. REC for availing loan.

ES/23	Distribution Infrastructure Strengthening works	DDUGJY IPDS	IP	MI	4597.6 8478.55 Tot=13076.15	7845.69	5230.46	MoP	Distribution Infrastructure Strengthening works: Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) Grant by MoP/Gol is 60 percent (Rs 551.712 Cr), Lending from Financial Institutions (FIs) is 30 percent (Rs 275.856 Cr) and Utility own funds 10% (Rs.91.952 Cr). Distribution Infrastructure Strengthening works: Integrated Power Development Scheme (IPDS) Grant by MoP/Gol is 60% (Rs 1017.52Cr), Lending from Financial Institutions (FIs) is 30% (Rs 508.76 Cr) and Utility own funds is 10percent (Rs.169.59 Cr).
ES/24	Feeder separation with HVDS project		IP	MI	NA			TANGEDCO	Pilot is done and further works will be taken up.

ES/25	Smart grid initiatives		IP	MI	8000	0	8000	TANGEDCO	TANGEDCO is proposing to implement Smart meters for 45 lakhs consumers in Chennai city.
ES/26	DSM (Demand Side Management) Activities		IP	MI	0			EESL	
ES/27	Preventive measures to mitigate climate change effects	- Implementing revised MoEF - Implementation of super critical technology - Coastal Disaster Risk Reduction Project (CDRRP)	IP	MI	12750 5700 720 Tot= 19170	100 percent from World Bank for CDRRP.		TANGEDCO	Provision of Flue gas desulfurization (FGD) and nitrogen oxide reduction equipments. Conversion of Overhead Conductor to Underground Cable in the coastal districts of Cuddalore and Nagapattinam. Work is under progress.
ES/N/1	School Energy Efficiency Programme on replacement of inefficient appliances with Energy Efficient Appliances in schools		IP	AD	12	12	0	BEE & Electrical inspectorate of TN	
ES/N/2	School Awareness programme through Eco clubs (500 schools)		CB	AD	1.6	1.6	0	BEE & Electrical inspectorate of TN	

ES/N/3	Capacity building programme for SME on DSM		CB	AD	0.5	0.5	0	BEE & Electrical inspectorate of TN	
ES/N/4	Capacity building programme for Financial Institutions / ESCOs		CB	AD	0.26	0.26	0	BEE & Electrical inspectorate of TN	
ES/N/5	Energy Conservation Awareness for General Public		CB	AD	1	1	0	BEE & Electrical inspectorate of TN	
ES/N/6	Notification of TNECBC for Commercial Buildings in the State with the support of TNECBC cell and for training		PA	MI	0	0	0	BEE & Electrical inspectorate of TN	
ES/N/7	Notification of TNECBC for Residential Buildings in the State with the support of TNECBC cell		PA	MI	0.8	0.8	0	BEE & Electrical inspectorate of TN	
ES/N/8	Model Energy Efficient village programme		PILOT	MI	1	1	0	BEE & Electrical inspectorate of TN	

ES/N/9	Solar Technician Training		CB	AD	26	0	26	Tamil Nadu Skill Development Corporation	
ES/N/10	Effective utilisation of fly ash in view of climate change		IP	AD	1324.4			TANGEDCO	
ES/N/11	Kundah Pumped Storage Hydro Electric Project (4*125 MW) in Nilgiris District		IP	MI	3700			TANGEDCO	
TOTAL					98056.7	19744.8	22777.56		
Note: AD-Adaptation related; MI-Mitigation related; PA-Policy Action; RD- Research and development; IP- Investment Project; CB- Capacity Building									

Sustainable Habitat

Code	Activity	Name of ongoing, new scheme from which the fund can be accessed	Nature	Type	Proposed Budget (2021-30) in crore	Amount likely from existing central scheme (2021-30) in crore	Amount likely from state Budget (2021-30) in crore	Implementing Department

SH/1	Implement ECBC norms in institutional, commercial and residential sectors	ECBC capacity building programme	PA	MI	0.35			
SH/2	Integrate design alternatives to withstand impacts of CC (extreme rainfall, flooding, cyclones and storm surges and other disasters)	i) Construction of ISWD in Kovalam Basin in extended areas of Greater Chennai Corporation in Nanganallur, Madipakkam, Sholiganallur and Perungudi ii) Construction of ISWD in Kosthalaiyar Basin in extended areas of Greater Chennai Corporation in Thiruvottiyur, Manali, Madhavaram	IP	MI	3761.15	KfW Bank, Asian Development Bank, World Bank		GCC
SH/7	Development in flood prone areas, protecting and resettling encroachments	Tamil Nadu Housing and Habitat development for urban poor and inclusive resilient and sustainable housing for urban poor in tamil Nadu	IP	AD	13000	External assistance (34percent)- 4420	GOTN Share (66%)- 8580	PWD, TNSCB & GCC

SH/8	Implementation of compulsory plantation of trees in all sectors (Housing, Institutional) to reduce heat island effect	AMRUT (Development of green space)	IP	MI	374.4	GOI Share: 150.01 (AMRUT)	GOTN Share: 60.03 (AMRUT) ULB Share: 90.06	DTP, RDPR, DTCP, CMA
SH/9	Providing water supply scheme and 24 X 7 ready water supply in extended areas	AMRUT, JNNURM, CMCDM, JICA, TNUDP-III	IP	AD	7114.72	GOI Share: 550.54 (AMRUT)	GOTN Share: 293.48 (AMRUT) ULB Share: 623.38	TWADB, CMWSSB, CMA
SH/10	Revamping existing water supply schemes to avoid loss of water by laying new pipelines in place of damaged pipelines	Combined Water Supply Schemes, AMRUT	IP	AD	56	GOI Share: 28 (AMRUT)	GOTN Share: 11.2 (AMRUT) ULB Share: 16.8 (AMRUT)	CMWSSB, TWADB, DTP
SH/12	Sewerage and Septage Management	AMRUT, JNNURM, CMCDM, TNUDP-III	IP	AD	9232.04	GOI Share: 3192.55 (AMRUT)	GOTN Share: 1504.028 (AMRUT)	CMWSSB
SH/14	Wastewater reclamation programme	TNUDF, AMRUT, TNIPP, I&AF	IP	MI	4383.2	GOI Share: 1250 (AMRUT)	GOTN Share: 500 (AMRUT) ULB Share: 750 (AMRUT)	CMWSSB

SH/19	Rainwater Harvesting Structures	MGNREGS (rural)	IP	MI	1717.25	GOI Share: 1545.53	GOTN Share: 171.73	DTP, RDPR
SH/21	Undertake regular water monitoring by establishing labs in all districts	Regular State Fund for running Laboratories	RD	Both	0.05		State (100%)- 0.05	Surface and Ground Water Board
SH/22	Protection of water sources including traditional water bodies	Restoration and rejuvenation of water bodies/ ponds/lakes under sustainable water; Smart City Fund	IP	AD	342	Central Share 50%- 171	State Share 50%- 171	GCC
SH/24	Reuse of Grey Water	UIDSSMT, JnNURM, MGNREGS	IP	AD	2603.77	Central share 20%- 520.754	State Share 80%- 2083.016	CMWSSB, DTP, RDPR
SH/25	Recharge of Ground Water	MGNREGS	IP	AD	250.15	Central share 90%- 225.15	State Share 10%- 25	DTP, RDPR
SH/27	Developing Satellite townships to decongest Cities (Urban)	Satellite Township Initiative	IP	AD	i) For Thirumazhisai Satellite Township, proposed budget can be determined by the consultant engaged for the financial		State Share (100%)- 4	TNHB

					assistance. ii) For Uchappatti – Toppur Satellite Township, the project proposal is based on the demand availability			
SH/33	Ensure 100% sanitized and open defecation	Swachh Bharat Mission	IP	AD	322.2	Central share (SBM) 60%-193.32	State share (SBM) 40%-128.9	DTP, GCC, RDPR
SH/34	Slum free cities programme	Housing for all, Green House	IP	AD	54873	Central share 33%- 18.215	State Share 66%- 36659	DTP, TNSCB
SH/36	Sustainable solid waste management (urban)	Special Solid Waste Management / Swachh Bharat Mission Urban	IP	MI	5232.50	Central share (SBM U) 75%-3924.38	State share (SBM U) 25%-1308.13	DTP, GCC
SH/37	Sustainable solid waste management (rural)	Special Solid Waste Management/Swachh Bharat Mission Gramin	IP	MI	3540.27	Central share (SBM G) 60%-2124.6	State share (SBM G) 40%-1416.11	RDPR
SH/39	Undertake source segregation through material recovery facility at disposal sites		IP	MI	16.08		16.08	GCC

	to avoid ground water pollution							
SH/62	Developing exclusive lanes for pedestrian Promote cycling with good cycling paths, cycle parking facilities and link between cycling and public transport	Smart City Fund	IP	MI	95	Central Share 50%- 47.5	State Share 50%- 47.5	GCC
SH/64	Improvement to all existing roads and maintenance at regular intervals	IUDM, NABARD, TURIP, Infra, O&M, CGF, SRP	IP	AD	13146.25			DTP, RDPR
SH/68	Organised Parking (urban)	Smart City Fund	IP	MI	14.16	Central Share 50%- 7.08	State Share 50%- 7.08	GCC
SH/79	Development of green parks	AMRUT, CRRT, ADYAR	IP	MI	197.99	GOI Share: 45.03 (AMRUT)	GOTN Share: 18.01 (AMRUT) ULB Share (AMRUT): 27.02 ADYAR State share (100%)- 71.05 CRRT State	DTP, GCC, DTCP

							Share (100%)- 36.87	
SH/N/ 1	Promoting Energy Efficiency in the economy, notably in industry, transportation, buildings and appliances	Chief Minister's Solar Powered Green House Scheme	IP	MI	420			RDPR
TOTAL					63376.98	18050.84	12097.42	
Note: AD-Adaptation related; MI-Mitigation related; PA-Policy Action; RD- Research and development; IP- Investment Project; CB- Capacity Building								