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 6*** and ***Annexure 7*** 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.

[42]https://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. Jayalaitha'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 *Littopenaeus vannamel* 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 8*** and ***Annexure 9*** 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 6*** and ***Annexure 7*** 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 insteadof60percentadoptedincalculatingirrigationfor 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 in11 blocks the quality is bad (Table5.7).

Table 5.7 Over-exploitation of groundwater in Tamil Nadu

S. No of	Year of Assessment	Total Number 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 Thiruvarur 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 increases towards end-century scenario when compared to the mid-century scenario. Projected peak discharge is higher under high emission scenario. Mani-fold 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 8*** and ***Annexure 9*** 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 6*** and ***Annexure 7*** 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 sand 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. The1988 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 between15.17 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 • TAFCORN 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 ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.	**SDG 13:** Take urgent action to combat climate change and its impact by regulating emissions and promoting development in renewable energy	**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_2e 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. Interms 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.
- CapacitybuildingonclimatechangeforintegratingCCinforestecosystemgovernance

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 461.96Crore for both adaptation and mitigation which consists of 7activities.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 8*** and ***Annexure 9*** 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 & Bio-diversity** 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 takenup.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 6*** and ***Annexure 7*** 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 8*** and ***Annexure 9*** 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 ***Annexure6*** and ***Annexure 7*** 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 • Theactivities/strategiesarecomponentsofalargerproject,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	

[51]The 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

Collectively12 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 INR3.45 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 8*** and ***Annexure 9*** 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 inThanjavur District.
Cyclones	Cyclonic activities on the east coast are more severe than the west
Sea Erosions	Districts like Kanyakumari, Thirunelveli, parts of Tuticorin, Ramanathapuram, Pudukkotai, Thanjavur, Thiruvarur, Nagapattinam, Cuddalore,Villupuram, Kancheepuram, Chennai and Thiruvallur.
Sea WaterIncursion	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	SixdistrictsnamelyChennai,Coimbatore,Dindigul,Kancheepuram,Maduraian d 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 2018-2030[51]. 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 … *health and disaster management*.
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.

[53]Available at: http://www.tn.gov.in/dear/Health.pdf
[54]Commissionerate of Revenue Administration and Disaster Management, 2019, available at: https://tnsdma.tn.gov.in/app/webroot/img/document/heatWaveAction2019.pdf