

TAMIL NADU CLIMATE CHANGE MISSION DOCUMENT

Department of Environment,
Climate Change & Forest





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1.1. BACKGROUND

INTRODUCTION

The land resources of Tamil Nadu are conventionally categorized into five major physical divisions - the Kurinji or mountainous region, the Mullai or forest region, the Marudham or the fertile plains, the Neidhal or coastal region and the Palai or arid region.

The State of Tamil Nadu, India is located in the extreme south of the Indian subcontinent. Bound by the Indian Ocean to the east and south and flanked by the states of Kerala to the west, Karnataka to the northwest, and Andhra Pradesh to the north, the state holds a strategic position amidst the southern states of India. The land resources of Tamil Nadu are conventionally categorized into five major physical divisions - the Kurinji or mountainous region, the Mullai or forest region, the Marudham or the fertile plains, the Neidhal or coastal region and the Palai or arid region. Each of the five categories represents distinct geographical features and have prominent climatic conditions leading to availability of diverse resources within the state.

Tamil Nadu is endowed with rich biodiversity that is protected and conserved through a network of five National Parks, seventeen Wildlife Sanctuaries, 14 Ramsar Sites – the highest in the country and three Biosphere Reserves surrounded by both Eastern Ghats and Western Ghats. On the other hand, the State has recorded impressive economic growth along with significant progress in human development in recent years. The evidence being that Tamil Nadu has the highest level of urbanization in India, where 48.45 per cent of the population live in urban areas. This conjunction brings with it a plethora of associated environmental problems. Thus Tamil Nadu has an urgent call for action on Sustainable Development.

It is now widely recognized that there is high probability of increase in the frequency and intensity of climate related natural hazards due to climate change posing potential threat in all states of India. Though there is fairly enhanced community awareness, still there is relative absence of robust regional climate models and vulnerability studies in Tamil Nadu. This makes it highly sensitive and vulnerable to climate change and its impacts.

1.2. CURRENT STATE OF GLOBAL CLIMATE CHANGE

INTRODUCTION

There is now enough evidence that the earth's climate is changing, and it is adversely affecting both biophysical (mountains, rivers, forests, wetlands, etc.) and socio-economic systems (hill and coastal communities, agriculture, animal husbandry, etc.)¹. Many of those challenges can be directly connected to human activity such as unchecked industrialization, unplanned urbanization, unregulated drilling, overfishing and bottom trawling, deforestation, strip mining, fracking, and the list goes on².

Climate change, a matter of international concern, poses a serious menace to human existence. Over the past two decades, with the effects of global climate change becoming increasingly manifested and visible at the local level, Climate Policy and Planning has become an urgent necessity across the country. Many countries are realizing the need to begin adapting to a warming world. As this climate phenomenon is constantly evolving and changing, responses to mitigation & adaptation must also be dynamic, scalable, and in line with emerging scenarios. The concentration of greenhouse gas (GHG) emissions in the atmosphere are wreaking havoc across the world and threatening lives, economies, health and food. The world is far from securing a global temperature rise to below 2°C as promised in the Paris Agreement. With a baseline in 1990, some countries are emitting more, some the same and others are emitting less.³

Individual structures, such as the Kyoto Protocol, International Carbon Action Partnership, Cancun Agreement, Paris Agreement etc. have led the countries to implement their own measures to reduce emissions and take mitigation and adaptation measures reflected in the "Nationally Determined Contributions". Paris Agreement in which countries have agreed in the year 2015, to limit global mean temperature within 2 degree, the country is committed to working towards a limit of 1.5 degree⁴.



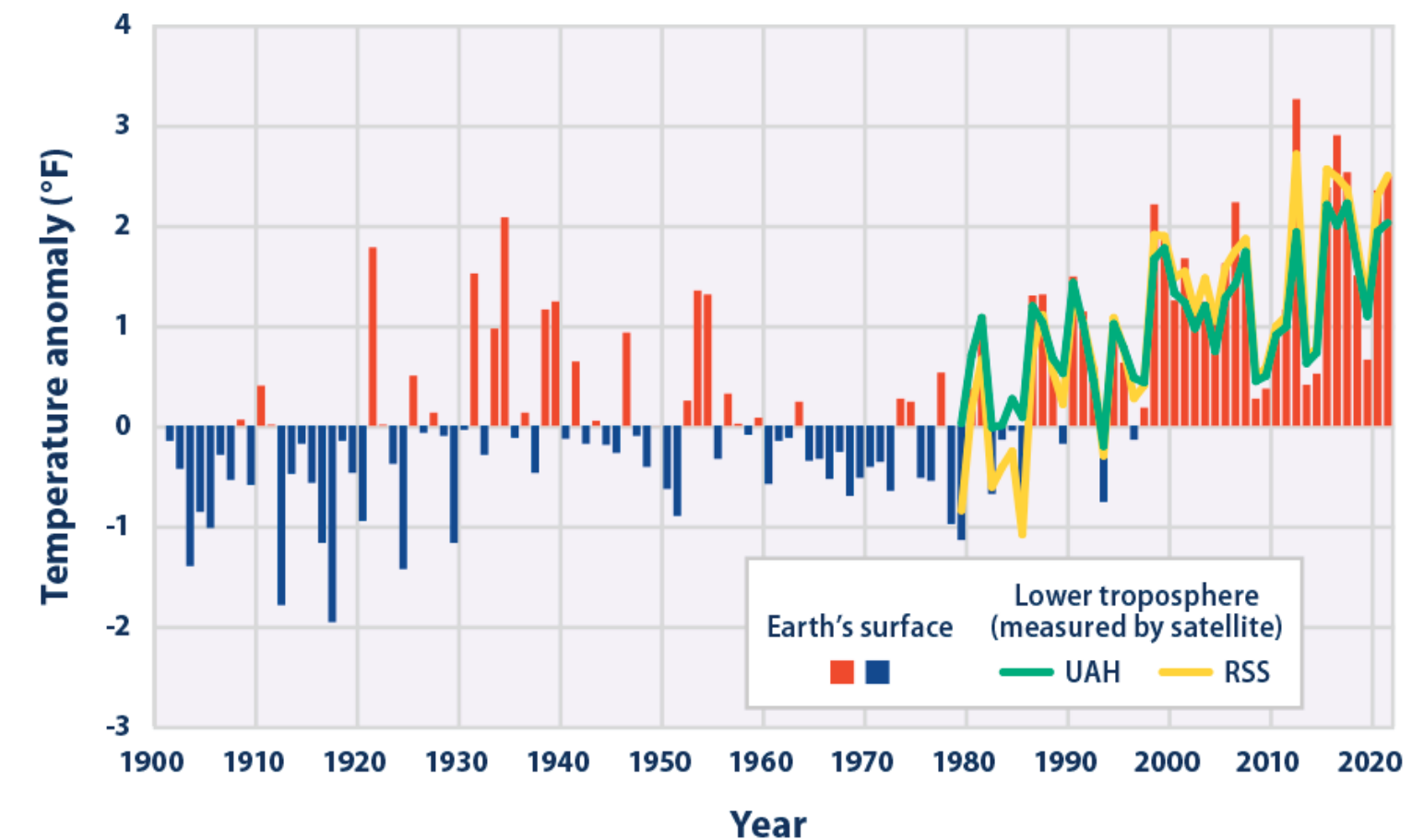
CURRENT STATE OF GLOBAL CLIMATE CHANGE

Various International scientific organizations have made the below observations using satellite measurements indicating the current state of climate change at the global level.

- Earth's temperature has risen by 0.14° Fahrenheit (0.08° Celsius) per decade since 1880, but the rate of warming since 1981 is more than twice that: 0.32° F (0.18° C) per decade. For 2021, the average temperature across global surfaces was 1.51°F (0.84°C) above the 20th-century average. This is the sixth highest among all years in the 1880-2021 record. The year 2021 marks the 45th consecutive year (since 1977) with global temperatures, at least nominally, above the 20th-century average. The nine years spanning 2013 through 2021 rank among the 10-warmest years on record⁵.
- Disasters have increased in the last 20 years (2000-2019). In the period 2000 to 2019, there were 7,348 major recorded disaster events compared to 4,212 between 1980-1999. Climate-related disasters have increased the most, accounting for 6,681 events⁶.
- There is a 50:50 chance of the annual average global temperature temporarily reaching 1.5 °C above the pre-industrial level for at least one of the next five years and the likelihood is increasing with time, according to a new climate update issued by the World Meteorological Organization (WMO)⁷.
- According to preliminary analysis of satellite measurements by Copernicus, the European Union's climate agency, atmospheric concentrations of CO2 reached an annual record of approximately 414.3 parts per million (ppm) in 2021 with April recording the highest monthly concentrations of 416.1 ppm⁸.
- To put this into context, the amount of CO2 in the atmosphere before the Industrial Revolution and large scale burning of fossil fuels was 280 ppm. Meanwhile, atmospheric concentrations of methane (CH₄), a more potent but shorter-lived gas that trap heat in the atmosphere 80 times more effectively than CO2, also reached an annual record of approximately 1,876 parts per billion (ppb) in 2021.
- Natural ecosystems have declined by 47 per cent on average, relative to their earliest estimated states and approximately 25 per cent of species are already threatened with extinction⁹.
- Global sea level rise accelerated since 2013 to a new high in 2021, with continued ocean warming and ocean acidification.¹⁰

- With regard to the total volume of atmospheric concentration of greenhouse gases, the IPCC's Sixth Assessment Report observed that in 2019, atmospheric concentrations of CO2 were higher than at any time in at least 2 million years and that of CH₄ and nitrous oxide (N₂O), another potent greenhouse gas, were higher than at any time in at least 800,000 years. It is therefore certain that atmospheric concentrations greenhouse gases will continue to increase with potentially dire consequences for the Earth's climate system.

- The concentration of greenhouse gases (GHG) in the atmosphere causes global temperatures to rise with a host of impacts and catastrophic consequences. At the moment the world is heading for a rise in excess of 3°C this century¹¹. UNFCCC provides the opportunity to the Global leaders to take credible action on climate change and transition towards clean energy, through their commitments to limit GHG emissions to restrict the temperature rise below 1.5 °C.



⁵ UNEP-State of the Climate 2022
⁶ UNDRR 2020

⁷ WMO-Climate Update 2022-2026
⁸ GHG concentrations-Copernicus-2021

⁹ IPBES, 2019
¹⁰ State of Global Climate 2021-WMO Provisional report

¹¹ UNEP State of Climate Emergency 2022

1.3 CURRENT STATE OF CLIMATE CHANGE – INDIA'S CONTEXT

INTRODUCTION

India's average temperature has risen by around 0.7°C during 1901–2018. This rise in temperature is largely on account of GHG-induced warming, partially offset by forcing due to anthropogenic aerosols and changes in Land Use Land Cover Change (LULCC). By the end of the twenty-first century, average temperature over India is projected to rise by approximately 4.4°C relative to the recent past¹².

India has suffered increasingly frequent and extreme heat waves since the start of the century. In 2015, over 2400 people died and heat waves and such events have become more common. 17 out of 20 people in India are vulnerable to extreme hydromet disasters¹³. As per UNEP global Climate Index, India ranked 7th among other countries with more climate risk¹⁴ and ranked 5th out of 181 countries, implying an extremely high exposure and vulnerability¹⁵. This ranking is based on quantified impacts of extreme weather events in terms of fatalities as well as economic losses that have occurred during 1999-2018. India is estimated to have suffered losses of almost USD 80 billion due to extreme climate events in the last two decades.⁸

In the recent 30-year period (1986–2015) of India's Climate observation, temperatures of the warmest day and the coldest night of the year have risen by about 0.63°C and 0.4°C, respectively. The Sea surface temperature (SST) of the tropical Indian Ocean has risen by 1°C on average during 1951–2015, markedly higher than the global average SST warming of 0.7°C, over the same period. Rainfall during the South West monsoon, over India has declined by around 6% from 1951 to 2015, with notable decreases over the Indo-Gangetic Plains and the Western Ghats¹⁶. The overall decrease of seasonal summer monsoon rainfall during the last 6-7 decades has led to an increased propensity for droughts over India. Both the frequency and spatial extent of droughts have increased significantly during 1951–2016. In particular, areas over central India, southwest coast, southern peninsula and north-eastern India have experienced more than 2 droughts per decade, on average, during this period. The frequency and intensity of extreme events in India have increased by almost 200% since 2005¹⁷. The area affected by drought has also increased by 1.3% per decade over the same period. Currently, sea levels along the Indian coast are rising. The long-term average of sea level rise is about 1.7 mm/year. However, these are changing at different rates along the Indian coast¹⁸.

Twenty-first century, average temperature over India is projected to rise by approximately 4.4°C relative to the recent past.

¹² Assessment of Climate Change over the Indian region-MoES, 2020

¹³ CEEW- Mapping India's Climate Vulnerability 2021.

¹⁴ UNEP-State of the Climate 2022

¹⁵ Germanwatch Global Climate Risk Index- 2019

¹⁶ Assessment of Climate Change over the Indian region- MoES, 2020

¹⁷ CEEW- Mapping India's Climate Vulnerability 2021.

¹⁸ India's Third BUR report to UNFCCC



1.4. NATIONAL POLICIES ON CLIMATE CHANGE TOWARDS LIMITING TEMPERATURE BELOW 1.5°C

INTRODUCTION

India has pursued major domestic policies and schemes in areas of climate change mitigation and adaptation actions, particularly in the fields of clean and renewable energy, enhancement of energy efficiency, development of less carbon-intensive and resilient urban development, promotion of waste to wealth and electric vehicles, etc. Keeping in mind the risks outlined by the United Nations framework convention on Climate Change (UNFCCC), the Government of India has formulated the National Action plan for Climate Change (NAPCC) which was released by the Prime Minister on 2008. It outlines a national strategy that aims to enable the country to adapt to climate change and enhance the ecological sustainability of India's development path. It stresses that maintaining a high growth rate is essential for increasing living standards of the vast majority of people of India and reducing their vulnerability to the impacts of climate change. There are eight-National Missions which form the core of the National Action Plan.

They focus on promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation.



There are eight National Missions on climate change:

1. National Mission for Sustainable Agriculture
2. National Water Mission
3. National Mission for a Green India
4. National Solar Mission
5. National Mission for Enhanced Energy Efficiency
6. National Mission on Sustainable Habitat
7. National Mission for Sustaining the Himalayan Eco-system
8. National Mission on Strategic Knowledge for Climate Change

India has submitted its first Nationally Determined Contribution (NDC) as part of the Paris agreement to UNFCCC on October 2, 2015 and the updated NDCs in August 2022. The NDC comprised eight goals; three of these have quantitative targets upto 2030.

The Updated NDC's are as follows:

- To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement for 'LiFE'-'Lifestyle for Environment' as a key to combating climate change
- To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
- To reduce Emissions Intensity of its GDP by 45% by 2030, from 2005 level
- To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF)
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management
- To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap
- 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



Tamil Nadu has harnessed around 9608.04 MW of wind energy and 4475.21 MW of solar energy as on March 2021. Tamil Nadu is also the 'Front runner' in SDG India index 3.0.

1.5. TAMIL NADU STATE PROFILE IN CLIMATE CHANGE CONTEXT

The State of Tamil Nadu, is located in the extreme south of the Indian subcontinent. The land resources of Tamil Nadu are conventionally categorized into five major physical divisions - the Kurinji or mountainous region, the Mullai or forest region, the Marudham or the fertile plains, the Neidhal or coastal region and the Palai or arid region. Each of the categories represents distinct geographical features and has a prominent climatic condition. This provides rich biodiversity that is protected and conserved through a network of 5 National Parks, 17 Wildlife Sanctuaries and 3 Biosphere Reserves.

INTRODUCTION

The forest cover in Tamil Nadu stands at 20.27% of its total geographical area, of which 1782 km² has been declared as protected areas. The total carbon stock in Tamil Nadu's forests is 216.78 million tonnes (794.86 million tonnes of CO₂ equivalent) which is 3.04% of total forest carbon stock of India as a whole as per ISFR 2022¹⁹. The Western Ghats are one of the 25 global biodiversity hotspots and one of the 3 mega centres of endemism in India. Five elephant reserves are also located within the State. The State is endowed with 14 prestigious Ramsar sites, the highest number in the country.

The average annual rainfall of the State is around 987 mm compared to the national average of 1,200 mm and Tamil Nadu has only 2.5% of the country's total water resources. As per Niti Ayog's report on State Energy & Climate Index (SECI) (Round 1) 2022, Tamil Nadu has harnessed around 9608.04 MW of wind energy and 4475.21 MW of solar energy as on March 2021²⁰.

Tamil Nadu has recorded impressive economic growth along with significant progress in human development in recent years. The evidence being that Tamil Nadu has the highest level of urbanization in India, where 48.45 per cent of the population live in urban areas. This conjunction brings with it a plethora of associated environmental problems. It is now widely recognized that there is high probability of increase in the frequency and intensity of climate related natural hazards due to climate change and hence increase in potential threat due to climate change related natural disasters in all states of India. Though there is fairly enhanced community awareness, there is still relative absence of robust regional climate models and/or vulnerability studies, making Tamil Nadu potentially highly sensitive and vulnerable to climate change and its impacts.

¹⁹ ISFR 2022
²⁰ Niti Ayog's report on State Energy & Climate Index (SECI) (Round 1) 2022



02

CLIMATE CHANGE
AND ITS **IMPACT**
IN **TAMIL NADU**

2.1 OBSERVED CLIMATE OF TAMIL NADU

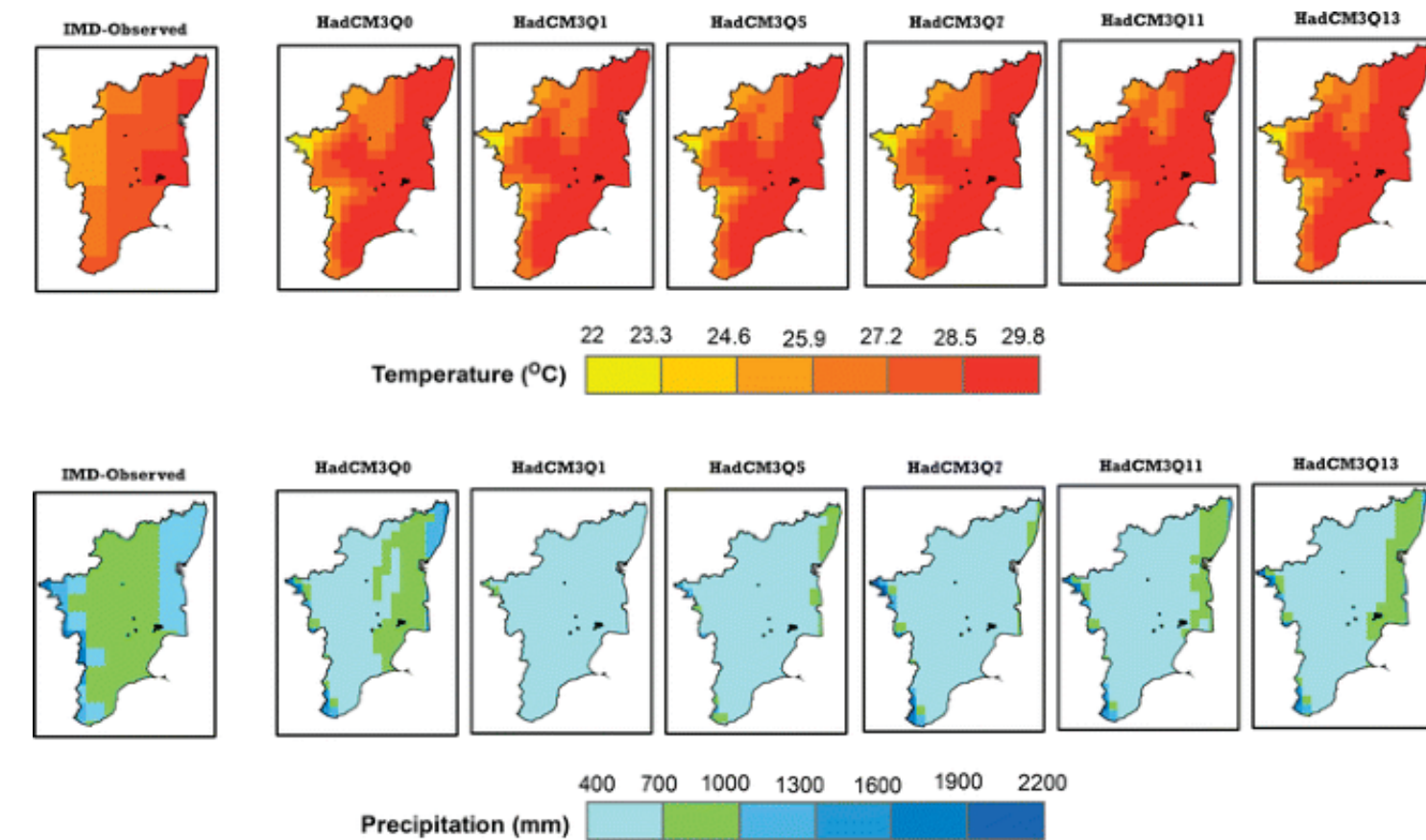
CLIMATE CHANGE AND ITS IMPACT IN TAMIL NADU

Tamil Nadu is heavily dependent on monsoon rains for recharging its water resources, monsoon failures lead to acute water scarcity and severe drought. The mean annual rainfall of the state for the thirty-year period from 1989-2018 is about 898 mm of which 48 percent is through the North East monsoon, and 35 percent through the South West monsoon²¹. However, there have been intense rainfall events in the past decades recording excess rainfall. **The temperature in Tamil Nadu in summer seldom rises above 45 °C and in winter seldom falls below 18 °C.**

It is observed that the changes in extreme indices with respect to baseline (1970–2000) reveal highly significant trend, with minimum temperature indices showing prominent increase compared with maximum temperature indices. It is also seen that there is a substantial increase in summer days above 40 °C. District wise studies on temperature and rainfall in Chennai, Kancheepuram, Kolli hills, Cuddalore and Thanjavur have indicated varying extent and pattern in temperature and rainfall over Tamil Nadu.

Increasing temperatures and changing precipitation patterns in Tamil Nadu is expected to influence even more profoundly the varied ecosystems and some vulnerable sections of human populations, with inter and intra-sectoral complexity. Effects of climatic changes on the environment and people's livelihoods could impact health, agriculture, forests, water resources, coastal areas, species and natural areas. There is a need to understand the implications of climate change on vulnerable sections of people and formulate special strategies for sustaining the diverse ecosystems as well as to ensure an inclusive sustainable growth of the State.

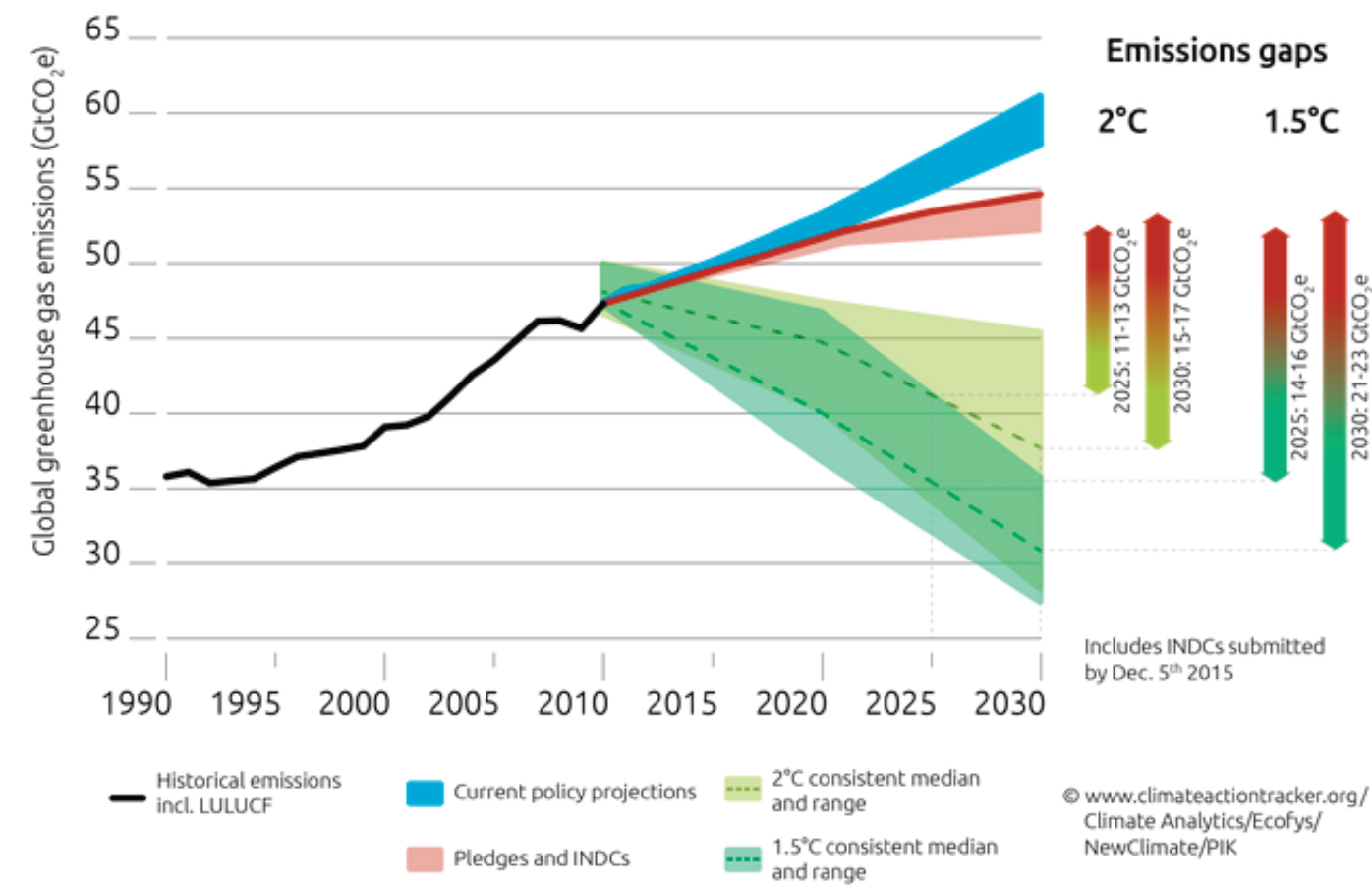
²¹ Report on NEM 2020





2.2. PROJECTED CLIMATE CHANGE IN TAMIL NADU

CLIMATE CHANGE AND ITS IMPACT IN TAMIL NADU



Technical information generated through scientific studies from PRECIS regional climate model indicated that maximum temperature over Tamil Nadu may increase by about 3.1 °C with a general maximum increase of 3.3–3.5 °C, over western zone and minimum temperature by about 3.5°C. **The minimum temperature projections consistently show higher values when compared to maximum temperature with a difference ranging from 0.2 to 0.5 °C.** No significant change in the rainfall is seen from the baseline by the end of the century for the whole Tamil Nadu. However, there is a slight increase in rainfall during the northeast monsoon season (October–December). PRECIS-generated rainfall and temperature scenarios were evaluated with ground-based observed data during 1970– 2000 in Tamil Nadu.

Tamil Nadu is also one of the extremes-prone States in India that faces more extremities of cyclones and drought recurrently. With respect to extreme weather events future projections clearly indicate an increased probability of extreme temperature spells that would be expected to be very detrimental for public health. Specific conclusions reveal that there may be an increase of 3.30 °C during daytime and 3.55 °C during night-time and denotes a decrease in rainfall of 3.24% by the end of the century. The maximum temperature above

40°C (summer days) is projected to increase drastically with a strong slope. These results intimate that Tamil Nadu will be adversely affected by warmer condition by the last quartile of the century, which will make the environment hostile for ecosystem and crop productions, and furthermore, the change may increase the occurrences of heat wave and health hazards in the future.

Tamil Nadu being a coastal state, is prone to the sea level rise. It has been estimated that the projected average medium range of SLR for the chosen study area may range from 7.12 cm to 36.98 cm for Representative Concentration Pathways RCP 2.6; 7.39 cm to 50.01 cm for RCP 4.5; 7.18 cm to 51.91 cm for RCP 6.0; 7.40 cm to 78.15 cm for RCP 8.5 for the time slices from 2025 to 2100.

With regard to extreme rainfall there is an overall increasing pattern. This increases the possibility of storm and flash floods in the 2080s. Furthermore, the probability of 1-day rainfall is higher than 5-day rainfall which implies that the duration of extremes will be reduced but the intensity will be increased. It was further explored that internal climate variability of El Niño Southern Oscillation ENSO also contributes to the North East Monsoon rainfall in the coastal districts of Tamil Nadu. These consequences will have a profound impact on agriculture, health, water resources, and coastal and economic sectors.

2.3. IMPACT OF CLIMATE CHANGE ON VARIOUS SECTORS OF TAMIL NADU

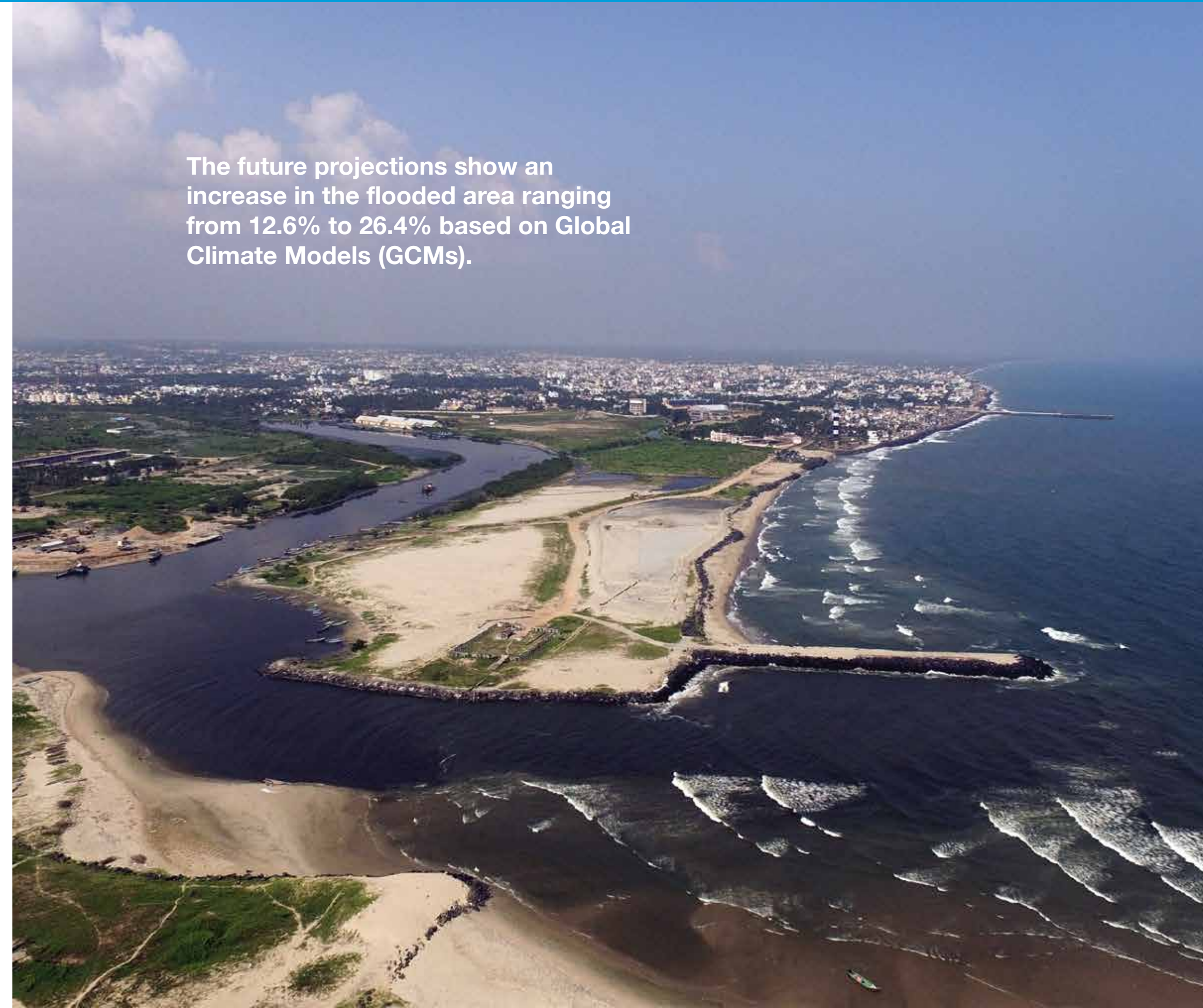
The impact of climate change is studied across various sectors in Tamil Nadu and it is found apparent that climate change is and may have a detritus effect on all realms of development both in rural and urban sectors.

WATER RESOURCES

The impact analysis of Chennai city, one of the fastest-growing economic centres of South India shows that the increase in temperature, erratic rainfall, sea-level rise, and other climate extremities will affect the key sectors such as water, infrastructure, health, biodiversity, energy, and transport. The Climate change impact study on the occurrence of fluvial flooding in the Adyar sub-basin, predicted that for the 100-year return period, the peak discharge for the future climate scenario would increase by 34.3%–91.9% when compared to the present climate scenario. Similarly, the future projections show an increase in the flooded area ranging from 12.6% to 26.4% based on Global Climate Models (GCMs).

Subsequently, while studying the flood carrying capacity of storm drainage under present and future climate scenarios through the integrated hydraulic and hydrological modelling, vulnerable hotspots were identified. Through the study, flood mitigation measures were suggested to reduce the flood risk at vulnerable areas in Chennai, which is projected to increase in the future. Drastic reduction in green cover, changes in land-use patterns, population growth, and changing climate are cumulative effects to develop the city's infrastructure, including climate-friendly policies to adopt and build the city's resilience.

The future projections show an increase in the flooded area ranging from 12.6% to 26.4% based on Global Climate Models (GCMs).

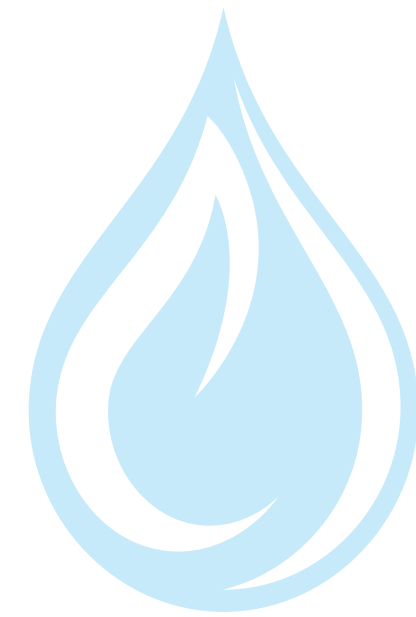


CLIMATE CHANGE
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AGRICULTURE

Tamil Nadu is an agrarian state and climate change has potential influence on various aspects of agriculture and allied sectors. A case study of Kancheepuram district projects that there is a decreasing trend in soil moisture for the period 2040-2070. The possible impacts of this change like changing cropping patterns, hampering crop productivity, increasing pests and insect attack may threaten the agro biodiversity and food security of the State.

As per the projections in Chengalpattu district of Tamil Nadu, there is going to be 3 to 23% increase in the number of drought days in blocks covering the south east parts of the district. This change warrants mainstreaming of appropriate drought proofing adaptations into developmental planning to enhance the resilience of agriculture and water management. **The findings from the spatiotemporal analysis of projected impacts of climate change reveal that under the RCP 4.5 scenario there will be decreases in the major C3 and C4 crop yields in the coasts of Tamil Nadu,** affecting local food security and the livelihood security of the people. Adaptation measures specific to the sector and one that are perceived directly through farmers at cadastral levels have promising future.



COASTAL AREAS

Being bestowed with a long coastline of 1,076 kilometres, Tamil Nadu is particularly vulnerable to the impact of sea-level rise coupled with the changes in other climate parameters viz. temperature and rainfall. **The vulnerability of coastal areas in Vellar-Coleroon estuarine region of Tamil Nadu coast to inundation calculated based on the projected SLR scenarios of 0.5 m and 1m,** demonstrated that about 1570 ha of the Land use and Land cover (LULC) would be permanently inundated to 0.5 m and 2407 ha for 1 m SLR and has also resulted in the loss of three major coastal natural resources like coastal agriculture, mangroves and aquaculture. It has been identified that six hamlets of the social communities who depend on these resources are at high-risk and vulnerable to 0.5 m SLR and 12 hamlets for 1 m SLR.

The analysis of rainfall data of Pichavaram mangroves, in the Cuddalore district of Tamil Nadu shows that there is a slight increase in the trend of mean annual total rainfall and the annual temperature show clear increasing trends in MMaxT and MAT, which poses threats as well as opportunities for the rich mangrove biodiversity to flourish in the event of future climate change. The study along the coasts of Tamil Nadu and Puducherry reveals that the projected average of SLR for Tamil Nadu and Puducherry may range from 77.39 cm to 50.01 cm for RCP 4.5 posing serious threats to coastal ecosystems, infrastructures, populations, livelihoods and other coastal resources.



IMPACT OF CLIMATE CHANGE ON VARIOUS SECTORS OF TAMIL NADU

FOREST AND BIODIVERSITY

Climate change poses critical threat to the composition and spatial distribution of prominent species. Evidences generated through scientific modelling show that there will be a significant reduction in the habitat suitability distribution of medicinally and **ecologically important tree species *Myristica dactyloides*** in the year 2050 and 2070 in Kolli hills, Eastern Ghats of India.

IMPACT OF CLIMATE CHANGE ON VARIOUS SECTORS OF TAMIL NADU



URBAN AREAS AND SUSTAINABLE HABITATS

In urban areas, on long term observation, high Thermal Heat Index (THI) discomfort level is noticed in Chennai during May and June months followed by July, August, April and September months. It is expected that in future there would be 2.0°C increase in THI during winter and post-monsoon months in the mid-century scenario. Studies on sustainable living in urban areas across Chennai city were also undertaken on the extent of water pollution, particulate matter, and the extent of vector-borne and water-borne diseases in Pallikaranai wetland.

With the growing consensus of climate risk, a comprehensive study of climate risks and their impacts based on sustainable development goals (SDG) in the state of Tamil Nadu shows that extent of vulnerability of districts within the State. The study revealed the significant contributing indicators of risk and the vulnerable districts of Tamil Nadu. Ariyalur was identified as the most vulnerable district due to its high sensitivity and low adaptive capacity to climate risks. The other top vulnerable districts were Nagapattinam, Ramanathapuram, Thiruvavur, Thiruvallur, Thanjavur, Perambalur, Pudukottai, and Thiruvannamalai. The outcome of the study may be deliberated as an indicator of alarming socio-economic and infrastructural conditions of the districts and may help planners to prioritize their actions toward climate resilience.

High Thermal Heat Index (THI) discomfort level is noticed in Chennai during May and June months

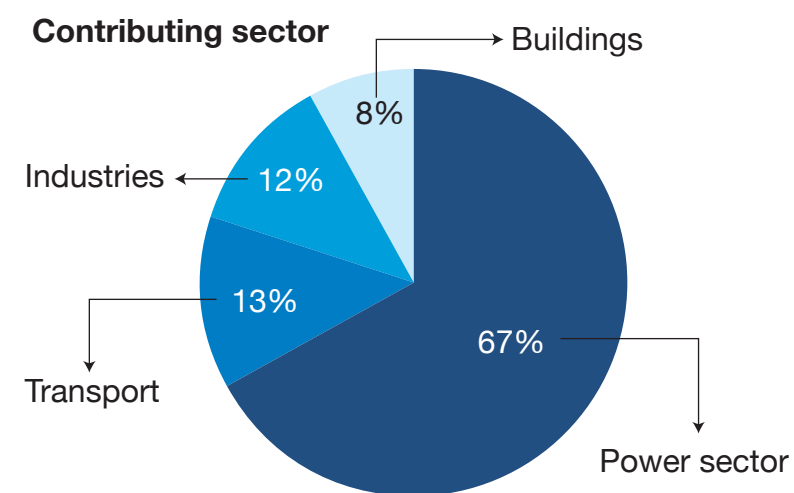


2.4 TN'S GREENHOUSE GAS ESTIMATES AND SUSTAINABLE CONOMIC TRANSITION ACHIEVING NATION'S NET ZERO VISION



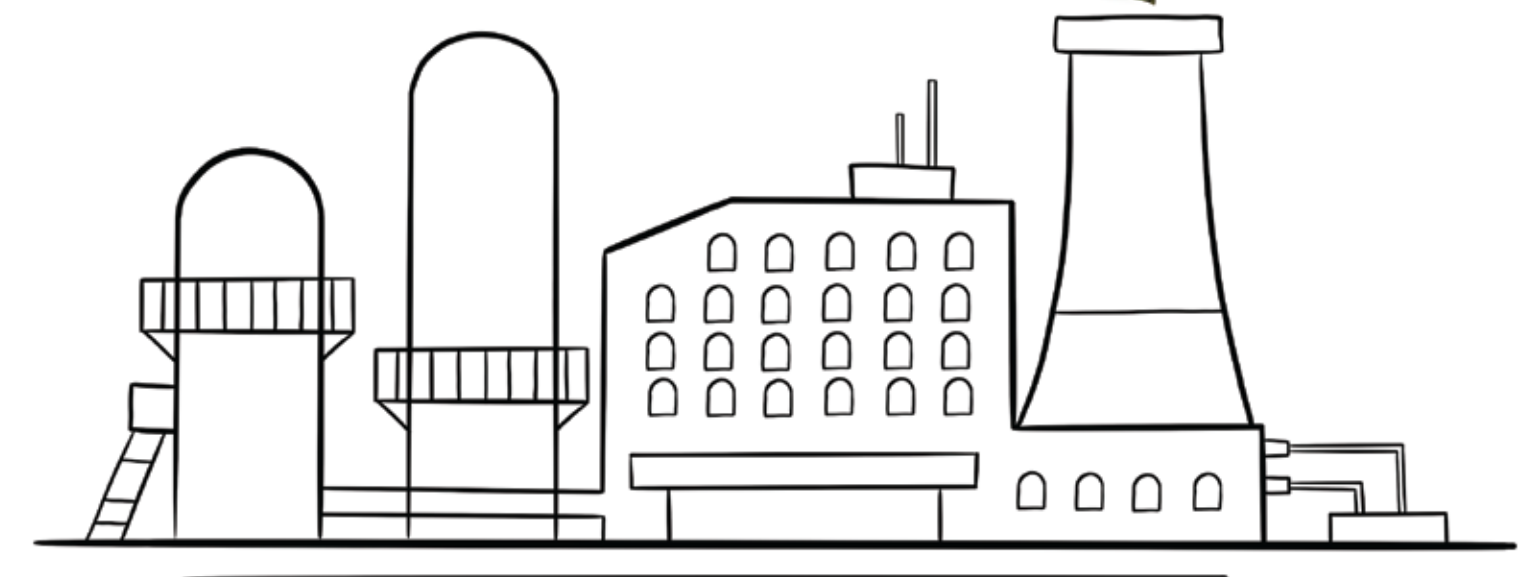
Tamil Nadu's economic transition stands on four pillars spanning the local, national and global economy. A cleaner industrial and agriculture transition at the state level will help India achieve its national net zero targets, and also protects domestic industries from possible global regulations.

Tamil Nadu accounts for 172.83 MtCO₂e emissions out of 2953 MtCO₂e emissions at the National level as per GHG platform estimates. The State has an estimated 73% increase in emissions from 100 Million tonnes of emissions in 2005 to 171.83 Million tonnes of emissions in 2018, out of which 80% (144 MtCO₂e) of the total emissions are estimated from the energy sector²². The contribution of various sectors to energy sector is as tabled below:



²² Ghg Platform 2022

CLIMATE CHANGE AND ITS IMPACT IN TAMIL NADU



2.5. MITIGATING GREENHOUSE GASES IN TAMIL NADU

CLIMATE CHANGE AND ITS IMPACT IN TAMIL NADU



Forests act as a natural carbon sink and carbon management in forests is inevitable in order to offset the carbon emission in the atmosphere. **Forests act as a sink for the CO₂ to mitigate the global climatic change.** However, there has been a continuous loss of original biodiversity and soil. These degradations led to a loss of sequestered carbon of standing biomass and in the soil as well. Hence, restoration of soil organic carbon (SOC) lost over the period of time due to anthropogenic interferences has to be built up and maintained with minimum threshold to support the tree growth.

A pioneer attempt on Forest soil degradation analysed the intricacies of biomass carbon and SOC in a degraded condition. Subsequent studies on carbon enrichment have provided ways to mitigate Carbon dioxide through the forests were undertaken provide natural ways to promote soils health-promoting methods to enhance carbon sequestration potential of Forest carbon soils.

The heavy emissions from the state need to be mitigated to curtail the harmful consequences of climate change. Few scientific ways to mitigate the carbon emission includes carbon capture experiments with Bio-char from biomass waste as a renewable carbon material utilization of industrial waste to capture carbon dioxide.

Mitigation strategy in Tamil Nadu is planned towards a push for a higher share of renewable energy in overall energy mix. This includes hydel, solar, wind and biomass-based energy, including energy from waste. The strategies are focused on two specific national missions viz.:

- Enhanced Energy Efficiency and Solar Mission and
- The “Sustainable Habitat” mission which includes waste sector, transport sector, and the buildings/ residential sector

Sectoral plans under agriculture, forestry and water sectors have investments that are likely to have several mitigation co-benefits. Activities related to Enhanced Energy Efficiency and Solar Mission (EEESM) are carried out by various government bodies like TANGEDCO, Electrical Inspectorate and TEDA. Tamil Nadu is also strengthening the State Designated Agency (SDA) to implement the comprehensive energy efficiency plan. It has integrated several energy and waste management solutions in plans associated with Smart Cities and AMRUT initiatives to mitigate emissions.



2.6. STATE LEVEL CLIMATE MODELS

CLIMATE CHANGE AND ITS IMPACT IN TAMIL NADU

With a high dependency on natural resources, Tamil Nadu is under constant threat of climate change and the negative impacts of it. Events in the past show that there is a high probability of increase in climate related natural hazards, with high frequency and intensity, which would result in a potential threat of natural disasters directly linked to climate change. **The Government of Tamil Nadu is crafting many solutions to leapfrog the State to a greener, cleaner, more resilient State.** Efforts are being taken by the State to draft plans that are not merely mitigative in nature, but which will also pave the way for the transformation of the economy underpinning 'Affordability, Sustainability and Scalability' as the key elements.

In line with the above, the Tamil Nadu state has proposed to focus on plans based on following areas of intervention, for successful implementation of the Missions:

i. Sustainable Agriculture

- Popularize strategies to reduce the losses in agriculture due to extreme weather
- Increase in use of micro-irrigation
- Efficient harvesting of rainwater
- Strengthened crop insurance programs
- Forecasting of disease outbreaks through reporting and monitoring system and
- Popularizing indigenous plant varieties

ii. Climate Resilience

- Increase crop productivity
- Creating ecosystems to manage droughts
- Creating institutional frameworks to combat climate change
- Educating and encouraging farmers to adapt to climate change strategies

iii. Water Resources

- Adapting climate change mitigation programs in water resources and management
- Modernize irrigation
- General increase of water use efficiency

iv. Forest & Biodiversity

- Assessment and monitoring of bio-resources in Forest systems
- Massive afforestation programs to maintain and increase green cover
- Integrated development of wildlife habitats
- Eco-restoration and conservation of water bodies

v. Coastal Area Management

- Integrate coastal tree plantation with water management and livelihood enhancement
- Climate proofed infrastructures and industry along coastlines to be developed
- Assess micro-plastics in coastal areas
- Manage disasters and risks
- Manage coastal livelihoods
- Less intrusive means of waste disposal

vi. Disaster management & mitigation

- State database and digital risk mapping models to combat risks
- Strengthen early warning systems
- Building capacity and better equipping response systems
- Zonal teams and medical response teams
- Create funds to mitigate disasters
- Encourage restoration and protection of ecosystems
- Mapping of vulnerable areas.

vii. Health

- Increase the capacity of primary and secondary healthcare network by improving infrastructure of hospitals such as bed strength
- Easier access to healthcare professionals
- Improving laboratories, radiology facilities etc.

viii. Technology

- Enabling the shift to renewable energy sources
- Transitioning industry away from high-emission and high-pollutant sectors
- Increase the use of mass transportation systems to reduce the carbon footprint of the individual with a focus on lower-income urban populations
- Introducing more efficient means of waste disposal
- Nature-based solutions across forestry, agriculture, food systems and related sectors by leveraging supply chains and technology.

ix. Energy Transition

- Moving away from fossil fuels
- Focusing on mitigation in the cities and villages by introducing low-emission buildings
- Mass transport with focus on resilience for the urban poor would be prioritized across supply chains by promoting energy efficiency

x. Emission Reduction

- Identifying effective ways to achieve emissions reduction without sacrificing productivity
- Promoting and adapting to use of electric vehicles
- Creating infrastructure to transition away from traditional internal combustion engine vehicles
- Incentivizing the transition to cleaner technologies
- Less polluting technologies

xi. Transportation

- Promoting the use of public transportation,
- Creating the infrastructure for a significant migration from individual to mass transportation
- Promoting the use and creating means to access more efficient cleaner fuels (electric vehicles, hybrid vehicles)
- Policies that mandate age-bound scrapping of high-polluting vehicles
- Improving and maintenance of public infrastructure (cycling lanes, walkways, public transportation centres) to further promote their use

xii. Wetland Protection

- Clear mapping of all wetland areas across the state, and inventorying the ecosystems to create a baseline
- Issuing necessary directions for the maintenance and conservation of wetlands, creating awareness amongst the public for conscious use and protection of wetlands, creating infrastructure and systems to transition from using wetlands as a dumping solution

As detailed above, the intended plans of the Government of Tamil Nadu to intervene and stem the impacts of Climate Change cover a wide arc of sectors, sub-sectors, and niches, across a spectrum of initiatives - ranging from direct action to making policies. The range of proposed activities have been consolidated into three missions, explained in the sections below, each having its own range of objectives.

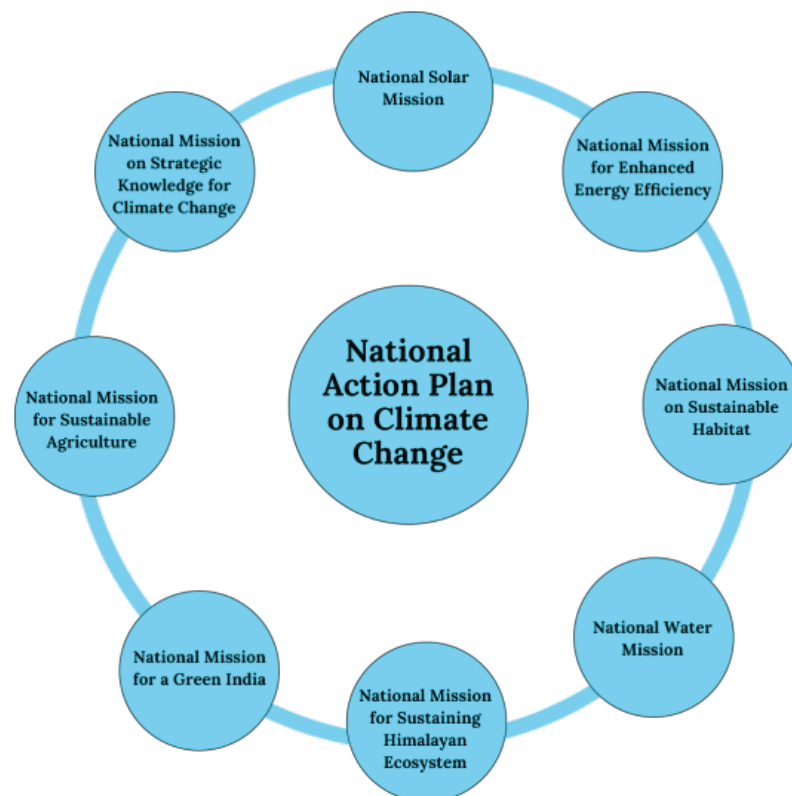


2.7. STATE'S POLICY FRAMEWORK TOWARDS CLIMATE CHANGE ACTION

Based on the National Action Plan for Climate Change, the State has prepared the Tamil Nadu State Action Plan on Climate Change (TNSAPCC) for 2015-2020, which was endorsed by Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India (GoI) on 31.03.2015.

TNSAPCC aims to reduce vulnerability due to climate change at State level by developing an overarching climate response framework that translates Missions of National Action Plan on Climate Change at State level. Tamil Nadu State Action Plan on Climate Change (TNSAPCC), provided the first State-wide and cross-sectoral climate change impact and vulnerability assessment, and formulated adaptation and mitigation strategies to be carried out by the State Government Departments. These strategies, in turn aligned with the eight National NAPCC Missions, were organized into seven State Sectors

In light of India's Nationally Determined Contributions (NDCs) to UNFCCC (Sustainable Lifestyles, Cleaner Economic Development, Reducing Emission intensity of Gross Domestic Product (GDP), Increasing the Share of Non Fossil Fuel Based Electricity, Enhancing Carbon Sink (Forests), Adaptation, Mobilizing Finance, Technology Transfer and Capacity Building) Ministry of Environment, Forest and Climate Change (MoEF&CC), GoI has advised to revise the Tamil Nadu State Action Plan on Climate Change and accordingly action has been taken to revise the TNSAPCC with the objectives to re-examine the State specific, impact, risk and vulnerability, to take stock of the implementation of the SAPCC, to re-examine various actions (adaptations and mitigation) in the light of climate goals set in INDC and to prepare new short term plans for 2023 and long term plans up to 2030.



CLIMATE CHANGE AND ITS IMPACT IN TAMIL NADU



The TNSAPCC 2.0 has identified following focus areas for climate action

- Sustainable Agriculture & allied sectors
- Water Resources
- Forest and Biodiversity
- Coastal Area Management
- Strategic Knowledge & Climate Literacy
- Disaster Management & Mitigation
- Health & Sanitation
- Enhanced Energy Efficiency & Solar Mission
- Sustainable Habitat & Green Mobility
- Gender and Climate Change
- Children and Youth for Climate Action

By extending India's Nationally Determined Contributions (NDCs) to the State-level, the TNSAPCC 2.0 holds relevance for implementing the Sustainable Development Goals (SDG) agenda.



03

GOALS OF
THE TAMIL NADU
**CLIMATE
CHANGE
MISSION**



Climate Change is an undisputed reality causing severe impact on the natural environment, human lives, economic assets and activities thus posing an urgent need for a comprehensive climate action. The challenge of Climate Change calls for extraordinary vision, leadership, understanding and wisdom. Human ingenuity and intellect will play a critical role in addressing issues arising out of Climate Change impact. The effect of climate-related shifts, which largely stem from global warming caused by humankind, are already affecting daily life.

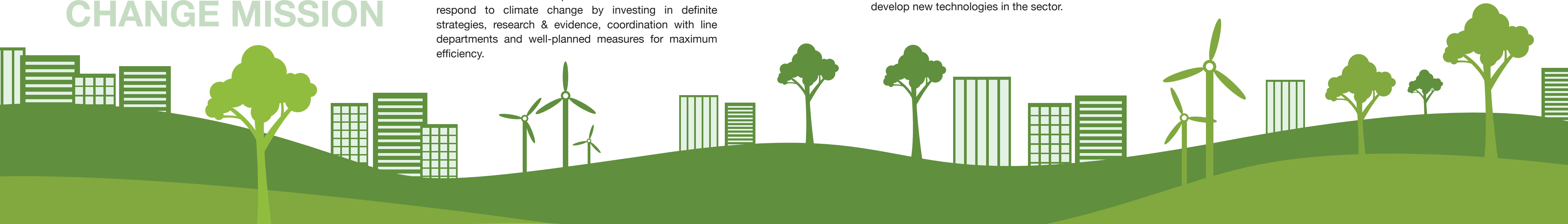
GOALS OF THE TAMIL NADU CLIMATE CHANGE MISSION

- The comprehensive goal of the Mission is to invest in transformational planning and programming methodology by adopting integrated strategies, planning and policymaking to maximise co-benefits between mitigation, adaptation and sustainable development.
- The State of Tamil Nadu has several Universities, Research Agencies and Academic institutions working on Climate Change Adaptation and Mitigation. The expertise and experience of these institutions shall be leveraged in Climate Change policies and ground truthing of initiatives
- The mission shall foster a comprehensive understanding of the impact of Climate Change across different sectors of society and how they are interrelated. Solutions for various climate crisis, be it unprecedented rise in sea levels, agricultural productivity, vulnerable coastal population and its infrastructural facilities and assets, guidance on ways and means to mitigate them.
- For initiatives under the Mission, efforts would be taken to augment resources from various funding options viz., National Adaptation Fund for Climate Change (NAFCC), Green Climate Fund (GCF) etc.,

The mission intends to expand collective human action to respond to climate change by investing in definite strategies, research & evidence, coordination with line departments and well-planned measures for maximum efficiency.

- The mission will also work towards reducing Greenhouse Gases developing methods for emission reduction by use of efficient public transport systems, use of clean and green energy, alternative fuel sources, better monitoring etc.
- **With a commitment to enhance the tree and forest cover of the State from 23.7% to 33% in the next ten years, the Mission will work in synergy with the Tamil Nadu Green Mission. Activities under this Mission shall also be worked out in close coordination with the Tamil Nadu Wetlands Mission as already announced by the Government of Tamil Nadu.**
- The Mission will closely work with stakeholder departments on eco alternative solutions to single use plastic, sustainable practices for disposal of solid waste including sewage, e-waste, bio-medical waste etc.,
- The Mission will work with partners and expert institutions to develop new technologies in the sector.

- The Mission will strive to create smarter infrastructure systems to help minimize disasters and handle them effectively.
- Gender mainstreaming in climate action for women and children shall be the prime focus of the Mission.
- The Mission shall follow a "one health approach" to Climate Change to bring a better understanding of Climate Change impact on environmental, animal and human health. This approach will help the State to develop an expertise in the sector by collaborating with experts from the fields of veterinary, medical and public health taking into account the dynamic nature of eco systems in a changing climate.
- Climate courses and curricula in Universities, Institutions, Agencies etc., shall be encouraged under the Mission.
- **The mission will focus on possibilities of creating new employment opportunities (Green Jobs) through promotion of Green Technology.**





04

**PROGRAMMES
IMPLEMENTED
UNDER TAMIL NADU
CLIMATE
CHANGE MISSION**

In order to drive innovative climate & sustainability solutions, transforming Urban & Rural infrastructure and its communities the Tamil Nadu Government has set up the Tamil Nadu Green Climate Company (TNGCC) which is a Section (8), Not-for-Profit Company. TNGCC is a first of its kind, ambitious initiative which will act as a Special Purpose Vehicle (SPV) to address the Climate Crisis in the State. TNGCC will also strive to coordinate and push for the progress of all activities proposed to be undertaken as per the State Action Plan on Climate Change in line with the National Commitments. The Tamil Nadu Green Climate Company has set up a specialized Project Management Unit (PMU) headed by the Chief Project Director for coordinating and monitoring of project activities under all three Missions. The Tamil Nadu Green Climate Company has been set up with the following objectives:

- Planning, execution and monitoring of the State-wide Programme for the climate change adaptation and mitigation, wetlands mapping and restoration, enhancing the forest and tree cover of the State to 33% over the next ten years.
- Creating strong policy support for climate change, cutting across all sectors of governance.
- Devise strategies to reduce greenhouse gas emissions, bench marking of industries to move towards green manufacturing etc.
- **Promote eco-friendly technologies towards a sustainable future e.g., solar and wind harvesting technologies, biodegradable packaging, e-vehicles etc.**
- **Develop collaborations and strengthen community engagement to build long term commitment for a Net Zero Carbon future for Tamil Nadu.**
- Promote multi stakeholder approach to fast-track climate change action in a synergized fashion.
- Use proven climate change science & technologies to create evidence based green models for emulation and adaptation.
- Educate and empower local communities in management of climate change at ground zero.
- Promote successful climate change adaptation and mitigation models for replication.
- Build standards for energy efficient infrastructure to save precious energy and reduce energy consumption.
- Create practical models for green mobility to reduce emissions.
- Create State-of-the-Art monitoring mechanism for better compliance of Environmental Standards through transparent and credible systems.
- Conserve and preserve natural resources and promote their sustainable use.
- Creating a framework to bring synergy among the line Departments of the State for initiatives for environment protection.
- Creating a platform for integration of knowledge and experience of National and International agencies through collaboration and partnership.
- Developing a framework for capacity building of various stakeholders (Line Departments, institution / Universities, Researchers, Experts, Non-Government Organizations (NGOs) on Climate Change Adaptation and Mitigation, wetlands, tree plantation, eco restoration etc.

The overall implementation framework for the Climate Change Mission is as follows:

4.1. SETTING UP OF DISTRICT CLIMATE CHANGE MISSION IN ALL DISTRICTS OF TAMIL NADU

PROGRAMMES IMPLEMENTED UNDER TAMIL NADU CLIMATE CHANGE MISSION

As part of the Tamil Nadu Climate Change mission, the Government of Tamil Nadu is integrating the climate concerns of the state in development plans at the grassroots level to climate-proof the districts and villages. In view of this, the Environment, Climate Change and Forest Department has come up with a one of its kind initiative where District Climate Change Mission is set up to strengthen the Climate response. The District Collectors are designated as the District Climate Change mission Directors and the District Forest Officers are designated as the District Climate officers. Through the District Climate Change mission, the site and sector specific key adaptation & mitigation strategies and action plans relevant to the district will be implemented in the districts. Also, district officials of all departments are trained to manage the climate hazards as per identified vulnerabilities and are made aware of timely interventions for the future to handle the climate crisis effectively.

Every project to be implemented in the district would be scrutinized under the Climate Change lens by the District Climate Change mission. Financial allocation of Rs. 3.80 crores for 38 districts (each district Rs. 10 lakhs each) for steering the Climate action at the district level has been sanctioned to the districts.

4.2. CLIMATE STUDIO AT ANNA UNIVERSITY

The Government of Tamil Nadu had set up the Climate Studio at the Centre for Climate Change & Disaster Management, Anna University in 2019 with the objective to contribute to Capacity Building & Knowledge Management on Climate Science and Research. The Studio was set up with the financial support of GIZ India at Rs 246.87 lakhs under their Climate Change Adaptation in rural areas of India Project.

The Climate Studio has now been revived and is operational with adequate infrastructure and State of the art Climate modelling tools. The Environment Climate Change and Forest Department, Government of Tamil Nadu has sanctioned Rs 3.8 crores for the period of 01.01.2022 to 31.12.2023.

The Studio aims to bring together the scientific community, Government agencies, National Research Institutes and other Universities with an integrated research program addressing the Climate Change issues in all the Districts. **The Studio is enabled with a State of the Art comprehensive lab facility to assess the Climate Risk and vulnerability on different sectors such as water resources, agriculture, forestry, coastal resources and sustainable habitat.**

CLIMATE STUDIO AT ANNA UNIVERSITY

Climate Studio Facilities:

The Studio, the only one of its kind is equipped with a high-performance cluster with 200TB of storage and accessories for Climate Modelling. Enabled with State of the Art facilities and updated software the Studio will provide precise & high-resolution cadastral information on;

Climate Modelling: Identification and downscaling of Global Climate Models (GCMs) to high-resolution Regional Climate Models (RCMs) and development of cadastral level data for the state of Tamil Nadu.

Water Resources: Setting up baseline Hydrological Model for 17 River Basins in Tamil Nadu, Process-based Simulation of 17 Basins, Hydrological Estimation of 17 Basins for future scenarios and framing adaptation plan for water resources.

Agriculture: Collating details of crop yield, leading varieties in all agro-climatic zones of Tamil Nadu, Crop Simulation using DSSAT across the Agro Climate Zones and for all districts of Tamil Nadu for projected climate scenario, vulnerability assessment and framing adaptation plan for Agriculture Sector.

Forestry: Mapping Western and Eastern Ghats using Geographical Information System (GIS) tool to understand forest types and composition in all forest types using ERDAS, employing the MaxEnt model to identify the most vulnerable and threatened species in the forest ecosystem.

Coastal Ecosystem: Developing Shoreline mapping, Identification of Coastal ecosystems including mangroves, Cadastral level study on Sea Level Rise (SLR) and its impact on the inland ecosystem, Climate Change Vulnerability on the Coastal Ecosystem and shoreline changes.

Sustainable Habitat: Assessment of Air Quality and Particulate Matter in the Urban area of Tamil Nadu, Identification of Heat Islands and climate impacts, Urban Green cover management to reduce radiation and enhance carbon sink, Urban flood management and disaster risk reduction activities, Understand Vector-borne diseases in Tamil Nadu and develop forecasting models.

Capacity Building and Training: With innovative tools & approaches workshops across sectors, Climate Literacy campaigns, preparation of sectoral handouts for training officials.

4.3. CHIEF MINISTER'S GREEN FELLOWSHIP PROGRAMME

PROGRAMMES
IMPLEMENTED
UNDER TAMIL NADU
CLIMATE CHANGE MISSION

The Government has issued orders for Chief Minister's Green Fellowship programme launched in 38 districts of Tamil Nadu at a cost of Rs.6.00 crores for 2 years. The Chief Minister's Green Fellowship Programme is an exciting opportunity for young people to work directly with the State Government and the District Administration of Tamil Nadu. **The primary role of a Green Fellow will be to inform policymakers on environmental issues at a District level.**

Core functions of the Green Fellows / Green Associates include supporting the implementation, monitoring and evaluating the outcomes, communicating the impact of policies aimed at protecting the environment of the State of Tamil Nadu, and delivering better environmental services. CM Green Fellows will assist the District Administration on all subjects that fall within the scope of the Department of Environment, Climate Change and Forests, Government of Tamil Nadu. The Green fellows will strive forward for achieving the following outcomes:

- Support implementation of three Flagship Missions & Establish institutional feedback mechanisms
- Support the District Administration in the effective delivery of environmental services.
- Support the District Administration in the effective implementation of the plastic ban.
- Promote the "Meendum Manjappai" initiative and eco-alte. 60,000/- & Rs. 15,000/- per month as travel allowance



4.4. BLUE FLAG CERTIFICATION



PROGRAMMES
IMPLEMENTED
UNDER TAMIL NADU
CLIMATE CHANGE MISSION

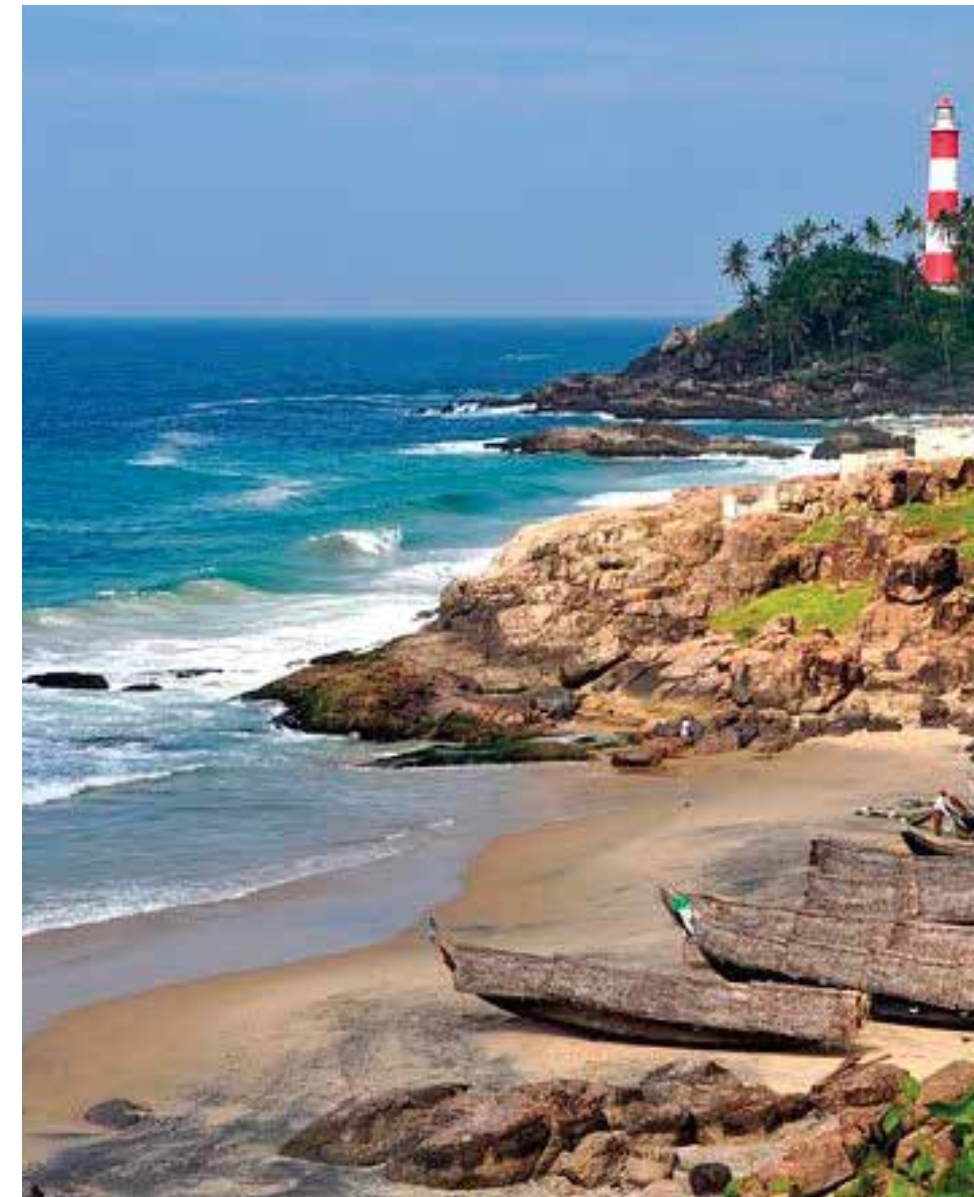
Blue Flag Programme is a world renowned Eco label certification for beaches and marinas. It is operated by the International, Non-Governmental, Non-profit Organization - FEE (Foundation for Environmental Education), Denmark. **The Blue Flag was created in France in 1985, as a pilot scheme by FEE and currently implemented in 49 countries.**

Blue Flag beach is an Eco-tourism model aiming to provide a clean and hygienic bathing water facility, safe and healthy environment and sustainable development of the area for tourists / beach goers.

In India, the Blue Flag certification programme is being implemented under the Beach Environment and Aesthetic Management System (BEAMS) programme. BEAMS is an integrated coastal management scheme conceived by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India to plan sustainable tourism and healthy coasts. This scheme is monitored by the Society of Integrated Coastal Management (SICOM) in the Ministry of Environment, Forest and Climate Change, Government of India.

Kovalam Beach, Chengalpattu was selected as the pilot beach in Tamil Nadu for the Blue Flag Programme implemented by SICOM. Kovalam Beach has been certified as the Blue beach in September, 2021.

The Government has issued orders Vide G.O(Ms.) No.89 Environment, Climate Change and Forests (EC-3) Department Dated 22.10.2021 for implementing Blue Flag Certification Programme in 10 Beaches for 5 years with the financial outlay of Rs.100 crores



Objective of the BEAMS programme

- To abate pollution in coastal waters & beaches
- Promote sustainable development of beach amenities/ facilities
- Protect & conserve coastal ecosystems & natural resources and encourage local authorities & stakeholders to strive and maintain high standards of cleanliness
- Hygiene, safety and security for beachgoers in accordance with coastal environment norms & regulations

The criteria for awarding the beach for blue flag certification

- 1) Environmental education and information
- 2) Water quality
- 3) Environmental Management
- 4) Safety and Services

Selected Beaches for BEAMS Programme in Tamil Nadu

| S. No | Beach Name/Location | District |
|-------|------------------------|----------------|
| 1. | Marina Beach | Chennai |
| 2. | Manalmelkudi | Pudukkottai |
| 3. | Kushi Beach | Ramanathapuram |
| 4. | Silver Beach | Cuddalore |
| 5. | Kottaipattinam | Pudukkottai |
| 6. | Neelankarai Beach | Chengalpattu |
| 7. | Kameshwaram Beach | Nagapattinam |
| 8. | Naravakkam, Marakkanam | Villupuram |
| 9. | Kayalpattinam | Thoothukudi |
| 10. | Neithal Nagar Beach | Nagapattinam |

4.5. PASUMAI PALLIKOODAM THITTAM (GREEN SCHOOLS SCHEME)

PROGRAMMES
IMPLEMENTED
UNDER TAMIL NADU
CLIMATE CHANGE MISSION

With Climate Change becoming a reality, young children need to be prepared for climate change adaptation and mitigation activities. Children and youth should be the point of focus for climate change since green revolution begins with the younger generation. A proposal, to give life to this idea as a first step, the Government of Tamil Nadu has announced that 25 Green Schools shall be selected to implement the green vision of the hon'ble Chief minister. **These schools shall undertake various green measures like promoting energy efficiency through solar, adapting rain water harvesting, composting, creating vegetable garden, medicinal garden and planting of fruit trees, reducing water use, recycling of waste water, creating a plastic free environment etc.** The electricity requirements for the school will be met by Solar Power. Total cost of Rs.5.00 cr. for 25 Schools at the rate of Rs. 20.00 lakhs per school is sanctioned for the Green Schools Scheme. These schools shall be the torchbearers of the green school initiative which will inspire all other schools to follow the green footprints. The schools shall also be ranked on a green index to create a repository of information on green initiatives.





05

ACTIVITIES
UNDER TAMIL NADU
CLIMATE CHANGE
MISSION

5.1. Rehabilitation of coastal habitats for climate change adaptation through eco-friendly solutions:

Formation of Bio-shields with Casuarina, Palmirah, Cashew, mangroves, and other specialized species. Propagating Mangroves, Seagrass beds, and Coral reefs.

Coastal ecology is under great threat from the visible effects of climate change. The impact and intensity of hydro-meteorological disasters too are increasing. The adverse impact of these on coastal communities is leading to an increase in losses of lives and livelihood. The Coastal zone is also considered as the vital ecological bridge between the terrestrial and aquatic ecosystems and therefore their protection, restoration, and conservation are essential to maintain biodiversity and ecological balance.

An eco-friendly measure for the protection and restoration of coastal habitats is now regarded as an effective response to reduce and reverse the negative effects of habitat loss, degradation, and fragmentation on native biological diversity and ecological processes. Ecosystem-based adaptation is a strategy for adapting to climate change that harnesses nature-based solutions and ecosystem services. For instance, protecting coastal habitats like mangroves provides natural flood defences; reforestation can hold back desertification and recharge groundwater supplies in times of drought; and water bodies like rivers and lakes provide natural drainage to reduce flooding.

The 1076 km long coastline of Tamil Nadu constitutes nearly 15% of the total coastal length of India. It is endowed with a rich biodiversity reserve now under great peril due to exposure to human activities and settlements. Coastal vegetation has a significant potential to mitigate damage and save human lives by acting as buffer zones during extreme natural events. Nature has provided biological mechanisms for protecting coastal communities from the fury of cyclones, coastal storms, tidal waves, and tsunamis. Bio-shields constitute one such mechanism for safeguarding the ecology of coastal areas and the livelihood of the fishing and farming communities. Bioshields can be created by strip planting of a sand dune with vegetation.



Such buffer zones serve several purposes:

- Shrubs control erosion and stabilize the shore;
- Green belts significantly alleviate wind energy thus protecting the hinterland from oceanic forces;
- A green belt of trees effectively reduced the force of devastating storm surges and waves;
- Trees are beneficial for biodiversity and can induce habitats for wildlife;
- People inhabiting hazard-prone coasts would benefit from green belts in terms of security, access to food, fodder, raw materials or industries, shelter and income;
- Strips behind the green belts served as areas of peace and tranquility.

The successful outcomes of the establishment of bioshield in the coastal regions will deliver

- Sand dune fixation,**
- Sand dune stabilization, and**
- Afforestation.**

It is to be mentioned that, the raising of bioshield plantations right from the high tide line may have serious implications on the ecology and wildlife of the coastal areas. As part of the Tamil Nadu Climate Change Mission, the Government of Tamil Nadu has decided to conduct a baseline study as well as the implantation activity along the vulnerable coastal stretches of Tamil Nadu.

5.2. CARBON ENRICHMENT PROGRAMME

ACTIVITIES UNDER TAMIL NADU CLIMATE CHANGE MISSION

Soil carbon storage is a vital ecosystem necessity that plays an extremely important role in promoting tree growth through an increased supply of nutrients, enhanced retention of water and by storing significant amounts of carbon. Greater Chennai Corporation has set up a biomining site at Perungudi, Chennai. Soil obtained after biomining of the legacy municipal solid waste is extremely rich in nutrients and carbon.

A demo site would be set up at the Nanmangalam Forest in Chennai. By using the bio-mined enriched soil from the Perungudi dump, the Forest Department, along with the Greater Chennai Corporation and Anna University, would try to enhance the growth of trees and forest expansion in the degraded forest landscape at Nanmangalam. The project will be implemented with an outlay of Rs. 1.00 Crore.

Outcomes of the project includes

- Improved carbon sequestration,
- Restored soil organic carbon
- Increased water holding capacity and increased nutrient availability beneficial for plant growth & micro organisms.
- Reclamation of land after biomining

A demo site would be set up at the Nanmangalam Forest in Chennai. By using the bio-mined enriched soil from the Perungudi dump.



5.3. CLIMATE SMART VILLAGES

ACTIVITIES UNDER TAMIL NADU CLIMATE CHANGE MISSION

Climate Change can have a dramatic impact on our natural resources, economic activities, food security, health, and physical infrastructure. India is one of the countries that is most affected by Climate Change. The threat is especially severe in places where people's livelihoods depend on natural resources. In such areas, Climate Adaptation measures take on a special significance for safeguarding vulnerable communities and their livelihoods as well as ensuring sustainable development. Governments across the world are promoting Climate-Smart Villages (CSVs) with an emphasis on the village as a production unit to sustainably produce more food and other agricultural produce while increasing resilience to Climate Change. The increasing frequency of climate hazards coupled with the vagaries of climate makes it imperative to start looking at alternate and climate-proofed models of rural lifestyles. Climate-Smart Villages have successfully combined global knowledge with local action to help farmers sustainably produce more food while curbing greenhouse gas emissions and increasing resilience to climate change.

The state of Tamil Nadu as part of its Climate Change Mission is looking into the concept of Climate Smart Villages. The idea of the Mission is to understand the challenges and vulnerability faced by the village communities posed by Climate Change. The Climate Smart Villages would serve as demo sites to test an approach through participatory methods with various technological and institutional options for dealing with Climate Change at the community level. As part of the Tamil Nadu Climate Change Mission, it is already planned to implement Climate-smart villages in 10 villages across the agroclimatic zones of Tamil Nadu with a budget of Rs. 10 crores. Further, it is proposed to conduct a baseline study on climate smart villages prior to the implementation at the 10 villages.

The Climate Smart villages will be implemented with the following broad objectives:

- Understand challenges and vulnerability of the local community to climate risks
- Develop future solutions to build climate resilience and increase adaptation & mitigation measures
- Identify & implement village/community level agriculture
- Identify ecological and socio-economical solutions viz., setting up village-level CC information centres for weather smart activities like agro advisories.
- Carbon / nutrient smart practices for better management of agroforestry, land use, and livestock management, biofuels etc
- Institutional, market smart activities like farmer-to-farmer learning, contingency planning, market info, etc
- Biowaste composting and vermicomposting (wet and dry waste) - Individual and community-level compost pits
- Biomass gasification of livestock waste and Waste-to-energy conversion - Waste-to-energy plants at the village level
- Crop residue management through Conservation farming - Happy seeder, super seeder, and other farm machinery, along with improved capacities of farmers
- Training and support for SHGs and micro-enterprises to take up manufacturing of biomass briquettes - Briquette manufacturing units
- Plastic Phase-Out - Replacing plastic bags with Manjappais (information to sensitise detrimental impacts of plastic can be disseminated through the ICT component of MGNREGS) - Installation of reverse plastic bottle vending machines in the bus stop along the arterial roads of the village - Innovative models for tying up with garment brands and infrastructure projects that could reuse plastic as inputs would be explored
- Horticulture Enhancement - Increasing individual horticulture cultivation and developing GP/village level horticulture gardens. This could be done in convergence with the National Ayush Mission - Create community-level horticulture and kitchen gardens to earn additional income and fulfill nutrition requirements locally. These can be tied up with local Anganwadi centres and run with the help of SHGs.
- Enhancing green cover, biodiversity and mitigating fuelwood consumption - Enhancing green cover - Preparation of Peoples' Biodiversity Register by Biodiversity Management Committee of the village covering agricultural, domesticated, and wild biodiversity - Identification of alien, intrusive and invasive species of plants and animals at the village level, and developing livelihood linked strategies for their removal. The livelihood component is to be enabled through MGNREGS and NRLM. - Plantation of scientifically identified species of trees and plants in degraded lands that have higher salinity or alkalinity for restoration through bioremediation
- Sustainable housing and power- Setting up rooftop solar power solutions and appliances, and energy-efficient lighting through the UJALA scheme
- Water Supply/micro watershed management and sanitation - Water Supply/micro watershed management and sanitation - Construction of Community Sanitary Complexes - Community toilets to be made as E-toilets or Bio toilets that can be combined with a solar-powered water systems - Decentralized Wastewater Treatment Systems (DEWATS) - Training of technicians and engineers in the village to build climate-resilient micro-water infrastructure under MGNREGS
- Promoting Organic Farming and sustainable agriculture - Setting up of organic farms, certification, and access to markets - Climate-smart fisheries and aquaculture as a part of Climate-Smart Agriculture - Training farmers and locals to desilt and maintenance of ponds, rivulets, water tanks, canals, shutters, etc., in the village
- Ensuring the dissemination and application of climate risk information services - Provision of stable climate information services.

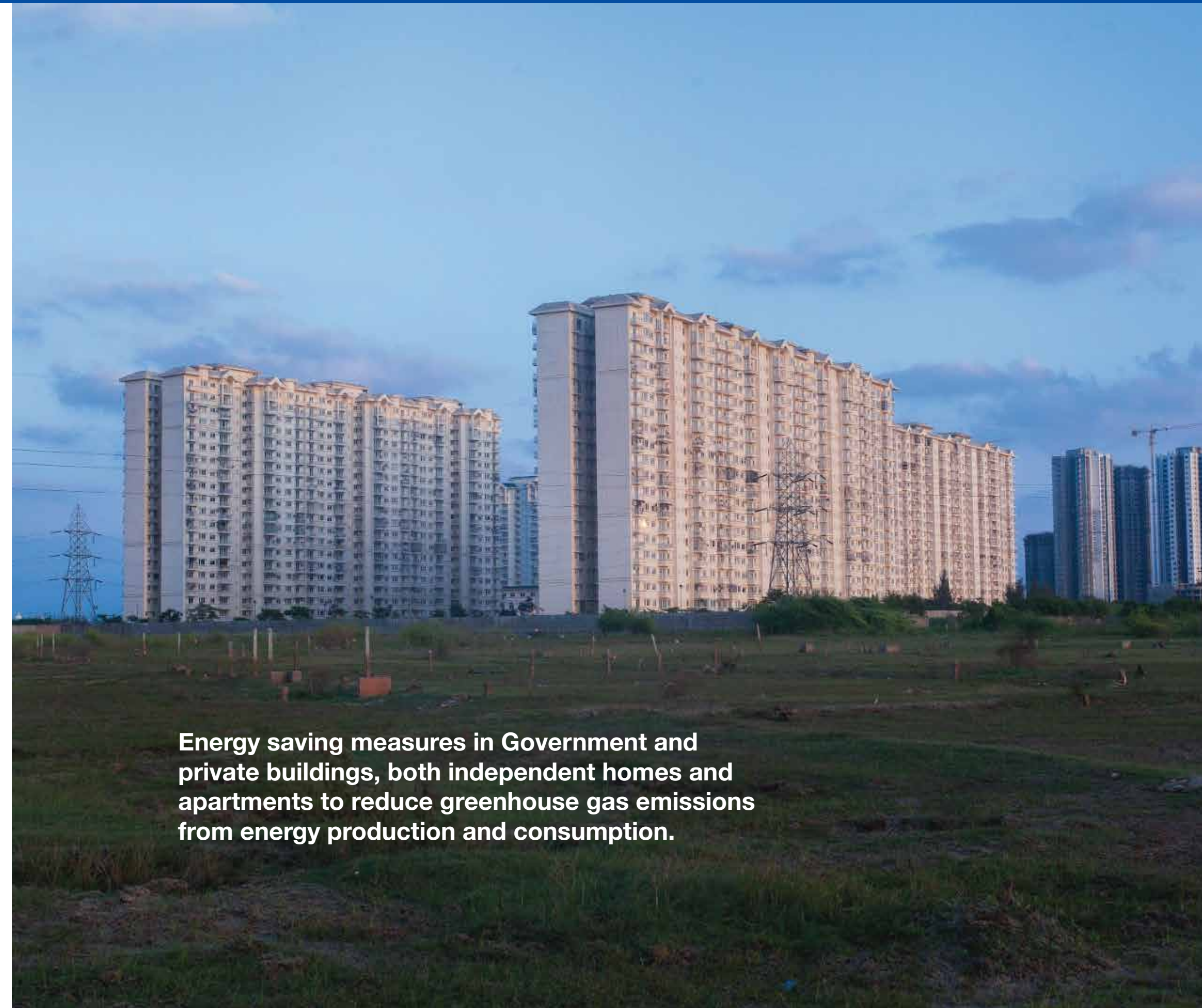
Learning's from Climate Smart Villages would help the State understand ground-level climate-related interventions which could be upscaled at the State level helping the Govt in climate proofing various Govt schemes.

5.4. SUSTAINABLE HABITAT: ENERGY SAVING MEASURES IN BUILDINGS TO REDUCE THE IMPACTS OF CLIMATE CHANGE

ACTIVITIES UNDER TAMIL NADU CLIMATE CHANGE MISSION

Energy efficiency delivers a number of environmental benefits. It notably reduces GHG emissions, both direct emissions from fossil fuel combustion or consumption and indirect emissions reductions from electricity generation. Energy-efficient technologies will reduce Green House Gas (GHG) emissions, sensitizing architects, engineers, interior designers and plumbers, electricians, and building industry stockholders on energy-efficient technologies in the construction sector. Conceptualize an approach to set out to implement policies to facilitate energy efficiency in buildings in the State. Energy saving measures in Government and private buildings, both independent homes and apartments to reduce greenhouse gas emissions from energy production and consumption.

One of the main objective of this activity is to create awareness about energy saving, skill development for builders & developers for building climate friendly infrastructure, developing Standard Operating Procedures (SOP) for construction of energy efficient houses and developing a green building rating mechanism. Right guidance from reputed green rating organisations will help to achieve the goal with certainty and ease.



Energy saving measures in Government and private buildings, both independent homes and apartments to reduce greenhouse gas emissions from energy production and consumption.

5.5. CLIMATE RESILIENT GREEN MONUMENTS

ACTIVITIES UNDER TAMIL NADU CLIMATE CHANGE MISSION



As part of the Tamil Nadu Climate Change Mission, the Government of Tamil Nadu has developed the concept of creating green monuments. The climate resilient green monuments aims to develop self-sufficient monuments that can withstand all kinds of climatic variations. The pilot project will include efficient solar lighting, water management, heat management, greening, eco-restoration of monument tanks, interventions to remove plastic and microplastic, etc. It will also include the enrichment of monument gardens to enhance biodiversity.

The green monument concept is a holistic development process that involves much more than simply putting solar panels on the roofs of monuments. It involves a comprehensive integration of: the ecological monument structure and energy system, economic sustainability, and integration with the surrounding environment. The pilot phase would throw light on the key measures to be adopted for buildings of cultural and heritage value to make them climate resilient.

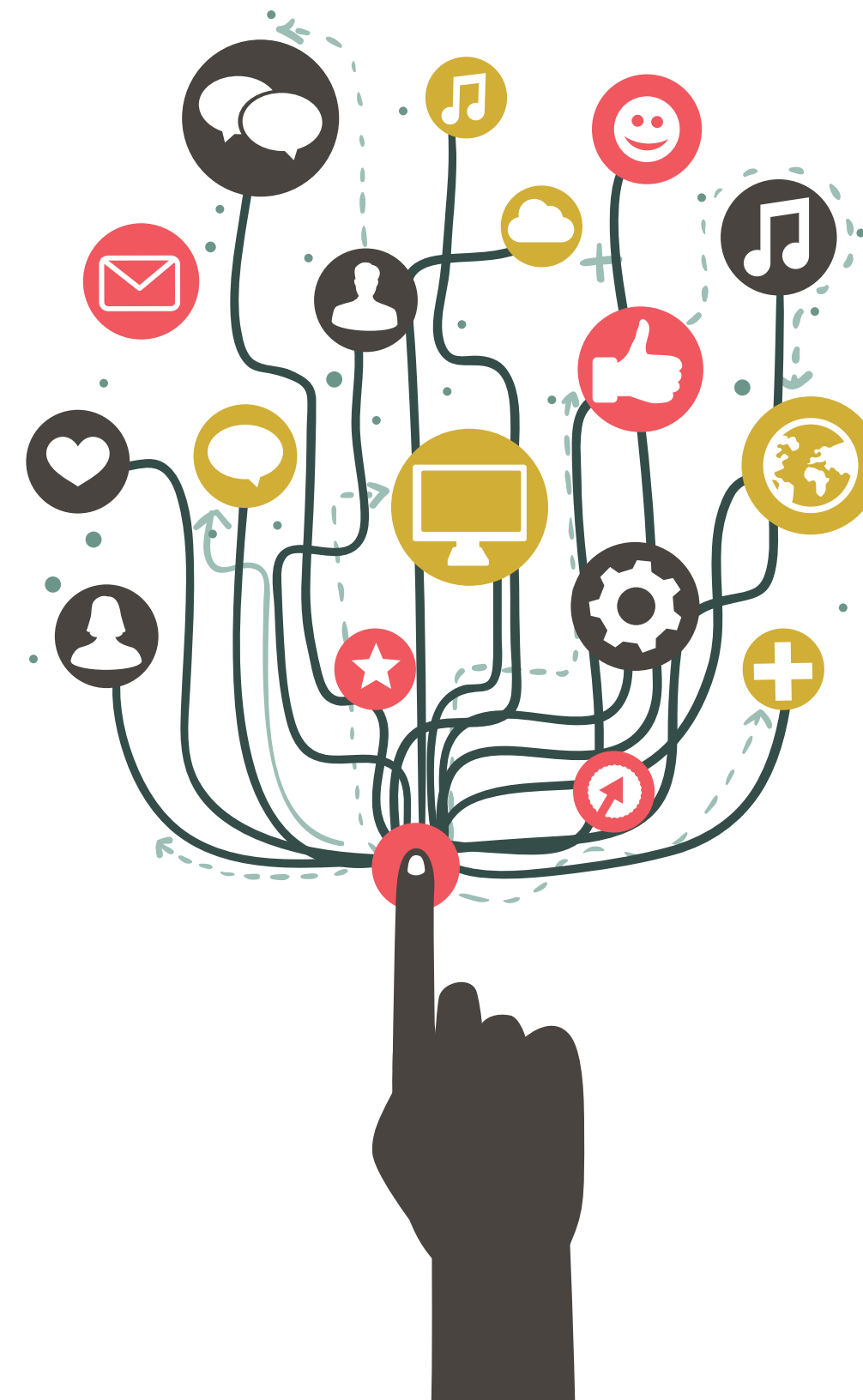
5.6 CLIMATE LITERACY AND INTERNATIONAL CLIMATE SUMMIT

ACTIVITIES UNDER TAMIL NADU CLIMATE CHANGE MISSION

Climate literacy across spatial, temporal and generational extent has become essential in the event of ever-increasing threats and damages posed by the climate hazards and its predicted future impacts. It is proposed to enhance the climate literacy of the state through various programmes and by conducting International Climate Summits.

The Climate Literacy Programme aims to create awareness and improve the comprehensive understanding of all the stakeholders viz. Government functionaries, Students from schools & colleges, Farmers, Fisher folk, Industries, Self Help Groups through all the audio-visual medium of information and communication methods. These include Videos, Television, Advertisements, Radio, Advertisement jingles, Extension sessions, Gram Sabha, pamphlets and posters, hoardings and Traditional Art folk. The objectives of the Climate Literacy Programme is to

- Create awareness on Climate Change impact
- Understand ways and means to mitigate climate change
- Educating students on climate science, adaptation and mitigation activities
- Disseminate best practices and practical solutions to mitigate Climate Change through media & digital communication platforms like short videos in social media, Apps etc.,
- Creating a platform for engaging students in Climate Change awareness campaigns on green days to actively involve them in group discussions, digital poster making, street plays, skits, podcast, public campaigns etc.,



To achieve the aim of the Climate Literacy Programme a baseline study is warranted. With an aim to assess the understanding of policymakers and students on the issues around climate change, impacts and vulnerability, it is proposed to conduct a Baseline Study on Climate Literacy in Tamil Nadu.

The study also seeks to document the knowledge products available to these stakeholders for promoting and raising awareness about it. The Baseline Study is to address the following specific objectives of the study:

- Understand the current levels of climate literacy among sample populations of different stakeholders, viz. officials at the state level, officials of line departments and school students.
- Systematically document the knowledge products available on climate change.
- Identify the knowledge gaps and suggest a methodology for implementing the Climate Literacy Enhancement Programme in Tamil Nadu.

The Baseline Study on Climate Literacy in Tamil Nadu will lay foundation to frame the Climate Literacy Programme in Tamil Nadu and to take it forward in a effective manner.

5.7. STAKEHOLDER WORKSHOPS ON INTEGRATING CLIMATE CHANGE ADAPTATION AND MITIGATION

A series of 38-district level Workshops and 2 State level workshops are planned to sensitize and enhance development planning. **Capacity-building workshops for local communities and government line departments are also a part of the proposed stakeholder workshops.** This will ensure prioritizing adaptation and mitigation planning of sectors in districts that require immediate attention to Climate Change vulnerability. Highlighting scientific evidence on Climate Change at Regional and Global arenas in addition to focusing on successful indigenous and technological interventions are needed for eco-friendly community adaptation for developing resilience in the society.



EXPECTED OUTCOMES OF THE PROPOSED ACTIVITIES UNDER THE TAMIL NADU CLIMATE CHANGE MISSION



The expected outcomes of the proposed activities under the Tamil Nadu Climate Change Mission are as follows:

- Prioritizing sectors in districts that are vulnerable to climate change
- Framing specific adaptation and mitigation strategies
- Protection of coasts, reduction of soil erosion, salinity control and improvement of biodiversity
- Palmyrah & cashew plantation provides solutions to tolerate drought and act as shore protection
- Mangroves to enhance coastal defence
- The identification of vulnerable & eco-sensitive areas on the coasts of Tamil Nadu will ensure sustainable coastal protection.
- Improved soil carbon sequestration.
- Restored soil organic carbon, increased water holding capacity and increased nutrient availability beneficial for plant growth & microorganisms and reclamation of land after bio mining

- Improved energy efficiency technologies will reduce GHG emissions
- Sensitizing service providers on energy efficient technologies in the construction sector
- Conceptualizing approach to set out and implement policies to facilitate energy efficiency in buildings
- Improved understanding of climate risks to generate local support for decision making
- Integration of adaptation approach to climate variability in water resources, forests, agriculture and allied sectors with resilient cropping practices
- Energy efficient interventions and increase in green cover in villages of Tamil Nadu
- Better coordination, effective monitoring and supervision of climate projects.

These pilot projects would throw light on significant measures to be adopted for buildings of cultural and Heritage value to make them climate resilient.

APPENDIX

IPCC – Intergovernmental Panel on Climate Change

GHG – Green House Gases

Ppb- Parts Per Billion (PPB)

LULCC- Land Use Land Cover Change

UNFCCC- United Nations Framework Convention on Climate Change

NAPCC – National Action Plan on Climate Change

SST- Sea Surface Temperature

NDC- Nationally Determined Contributions

GDP- Gross Domestic Product

GCF- Green Climate Fund

GCMS- Global Climate Models

THI- Thermal Heat Index

SDG- Sustainable Development Goals

SOC- Soil Organic Carbon

TEDA- Tamil Nadu Energy Development Agency

TNSAPCC- Tamil Nadu State Action Plan on Climate Change

AMRUT- Atal Mission For Rejuvenation And Urban Transformation

NAFCC- National Adaptation Fund For Climate Change

TNGCC- Tamil Nadu Green Climate Company

SPV- Special Purpose Vehicle

MoEF&CC – Ministry of Environment, Forest and Climate Change

MGNREGS- Mahatma Gandhi National Rural Employment Guarantee Scheme

NRLM- National Rural Livelihoods Mission

UJALA- Unnat Jyoti by Affordable LEDs for All

DEWATS- Decentralized Wastewater Treatment Systems

TNPCB- Tamil Nadu Pollution Control Board

H&UD - Housing & Urban Development

GoTN- Government of Tamil Nadu