



Pan- Clivar Meeting 2025
CLIVAR Symposium : Bridging Science and Society in Southeast Asia and Beyond
22-26 September, Bali, Indonesia

Climate Change induced Sea Level Rise and Coastal flooding Vulnerability
in Chennai region, Tamil Nadu, India

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ABSTRACT

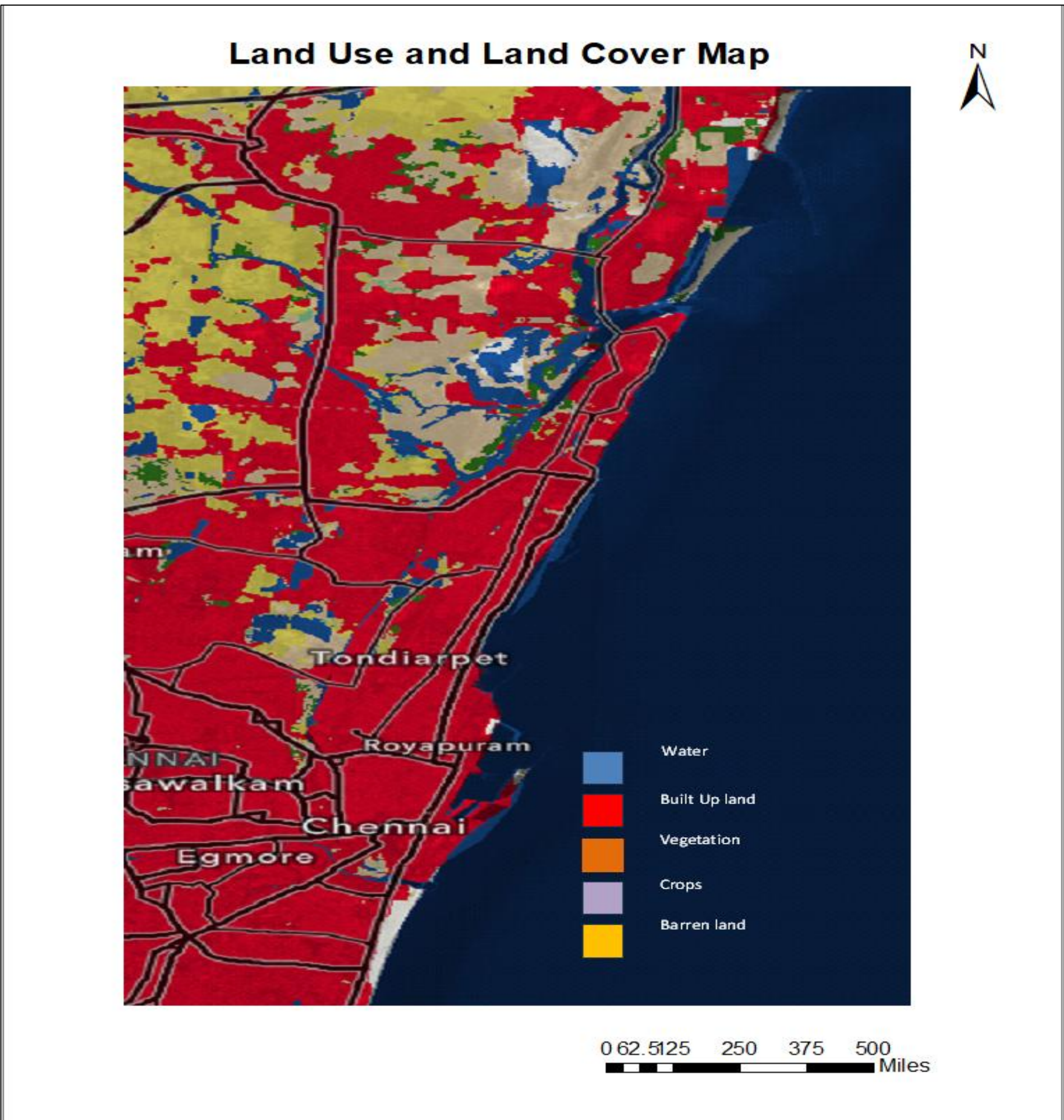
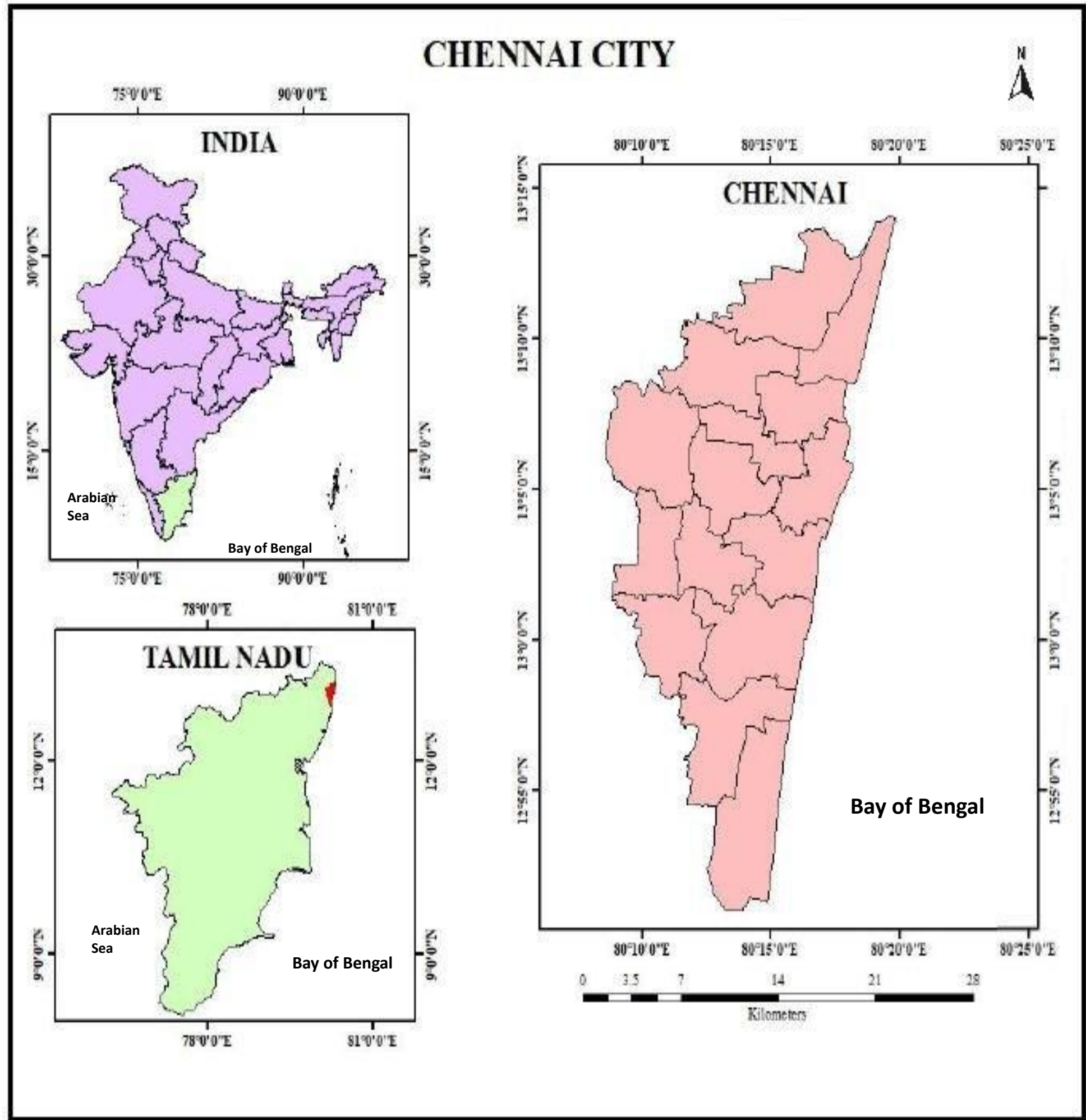
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Global climate change, driven by anthropogenic greenhouse gas emissions, is causing a rise in global mean sea level (GMSL) through thermal expansion and ice melt. The Intergovernmental Panel on Climate Change (IPCC) provides a range of future sea-level rise (SLR) projections based on different Shared Socioeconomic Pathways (SSPs), highlighting a spectrum of potential increases by the end of the century and beyond. This study focuses on Sea Level Rise impacts in Chennai region, a densely populated and the vulnerability to coastal flooding under the different SLR scenarios. High-resolution satellite imagery, digital elevation models, historical tide gauge records, and future SLR projections from SIMCLIM AR6 data will be integrated to conduct Digital Terrain Analysis. This analysis will involve overlaying the resulting inundation maps with critical infrastructure, densely populated areas, and ecologically sensitive zones like mangroves, wetlands to identify highly vulnerable locations. The findings will generate detailed inundation maps and vulnerability areas, providing crucial information for urban planners, policymakers, and disaster management agencies. This information will enable the development of effective adaptation strategies, thereby mitigating the adverse impacts of climate change and SLR on coastal Chennai.

Key words: Climate Change ; Sea Level Rise ; Coastal Flooding ; Inundation Mapping ; Geospatial Analysis and Adaptation Strategies.

INTRODUCTION

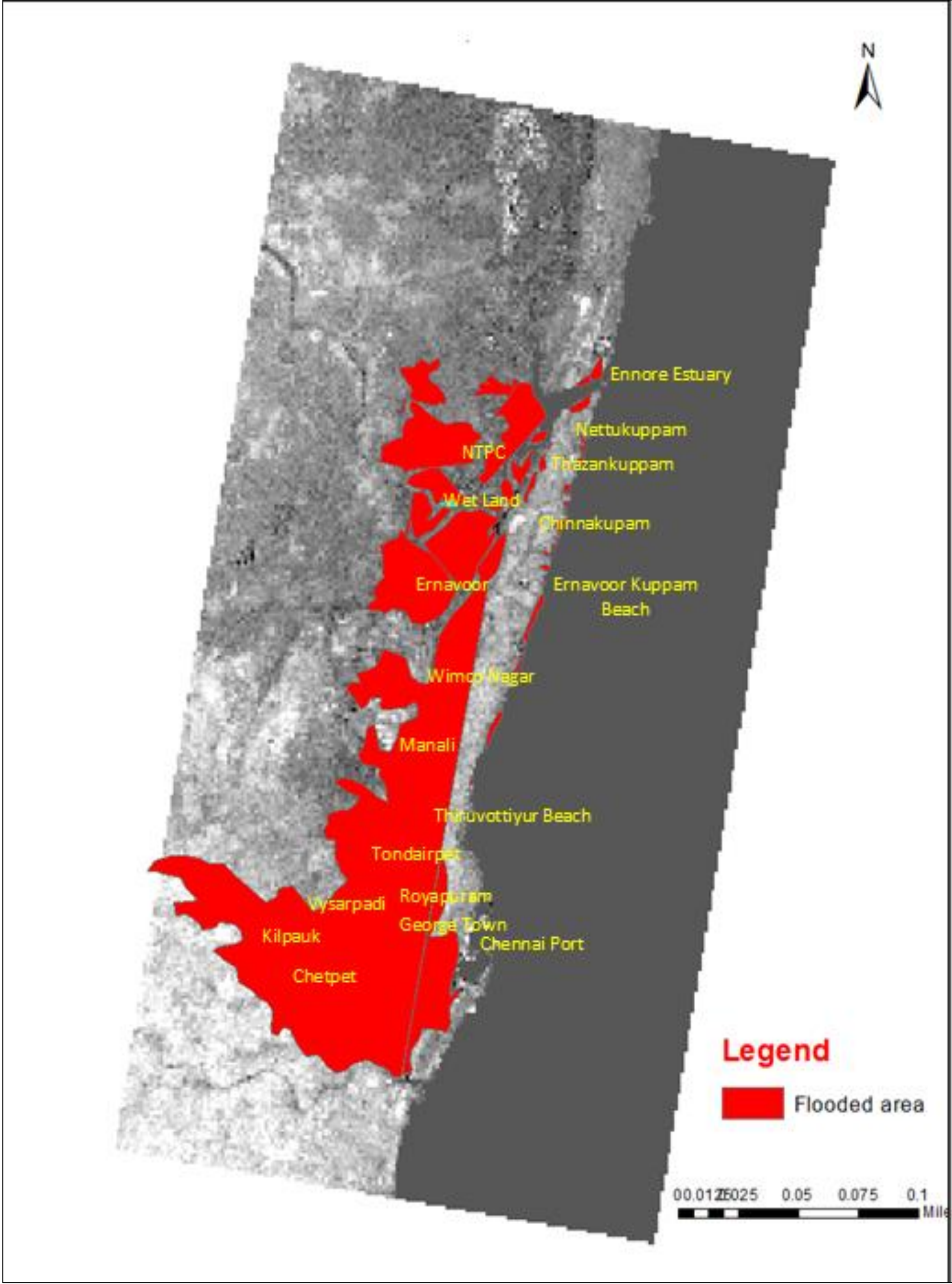
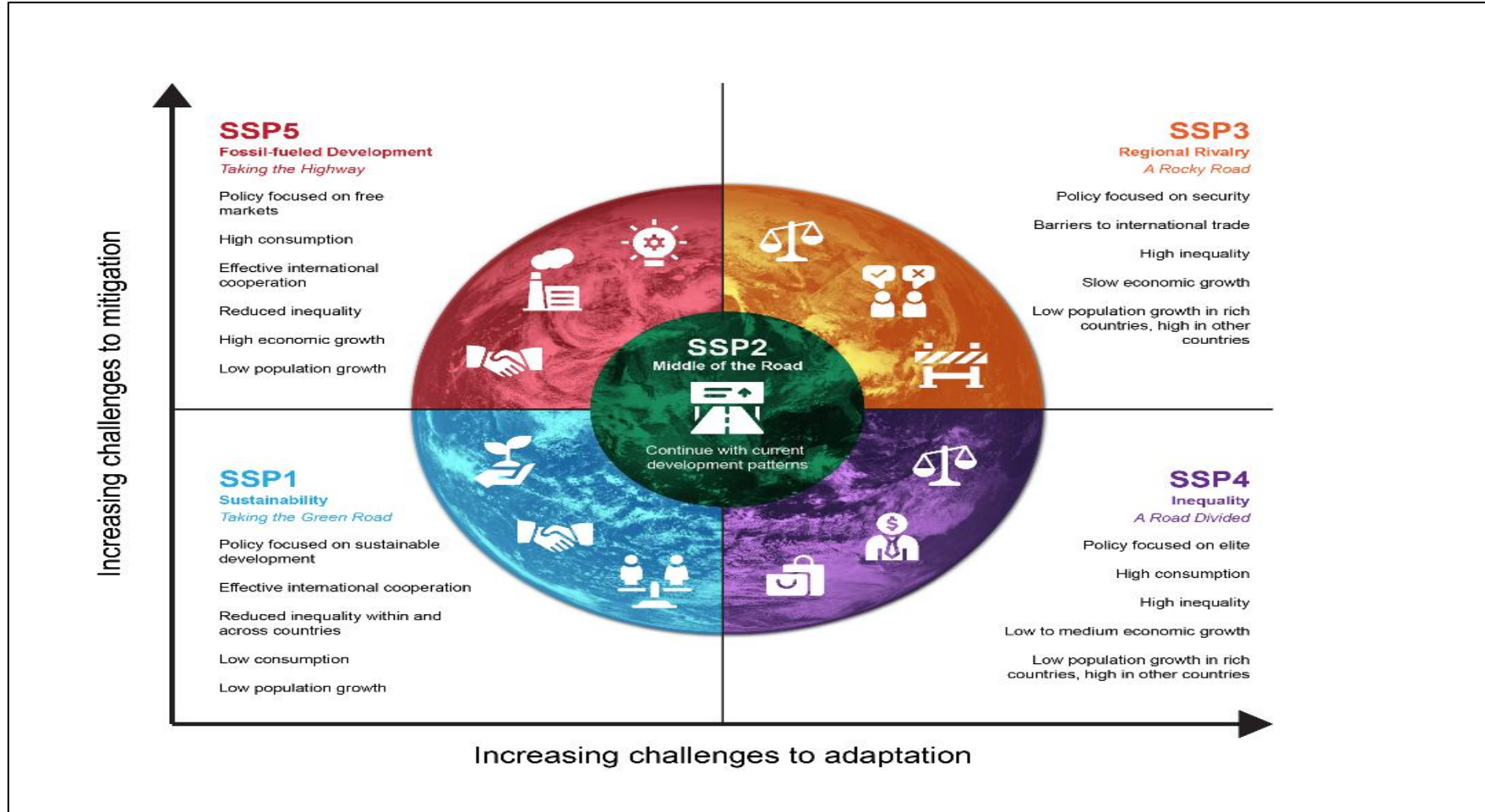
Chennai, a bustling megacity and the capital of Tamil Nadu, faces a severe and escalating threat from climate change, particularly through sea-level rise and coastal flooding. Its rapid urbanization and dense population of over 7 million people are concentrated on a low-lying, flat coastline, making it highly susceptible to inundation. Critical infrastructure, including the Chennai Port, the city's international airport, and the key IT corridor, is situated in vulnerable, low-elevation coastal zones. This combination of a vulnerable geographical position and a massive human and economic footprint puts Chennai at the forefront of climate change risks in India, with potential for widespread displacement and economic disruption.



SSP-based scenarios were used in the most recent set of climate model experiments, known as the sixth phase of the Coupled Model Intercomparison Project, or CMIP6 for short. (AS PER IPCC AR 6)

COASTAL FLOODING DUE TO SLR

HYBRID SOLUTIONS



REGIONAL SEA LEVEL RISE FOR CHENNAI COAST – SIMCLIM AR6 UNDER DIFFERENT SSP SCENARIOS				
Year	Scenario	Low(cm)	Mid(cm)	High(cm)
2025	SSP2-4.5	6.07	6.69	8.24
	SSP5-8.5	6.7	7.3	8.9
2050	SSP2-4.5	16.39	19.19	24.6
	SSP5-8.5	21.5	24.5	30.5
2075	SSP2-4.5	28.45	34.82	46.14
	SSP5-8.5	41.1	48.4	61.7
2100	SSP2-4.5	41.03	52.16	71.12
	SSP5-8.5	63	76.5	99.7

OBSERVATION ON CHENNAI SLR

Land Use Affected
❖ The red shaded areas on the map indicate land at risk in Chennai.
❖ These areas are predominantly coastal zones, riverbanks, marshlands, and low-lying urban and suburban zones.
❖ Ecologically sensitive zones such as declared ecological zones with mangroves, mudflats, salt marshes, and nesting grounds for various wildlife species are affected.

Villages/Areas Affected
❖ The listed villages and neighborhoods, including Minjur, Vallur, Elandanur, Manali New Town, and Royapuram, are located in Chennai's northern and coastal floodplains, making them highly vulnerable to flooding and sea level rise due to their low elevation and proximity to the sea, river outlets, and marshlands.
❖ These areas experience compounded risks from storm surges, inundation, urban expansion, inadequate drainage, and proximity to industrial zones, which increase both environmental and economic vulnerabilities.
❖ The recurring threat of coastal and riverine flooding poses serious risks to residential, commercial, and industrial zones, necessitating urgent flood hazard management and climate adaptation strategies.

Infrastructure Getting Affected
❖ Major public infrastructure such as the Shipyard and Ennore Power Station are located within risk zones vulnerable to flooding and sea level rise.
❖ Essential services including roads, railways, ports, drinking water supply, energy grids, internet infrastructure, sanitation, tourism, and agriculture sectors in these regions face potential disruption and damage due to climate hazards.
❖ Vulnerable infrastructure exists along river banks of ennore and Cooum, and residential areas along the sea coast are increasingly exposed to regular flooding and rising sea levels.

Acknowledgement : Anna Research Fellowship, Centre for Research, College of Engineering, Anna University, Chennai, TamilNadu, India

Category	Soft Measures (Infrastructure & Community Livelihoods)	Hard Measures (Infrastructure)
Community Livelihoods	Diversification of livelihoods instead of sole dependence on fisheries and natural resources	-
	Resilience enhancement through skill development, infrastructure support like cold storage for fish products	
Coastal Infrastructure	Resilience enhancement through skill development, infrastructure support like cold storage for fish products	Seawalls and stone rubble mound walls at erosion-prone areas (Royapuram, Ennore)
	Mangrove and coastal vegetation restoration to stabilize shorelines and act as natural buffers	Groynes constructed perpendicular to the shore to prevent sand bar formation and protect beaches
	Regular desiltation and maintenance of creeks and estuary mouths (Ennore creek, Cooum mouth) to improve flushing and reduce flooding risks	Breakwaters off shore near ports reducing wave energy and sediment movement
	Community-based awareness and capacity building for sustainable fishing and adaptive livelihoods	Training walls at river mouths (Cooum, Ennore creek) to prevent sand bar formation and siltation that disrupt water exchange
	Promotion of alternative livelihoods to reduce pressure on coastal fisheries	Flood embankments and drainage improvements to protect settlements from flooding