Downscaling of Climate Data for Local Governments in Kerala



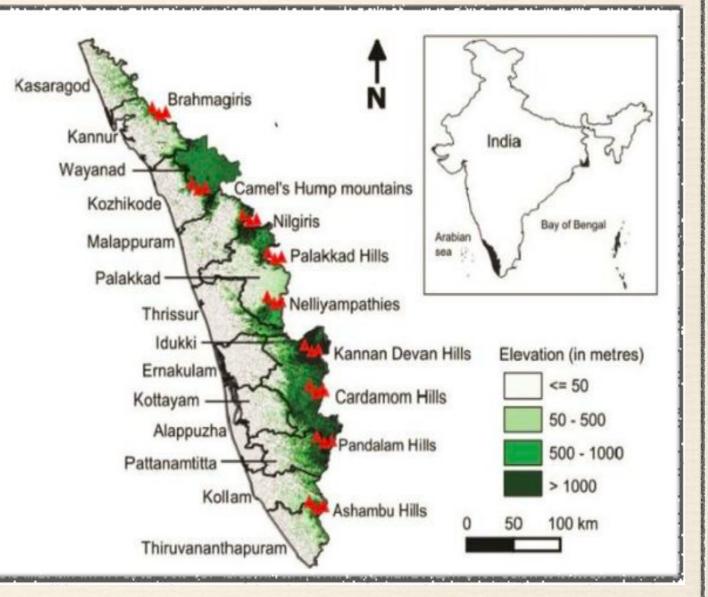
Dr. Shinu Sheela Wilson Kerala State Disaster Management Authority



Contributors: Mr. Faheed Jasin Ms. Abhija J Ms. Arunima N Mrs. Kavya Gopan Dr. Raveendran Sekhar Dr. Sekhar L Kuriakose

Kerala

- South west coastal State
- Gateway to Monsoon
- Multi-hazard prone state
- 1.18% of Indian landmass
- Area : 38863 km²
- Coastal line : 592. 9 km
- Width : 30 km to 120 km
- Population density: 860/km²
- Districts: 14
- Local Self Government: 1034



Kerala's Vulnerabilities

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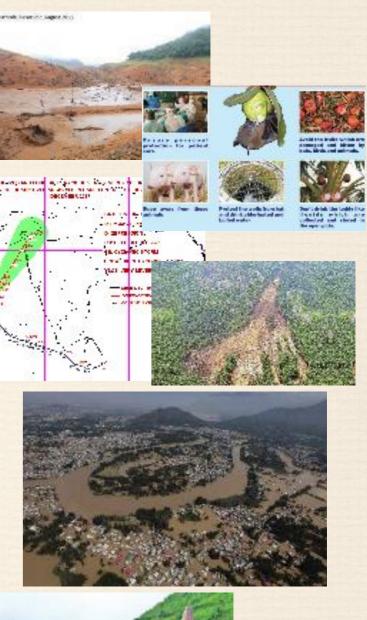
	Flood (Riverine, Urban and Flash Floods)			
	Landslides (includes debris flows, rock fall, rock avalanche,			
	rock slide, landslips and mud slips)			
	Drought			
	Coastal hazards (High waves, Storm surges, Kallakadal,			
	Tsunami, Salt Water Intrusion, Coastal erosion)			
	Wind (Cyclone, Gustnados, Gusty winds)			
	Lightning			
	Earthquakes			
Natural Hazards	Human epidemics			
	Plant disease epidemics and pest attack on crops			
	Avian epidemics			
	Animal epidemics			
	Pest attack of human habitations			
	Forest Fire			
	Meteorite/asteroid impacts			
	Soil Piping			
	Heat wave/sunburn/sunstroke			
	Natural background radiation			

Kerala's Vulnerabilities

	Stampedes
	Fire cracker accidents
	Petro-chemical transportation accidents
	Industrial accidents
	Dam break
	Dam spillway operation related floods & accidents
	Oil spill
	Road accidents involving civilian transport vehicles
	Human induced forest fire
	Human-animal conflicts
	Fire accidents in buildings and market places
Anthropogenic Hazards	Boat capsizing
	Accidental drowning
	Building collapse
	Hooch accident
	Air accidents
	Rail accidents
	Terrorism, riots and Naxalite attacks
	Nuclear and radiological accidents
	Space debris impacts
	Biological accidents
	Occupational hazards
	Accidents in Armed Forces premises
	Anthropogenic Hazards

Recent disaster events in Kerala

Event	Year	Damage/Fatality
Drought	2012-13	₹23.78 billion
Drought	2016	₹9.93 billion
Cyclone Ockhi	2017	142 fatalities
Nipha Virus	2018	17 fatalities
Floods & Landslides	2018	451 fatalities
Floods & Landslides	2019	125 fatalities
Covid19	2020	64,466 fatalities
Landslides	2020	69 fatalities
Air Crash	2020	18 fatalities
Landslides	2021	27 fatalities
Nipha Virus	2023	2 fatalities





Relevance

In order to mitigate the increasing number of climate change-driven disasters in Kerala, adaptation initiatives must be undertaken at the grassroots level.

It is essential to consider disaster risks and potential climate change scenarios in long term and short term development plans.

To achieve this, local government entities must have access to information about climate change.

Data

Observational data

Varaibles	Source		Temporal resolution
Precipitat ion	IMD	0.25° × 0.25°	Daily
Maximu m temperat ure	IMD	1° × 1°	Daily
Minimu m temperat ure	IMD	1° × 1°	Daily

Period Historical : 1976-2005 Future: Near term (2021-2040) Medium term (2041-2060) Long term (2061-2099)

Downscaled model data

Varaibles	Source	Spatial resolution	Temporal resolution
Precipitation	CORDEX	0.5° × 0.5°	Monthly
Maximum temperature	CORDEX	0.5° × 0.5°	Monthly
Minimum temperature	CORDEX	0.5° × 0.5°	Monthly

Seasons JF MAM JJAS OND Annual

Climate Scenarios RCP 4.5 RCP 8.5

CORDEX Simulation	Regional Climate Model	Variables
CNRM-CERFACS-CNRM-CM5	SMHI-RCA4	Precipitation
NOAA-GFDL-GFDL-ESM2M	SMHI-RCA4	Precipitation Max Temperature Min temperature
IPSL-CM5A-MR	SMHI-RCA4	Precipitation Max Temperature Min temperature
NCC-NorESM1-M	SMHI-RCA4	Precipitation Max Temperature Min temperature
CCma-CanESM2	SMHI-RCA4	Max Temperature Min temperature
MIROC-MIROC5	SMHI-RCA4	Max Temperature Min temperature
CNRM-CERFACS-CNRM-CM5	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
IPSL-IPSL-CM5A-LR	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
CCma-CanESM2	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
CSIRO-QCCCE-CSIRO-MK3-6-0	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
NOAA-GFDL/GFDL-ESM2M	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
MPI-M-MPI-ESM-MR	IITM-RegCM4-4	Precipitation Max Temperature Min temperature

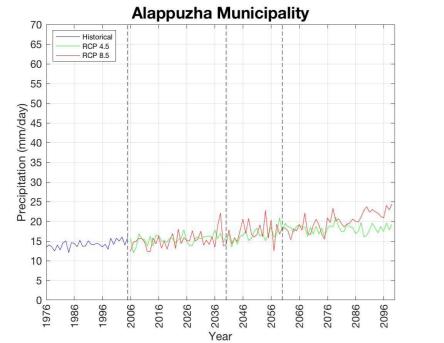
Source: <u>https://esgf-node.ipsl.upmc.fr/search/cordex-ipsl/</u>

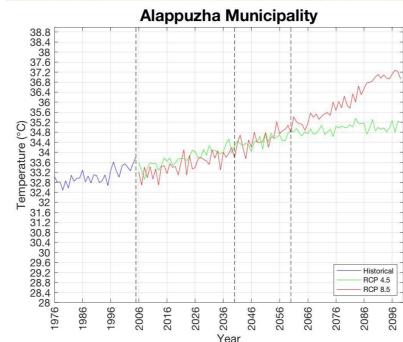
Time Series of precipitation, maximum temperature and minimum temperature

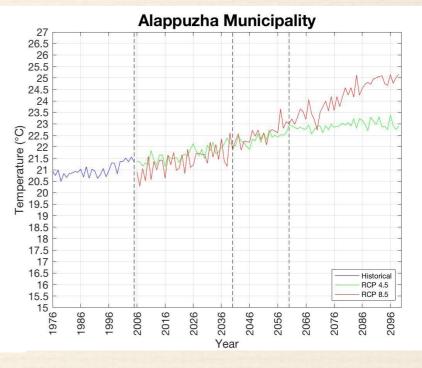


Max Temperature (MAM)

Min Temperature (JF)



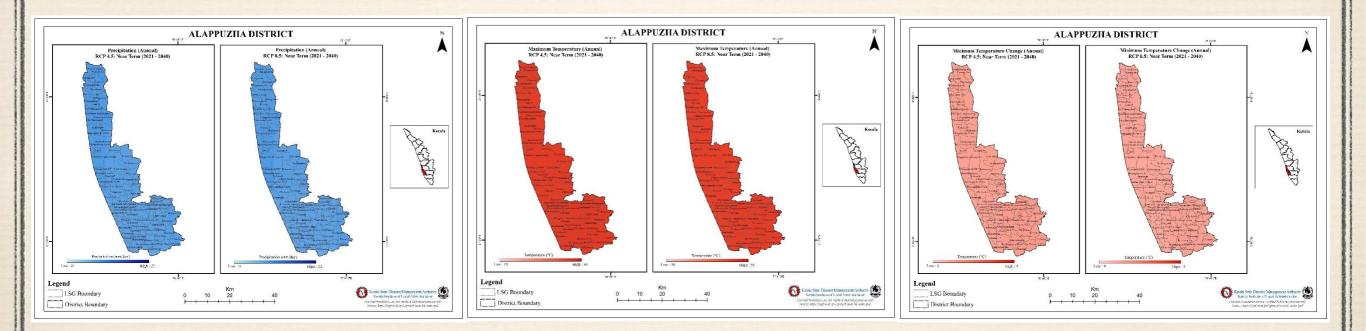


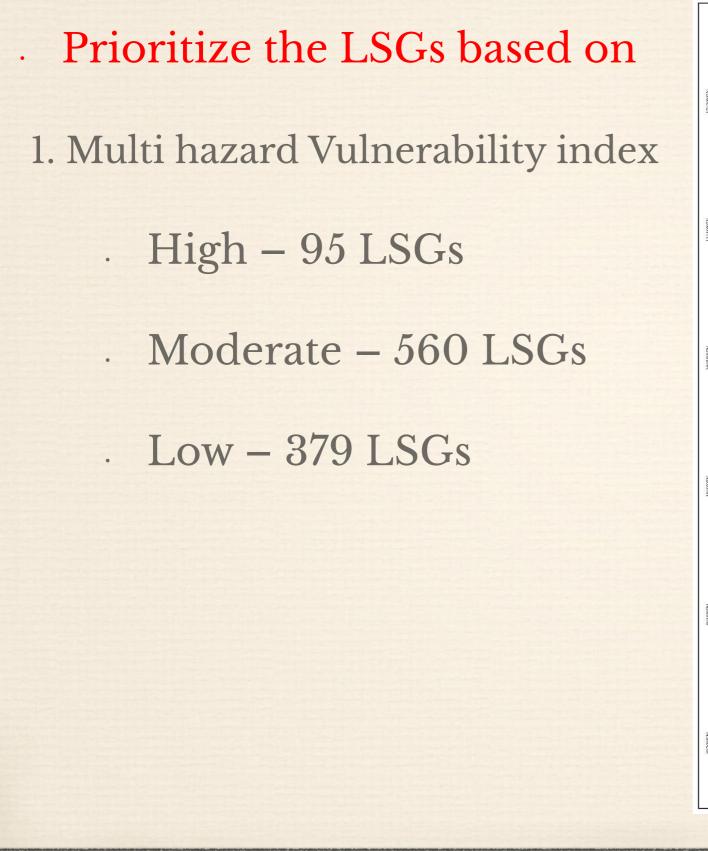


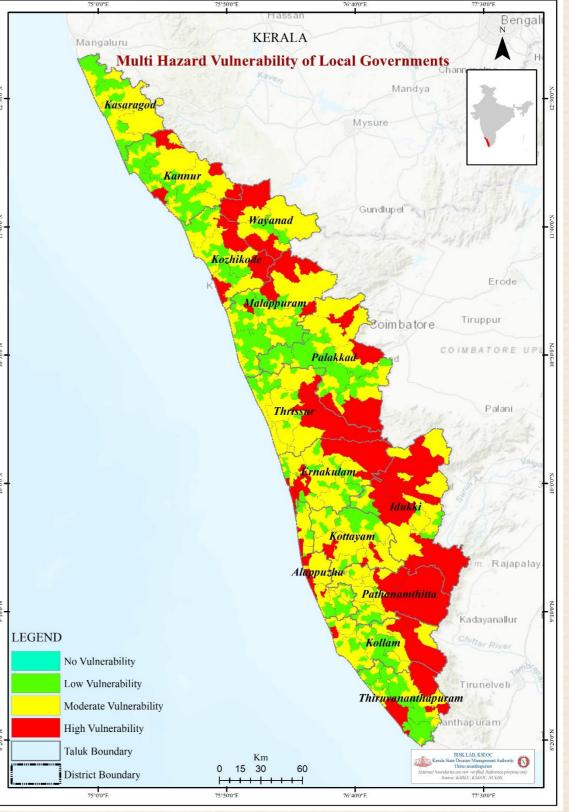
Mean value of maximum temperature/ minimum temperature/ precipitation for each season -1034 LSGs

Change in maximum temperature/ minimum temperature/ precipitation in near term/medium term/long term from historic period

Available at KSDMA website: <u>Climate Change Information for</u> Local Governments – Kerala State Disaster Management Authority

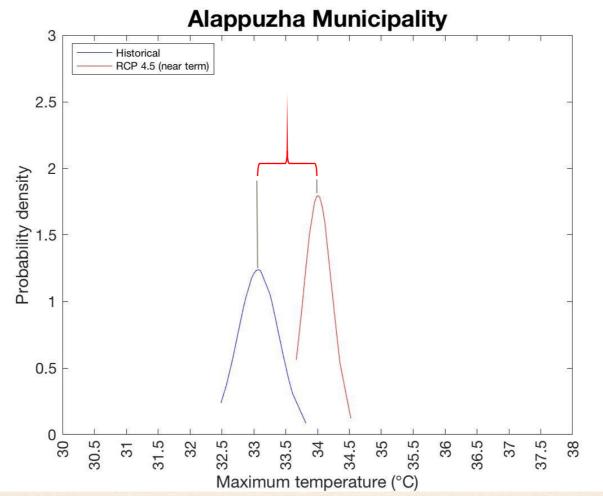






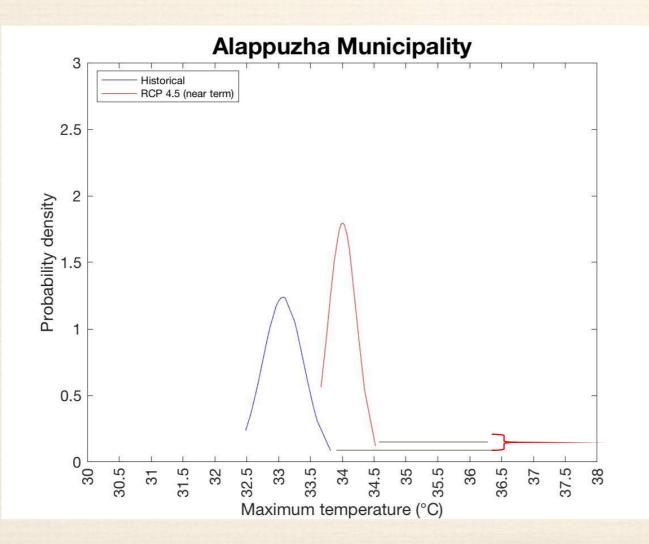
Prioritize the LSGs based on

2. Difference between the value (temperature/precipitation) with maximum probability to occur in the near term (2021-2040) and historic period.



Prioritize the LSGs based on

3. Difference between the probability of occurrence of extreme events in the near term (2021-2040) and historic period



Change in the frequency of occurrence of extreme events

Inference

Both the maximum temperature and minimum temperature is rising in all the seasons

Increasing probability of occurrence of extreme temperature events

Rainfall (mm/day) is decreasing in winter and pre-monsoon season

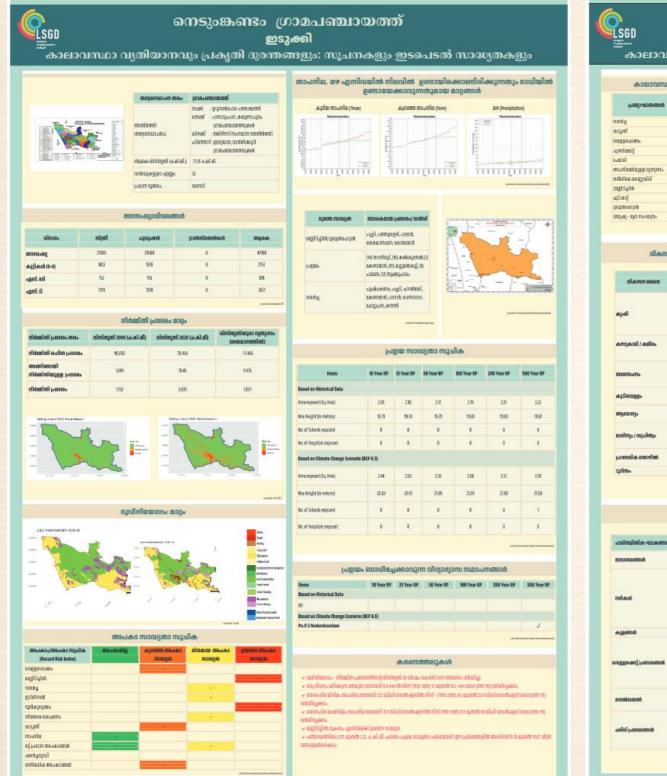
Increasing rainfall (mm/day) in monsoon season and probability of occurrence of extreme rainfall events are increasing in some LSGs (Thakazhy, Kanjoor...) and decreasing in some other LSGs (Pallipad, Pattanakkad...)

Rainfall (mm/day) is increasing in some LSGs and decreasing in some other LSGs in post monsoon season

Climate Change Atlas for Local Self Governments

Contains the climate change details and maps of each LSGs CLIMATE CHANGE ATLAS FOR LOCAL SELF GOVERNMENTS

Local Action Plan on Climate Change



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njenit	 ISU TUTA (FILID & ALDOFFIC) 	 សេច្បាស់ថា សត្វបាននៅ. នោះសេទិកាលសំហែសថា ថា Trip-ogg, សេប្តារា សេបាទ័ណាទ័ សាកាតុសាយ សេចឲ្យខ្លួន។ សុរស យោបានជាតិ លោងសូសថា សាកាតុសូសស្រុង សម្តេចកាស់សេចថ្មា កាំងពាល់ថា សូតប្រទេ- ទូការសេសសម្តុគ សេចថ្កែរ្យូ
waan	 ಎಂಗಿನೆ ಎಂಗಿನ್ನಾರು ಕ್ಲವಾಗಿಕೆ ಎಂಗಾಂ, ಎಗಗೆ, ಎಂಗ್ರಾಂ, ಎಗಗೆ ಎಂಗಾಗೆ, ಹಗಿರೆ, ಎಂಗ್ರ ಎಂಗಗೊಡಗಾಂ, ಎಂಗಿ, ಎಂಗಿ, ಎಂಗಗೊಡಗಾಂ, ಎಂಗಿ, ಎಂಗಿ 	•សុវានៅ ៣៦៣,ជួរដៃ សេម «ព្រះនៃទាន ខ្លាក់ សារសារ សុវានៅ ៣៦៣,ជួរដំ សេម «ព្រះនៃទាន ខ្លាក់ សារសារ
lest	• (dašlau) ajterraj	 សារនាសារ ដាមវាតំនូវទះពេល ដំណូតពាល្ សារនាសាវា សូវាថាហ្គេ, សារនាសាវា សូវាថាហ្គេ, សារនាសាវា សារលេច, សារនាសាវា សារលេច, សារប្រសាស ស្ថាវាហារប្រ, សារប្រសាស ស្ថាវាហារប្រ, សារប្រសាស ស្ថាវាហារប្រ, សារប្រសាស ស្ថាវាហារប្រ,
ಣುನ (ಎಣ್ಣ)ಎ/ ತೆಪಣಿಯಹಿತನ)	 Afstrockritesjes medimente gyvenovy, este negline rogasenerogaset meliograpoit. 	ρπποίρα γεροκματικό μα επατέρα σύμα • μποτέρα προτεία πρό το πρό τ
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actory form and a through the test the second on the test a condition of the test the condition of the test the test the test test test test test te	non que que este de la consecutor teneral política de la consecutor esta consecutor noi al político de la consecutor teneral	aust sayaant.
koo nogi yaawa xhatani ngaani xi nangi nagacawa mwa nangi nagacawa mwa nangi nagacawa mwa na nangi nagacawa mwa na nagacawa mwa na nagacawa mwa nagi ya nagacawa ka nagi wa nagi wa nagi wa nagi wa nagi wa nagi wa ka nagi wa nagi ka nagi wa nagi wa ka nagi wa	ຖາດກາງແຂດງແບ, ແກ້ມເພື່ອດາກ ຊອງ, ການແຫວດ" ເຫັນໄປແຕ່ປາງກະເດີຍແຫດກາ ແກ່ ແກ່ ແກ່ ແກ່ຖາງປະຊາດ, ເປັນເຮັດ, ເປັນເປັນ ແກ່ຖາງປະຊາດ, ແມ່ນີ້ແຜ່ນູ້. ແຕ່ ແມ່ນການຊາດ, ເປັນໃຫຍ່ນູ້. ແຕ່ ຖາວານການ. ແຫວ ເຫັນ	rant) anjaan managaamatann mud aggaa tartheiga averagg garaug af alimigegacaap, mga agatt - aast spanigm
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Source: Kerala Institute of Local Administration (KILA)

Local Action Plan on Climate Change

• Prepared by KILA in native language

- Contains
 - General information about LSG
 - Climate change and our LSG
 - Impact of climate change on local environment
 - Climate change impacts on livelihoods in the LSG
 - Climate change impacts on local biodiversity
 - Climate change and disasters
 - Intervention possibilities in the LSG
- Prepared for all LSGs of Alappuzha, Pathanamthitta, Idukki and Kottayam districts

Local intervention possibilities

- Carbon Neutral LSGs
- Filament free LSGs
- Green Protocol
- Green building
- Cool roofing
- Solid waste management techniques
- Energy efficient equipments
- Creation of energy self sufficient villages and towns using renewable sources
- Paperless office governance

Local intervention possibilities

- Climate Smart Agriculture
- Climate resilient seed/Local seed varieties/ conservation of local cattle breed
- Paddy fields, wet land conservation
- Rainwater harvesting, Well recharging, conservation of ponds
- Soil and water conservation
- Issue soil health card to farmers based on soil constituents
- Water testing facility
- More Crop insurance schemes

Local intervention possibilities

- Investing in resilient tourism infrastructure
- Implementation of pollution control measures
- Carbon neutral tourism destination
- Relocation of vulnerable population from the coast.
- Rejuvenation of rivers
- Revival of polluted lakes and ponds
- Establish Water data bank
- Climate resilient Urban Infrastructure Development

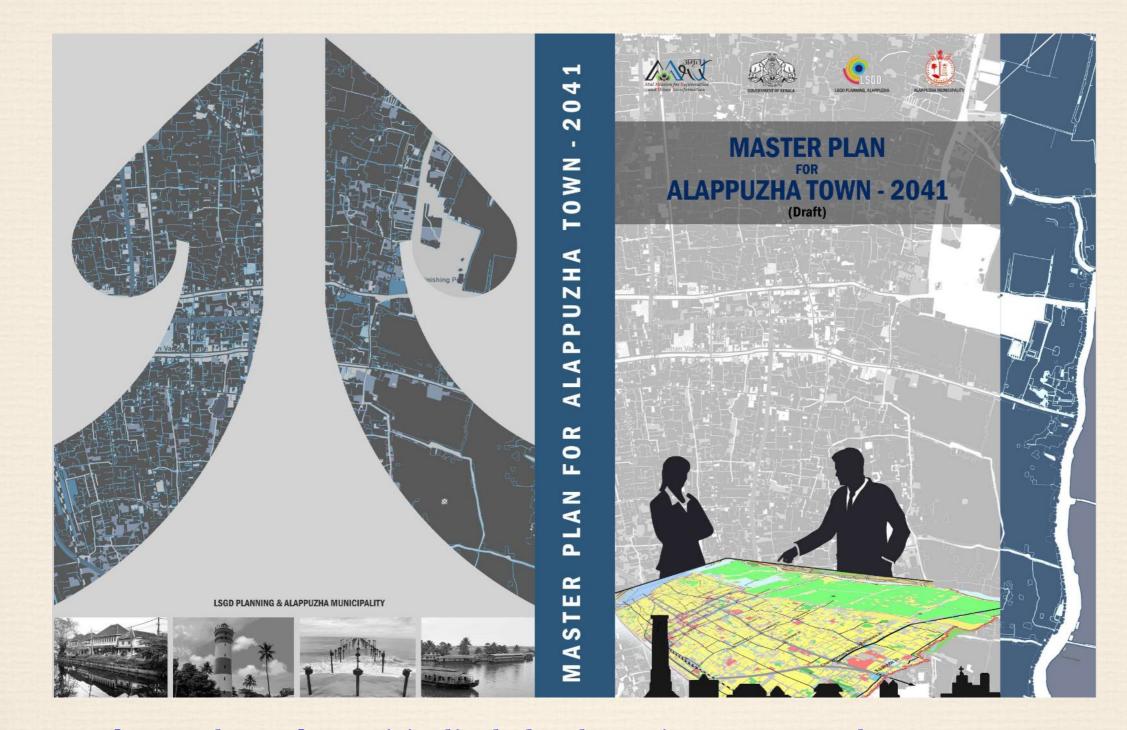
Disaster Risk management & Climate Action Tracker (DCAT) tool

• Tool developed by KILA to assess and incentivise LSGs that achieve the co-benefits of climate proofing in their development planning

• To empower LSGs to build resilience through climate and disaster risk informed project planning and implementation at the local level

• To evaluate local disaster management and climate resilient activities and provide financial incentives to LSGs based on their performance

Risk Informed Master Plan



Source: <u>https://alappuzhamunicipality.lsgkerala.gov.in/?q=master_plan</u> Prepared by: LSGD Planning Department

Limitations

The coarse resolution of the data limits the ability to pinpoint the specific hotspots within each LSGs, which may hinder targeted interventions

. Uncertainties in the analyses, which can impact the reliability of the results and the decisions based on them.

