CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU

WATER RESOURCES

Capacity Building Programme

REPORT

MARCH 2024

Funded By
Department of Environment and Climate Change
Government of Tamil Nadu

Prepared By
Centre for Climate Change and Disaster Management
Department of Civil Engineering
Anna University, Chennai

CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU

WATER RESOURCES

CAPACITY BUILDING PROGRAMME

REPORT

UNDER

OPERATIONALIZATION OF CLIMATE STUDIO

MARCH 2024

TEAM – CLIMATE STUDIO

PRINCIPAL INVESTIGATORS	:	**Dr. Kurian Joseph,** Professor & Director, CCCDM
		Dr. A. Ramachandran Emeritus Professor, CCCDM & Member, Chief Minister's Governing Council on Climate Change
RESEARCH TEAM		
CLIMATE MODELING	:	**Dr. R. Geetha,** Project Scientist
		Mrs. K. Sathyapriya, Project Associate
WATER RESOURCES	:	**Dr. L. Balaji,** Project Scientist
		Dr. R. Malarvizhi, Project Associate
SUSTAINABLE AGRICULTURE:		**Dr. S. Pavithrapriya,** Project Scientist
		Mr. P. Praveenkumar, Project Associate
FOREST ECOSYSTEM	:	**Dr. S. Hariharan,** Project Scientist
		Dr. M. Mithilasri, Project Associate
COASTAL ECOSYSTEM	:	**Dr. Madavi Venkatesh**, Project Scientist
		Ms. S. Nivetha, Project Associate
SUSTAINABLE HABITAT	:	**Dr. Divya Subash Kumar**, Project Scientist
		Mr. S. N. Ahamed Ibrahim, Project Associate
GEOSPATIAL INFORMATION	:	**Dr. M. Mathan,** Project Scientist
WEB PORTAL	:	**Mr. K. Asan Basheer**, Project Associate
ADMINISTRATION TEAM	:	**Mr. D. Murali,** Superintendent
		Ms. H. Janani, Project Assistant
		Mr. S.T.Udhayachandran, Project Assistant

ACKNOWLEDGMENT

We sincerely acknowledge the support and encouragement by **Tmt. Supriya Sahu IAS**., Additional Chief Secretary to Government, Department of Environment, Climate Change and Forests, Government of Tamil Nadu, **Thiru. A.R. Rahul Nadh IAS**., Director, Department of Environment and Climate Change, Government of Tamil Nadu and **Thiru. Deepak Bilgi IFS**., Chief Mission Director, Tamil Nadu Coastal Restoration Mission, for the successful execution of the project "Operationalisation of Climate Studio" and in completion of the Climate Risk Assessment and Adaptation Plan for the key sectors of Tamil Nadu.

We extend our acknowledgment to the **Department of Water Resources, Government of Tamil Nadu**, for their support in nominating participants for the capacity building program. Additionally, we would like to thank all the participants who attended the program.

We humbly acknowledge **Prof. Dr. R. Velraj**, the Honourable Vice Chancellor, Anna University, **Prof.Dr. K.P. Jaya**, Head of the Department, Department of Civil Engineering, **Dr. K. Palanivelu**, Professor, CCCDM, **Dr. R. Saravanan**, Professor, CWR & adjunct faculty of CCCDM, Anna University, **Er. S. Raja**, Joint Chief Engineer (Retd.), WRD, **Dr. P. Radha Priya**, Climate Change Advisor, GIZ, New Delhi for their valuable inputs and expertise.

We sincerely thank other **Project Staff** and **Administrative Staff** of CCCDM for their continuous support towards the successful execution of the capacity building programme.

ABOUT THE PROGRAMME

The Capacity Building Program on Climate Risk Assessment and Adaptation Plan of Tamil Nadu - Water Resources was designed and implemented to enhance the capability of stakeholders to assess and manage climate-related risks to water resources effectively. This program was developed in response to the scientific assessment of the growing recognition of climate change's significant impacts on water availability and distribution, posing substantial challenges to water resource management.

Climate Studio at CCCDM

Embracing its commitment to the Nationally Determined Contribution (NDC), Tamil Nadu has emerged as a pioneer in developing adaptation strategies across sectors. Utilizing the acclaimed IPCC framework on "Climate Change Risk Assessment," the Government of Tamil Nadu has established the 'Climate Studio' at the Centre for Climate Change and Disaster Management (CCCDM), Department of Civil Engineering, Anna University. This state-of-the-art facility, funded with Rs. 3.89 crores, is equipped with high-performance computational resources and digital learning tools (financially supported by GIZ, Germany) to analyse global climate data at the cadastral level. The climate studio project includes a capacity development programme that has been allotted a sum of Rs. 27,00,000 lakhs for all six sectors. Among these sectors, three programme have been performed specifically for the water resources sector. The Climate Studio aims to provide updated high-resolution regional climate scenarios, assess climate change impacts on natural resources, develop multi-sectoral spatial information, and disseminate knowledge to stakeholders.

Program Components

Participants engaged in interactive lectures covering topics such as climate science, the status of water resources in Tamil Nadu, hydrological concepts and their modelling techniques, water risk assessment methodologies, and water adaptation planning strategies. Hands-on training sessions were conducted to familiarize participants with the hydrological model, such as the Soil and Water Assessment Tool (SWAT), and its applications for climate risk assessment and decision-making. IPCC AR6 projection scenarios, real-world case studies, and best practices from diverse geographical regions of Tamil Nadu with respect to river basin scale were presented to illustrate practical approaches to climate risk assessment and adaptation in water resources management. This program facilitates a networking forum and peer-learning opportunity for easy collaboration and knowledge exchange among the participants, experts, and practitioners in the field of water resources.

Training Module

The capacity building programme "Training Manual" on the topic of Climate Risk Assessment and Adaptation Plan of Tamil Nadu – Water Resources has been released by Tmt. Supriya Sahu IAS, Additional Chief Secretary to Government of Tamil Nadu, Dept. of Environment, Climate Change and Forest. Prof.Dr.R.Velraj, Vice Chancellor, Anna University; Dr.Nayanika Singh, UK PACT India Programme Adviser, British High Commission, New Delhi; Thiru. Deepak Bilgi IFS, Director of Environment and Climate Change, Government of Tamil Nadu; Dr. A. Ramachandran, Founder Director and Emeritus Professor, CCCDM; and Dr.Kurian Joseph, Professor and Director, CCCDM, were present. This training manual equips Water Resources Engineers (WRD) from the Tamil Nadu Public Works Department (PWD) with the skills to assess climate change impacts on river basins in Tamil Nadu.

Technical Sessions

Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster Management, Anna University, Chennai shared the knowledge on "Climate Risk and Resilience" where the concept of climate risk factors such as hazard, vulnerability, exposure and response was derived. On clear picture, the IPCC Assessment Report (AR6) and its findings on water resources based on the shared socio economic pathway (SSP) scenarios.

Dr. A. Ramachandran, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University ensured that the programme would instigate the real time methodology to assess the climate risks at river basins scale and how to enhance the adaptation strategies. He carried over the programme by the lecture on "An outlook of Climate Change Research in Tamil Nadu" with the

brief on IPCC reports and its inter-disciplinary approaches to manage the climate change impacts on global scale that fits in with the state of Tamil Nadu.

Dr. R. Saravanan, Professor, Centre for Water Resources, Anna University and Adjunct Faculty, CCCDM delivered the lecture on "Climate Change Adaptation plan on Water Resources". In which the connection between the hydrology and its impact due to climate change was deep down technically enhanced from the grass root level. The hydrological concepts and definitions for both the surface and sub-surface level of water resources were in brief from global to regional scales in terms of climate change.

Er. S. Raja, Joint Chief Engineer (Retd.), WRD forwarded the programme and emphasized the current status of water resources in Tamil Nadu, and in taking action towards enhancing the surface and groundwater potential which will improve the water resources management of Tamil Nadu. He briefed about the challenges faced by the department to manage the water and its resources by the existing projects and proposals. He also insisted about the future challenges and community collaboration in managing the water resources of Tamil Nadu.

Dr. P. Radha Priya, Climate Change Advisor, GIZ, New Delhi shared the field knowledge on "Climate Adaptation in Water Resources – WASCA Case Study". The perception of climate change and its impacts on water resources at ground level verification and implementation of resilient adaptation actions worked out at the field have been shown up as an evidence. The mini forest idea of afforestation as one of the climate adaptation action which is successful in Ramanathapuram district was picturized as the case study.

Dr. L. Balaji, Project Scientist and Dr. R. Malarvizhi, Project Associate, Water Sector, Centre for Climate Change and Disaster Management, Anna University, Chennai discoursed the lecture on "Climate Change Risk and Assessment on Tamil Nadu - Water Resources" regarding the framework done to derive the future climate risk on the 17 river basins of Tamil Nadu. In order to derive the existing water adaptation actions at the field, the appraisal session was conducted as the practical exercise to measure the gap of climate and water adaptation strategies.

Outcomes and Impacts

Knowledge dissemination is the primary outcome of this project where the training manual was released and distributed through this programme. The success of three capacity-building programmes that have covered all 38 districts of Tamil Nadu has helped to get insight into the climate change and river basin risk assessment. The 45 Water Resources Engineers (WRD) from the Tamil Nadu Public Works Department (PWD) attended three capacity building programs held on June 27-28, July 25-26, and August 8-9, 2023, divided into three batches.

The Key Outcomes of the Capacity Building Progamme are

- Understanding the fundamentals of climate change and climate change impact
- Conceptualizing vulnerability, hazard, exposure and risk
- Interactive exercise on hydrological model on climate risk assessment of Tamil Nadu River Basins

Stakeholders gained insights into the potential impacts of climate change on water resources. Also, it suggested that the future need for climate and water mitigation and adaptation actions to be addressed was documented through the evaluation survey form. Participants acquired enhanced technical skills and knowledge, empowering them to integrate climate risk considerations into long-term planning and decision-making processes, promoting sustainable water management practices.

Table of Contents

Report on the 1st Capacity Building Program
Climate Risk Assessment and Adaptation Plan of Tamil Nadu
June 27 & 28, 2023

The Centre for Climate Change and Disaster Management, Anna University with financial support by the Department of Environment and Climate Change, Government of Tamil Nadu has conducted two days Capacity Building Program on "Climate Risk Assessment and Adaptation Plan of Tamil Nadu" on June 27th & 28th 2023 to PWD Water Resources Engineers at Climate Studio, Conference Hall. The Water Resources Engineers (WRD) of Tamil Nadu Public Works Department (PWD) are the participants of the training programme.

Training Programme Proceedings

The inaugural function of the training programme on "Climate Risk Assessment and Adaptation Plan of Tamil Nadu" was on June 27th, 2023. Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster management, Anna University, Chennai inaugurated the capacity building programme and highlighted the importance of river basins and its climate risks. Also, welcomed the dignitaries and briefed about the training programme by edging through sustainable mind-set for effective action at field.

The two-days training programme had four technical sessions of 60 minutes duration each with lectures delivered by eminent speakers who are experts in the field, academicians and water sector officials. Followed by a practical training of more than three hours at the Climate Studio, Anna University.

Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster Management, Anna University welcomed the guests and participants for the valedictory session of two days capacity building programme. Thiru. Deepak S. Bilgi I.F.S., Director, Department of Environment and Climate Change, Government of Tamil Nadu, delivered the felicitation address and empowered this training programme as a benchmark action to connect the climate change science and the Water Resources Department to facilitate ground level scientific implementation.

Dr. A. Ramachandran, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University delivered the special address regarding the usefulness of this programme for the Water Resources department. Dr. P. Radha Priya, Climate Change Advisor, GIZ, New Delhi felicitated the Water Resources department and the CCCDM, Anna University for organising the training programme jointly with the Department of Environment and Climate Change for addressing the significant role of operationalization of climate studio to tackle climate change.

Dr. L. Balaji, Project Scientist, CCCDM thanked the members on the dais, the organisers, and the participants and wished the programme great success. Acknowledgement to all CCCDM Staff who completely accomplished their works to achieve this humongous task of the 1st capacity building programme.

Capacity Building Programme Photographs






UNDER

OPERATIONALIZATION OF CLIMATE STUDIO

27 and 28 June 2023

CAPACITY BUILDING PROGRAMME ON CLIMATE CHANGE RISK ASSESSMENT AND ADAPATION PLAN OF TAMIL NADU

WATER RESOURCES





Report on the 2nd Capacity Building Program
Climate Risk Assessment and Adaptation Plan of Tamil Nadu
July 25 & 26, 2023

The Centre for Climate Change and Disaster Management, Anna University with financial support by the Department of Environment and Climate Change, Government of Tamil Nadu has conducted two days Capacity Building Program on "Climate Risk Assessment and Adaptation Plan of Tamil Nadu" on July 25th & 26th 2023 to PWD Water Resources Engineers at Climate Studio, Conference Hall.

Training Programme Proceedings

The inaugural function of the training programme on "Climate Risk Assessment and Adaptation Plan of Tamil Nadu" was on July 25th, 2023. Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster management, Anna University, Chennai has inaugurated the capacity building programme and highlighted the importance of river basins and its climate risks. Also, welcomed the dignitaries and briefed about the training programme by edging through sustainable mind-set for effective action at field.

The two-days training programme had five technical sessions of 60 minutes duration each with lectures delivered by eminent speakers who are experts in the field, academicians and water sector officials. Followed by a practical training of more than three hours at the laboratory, Climate Studio.

Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster Management, Anna University welcomed the guests and participants for the valedictory session of two days capacity building programme. Dr. K. Gunasekaran, Director, Planning and Development, Anna University has presided over the programme by welcoming the chief guest and participants as the representative of this programme. Thiru. Manish Meena I.F.S., Assistant Mission Director, Tamil Nadu Climate Change Mission, Department of Environment and Climate Change, Government of Tamil Nadu, delivered the valedictory address and empowered this training programme as role and action to connect the climate change science and the Water Resources Department to facilitate ground level scientific implementation.

Dr. A. Ramachandran, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University delivered the special address regarding the usefulness of this programme for the Water Resources department. In addition, applauses the CCCDM for organising the training programme jointly with the Department of Environment and Climate Change for addressing the significant role of operationalization of climate studio to tackle climate change. Dr. K. Palanivelu, Professor, Centre for Climate Change and Disaster Management, Anna University thanked the members on the dais, the organisers, and the participants and wished the programme great success.

Capacity Building Programme Photographs

Report on the 3rd Capacity Building Program
Climate Risk Assessment and Adaptation Plan of Tamil Nadu
August 8 & 9, 2023

The Centre for Climate Change and Disaster Management, Anna University with financial support by the Department of Environment and Climate Change, Government of Tamil Nadu has conducted two days Capacity Building Program on "Climate Risk Assessment and Adaptation Plan of Tamil Nadu" on August 8th & 9th 2023 to PWD Water Resources Engineers at Climate Studio, Conference Hall.

Training Programme Proceedings

The inaugural function of the training programme on "Climate Risk Assessment and Adaptation Plan of Tamil Nadu" was on August 8th, 2023. Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster management, Anna University, Chennai has inaugurated the capacity building programme and highlighted the importance of river basins and its climate risks. Also, welcomed the dignitaries and briefed about the training programme by edging through sustainable mind-set for effective action at field.

The two-days training programme had five technical sessions of 60 minutes duration each with lectures delivered by eminent speakers who are experts in the field, academicians and water sector officials. Followed by a practical training of more than three hours at the laboratory, Climate Studio, Anna University, Chennai.

Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster Management, Anna University welcomed the guests and participants for the valedictory session of two days capacity building programme. Dr. A. Ramachandran, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University has presided over the programme by welcoming the chief guest and participants as the representative of this programme. Er. K. Prabakar, Special Chief Engineer, WRD, Tamil Nadu Integrated Agriculture Modernisation Project (TNIAMP), Chennai delivered the valedictory address and empowered this training programme as role and action to connect the climate change science and the Water Resources Department to facilitate ground level scientific implementation. Dr. K. Palanivelu, Professor, Centre for Climate Change and Disaster Management, Anna University delivered the special address regarding the usefulness of this programme for the Water Resources department. In addition, applauses the CCCDM for organising the training programme jointly with the Department of Environment and Climate Change for addressing the significant role of operationalization of climate studio to tackle climate change.

Dr. L. Balaji, Project Scientist, CCCDM thanked the members on the dais, the organisers, and the participants and wished the programme great success.

Capacity Building Programme Photographs

CAPACITY BUILDING PROGRAMME ON CLIMATE CHANGE RISK ASSESSMENT AND ADAPATION PLAN OF TAMIL NADU

WATER RESOURCES

UNDER

OPERATIONALIZATION OF CLIMATE STUDIO

8 and 9 August 2023

Summary of the Capacity Building Programme (CBP)

A three capacity-building programme trained 45 water resource engineers from Tamil Nadu's Public Works Department on climate change and river basin risk assessment. This training covered all 38 districts of the state. The programme was held in three batches on June 27-28, July 25-26, and August 8-9, 2023.

This kind of program is the first of its origin in Tamil Nadu and has enlightened the participants (Water Resources Department Engineers) as an eye-opener for framing the policy, and future projections of the river basins with respect to flood and drought assessment will be considered as the base material for decision supported policymakers.

The program helped stakeholders understand how climate change might affect water resources in the future. An evaluation survey showed the importance of future actions to reduce climate change's impact and adapt to it. Participants gained valuable technical skills, allowing them to consider climate risks in long-term planning and water management decisions, leading to more sustainable practices.

The officials from the WRD department have suggested future adaptation actions at the sub-basin level based on the existing problems through a capacity-building programme. Some of the proposed actions are listed below.

- Restore tanks, interlink rivers, and construct check dams to enhance water storage and distribution efficiency
- Implement climate change adaptation training for farmers and engineers
- Promote mixed crop patterns, capacity building, and regulate water usage to mitigate drought
- Strengthen river banks, desilt channels, and rehabilitate existing water structures
- Enhance data acquisition for climatic data and prioritize groundwater recharge projects
- Regulate bore well digging and limit domestic and commercial bore well usage
- Divert floodwater from surplus basins to deficient ones and manage water flow to prevent overexploitation
- Conduct a comprehensive survey of water resources to prevent water flow to other states
- Encourage tree plantation, remove invasive species, and conduct awareness programs for groundwater recharge
- Establish water usage associations and enforce strict measures against encroachment.
- Introduce more rain gauges and measuring gauging stations for accurate monitoring.

- Rehabilitate and improve existing water structures, increasing their capacity
- Integrate interdisciplinary departmental activities for basin improvement
- Avoid single-crop cultivation in drought-prone areas and encourage crop alteration
- Provide financial support and encourage farmers' cooperation in effective water utilization
- Create awareness among the public about future climate scenarios and adaptation measures
- Monitor rainfall and weather patterns through frequent installations and external agencies
- Link rivers strategically to ensure efficient distribution of floodwaters
- Initiate large-scale irrigation infrastructure revamping and propose new dam constructions
- Incorporate climate change considerations into future project formulations
- Design sub-basin structures considering climate change impacts on discharge
- Ensure structural adequacy of water infrastructure based on future flood forecasts
- Map recharge structures in drought-prone areas for effective water management
- Encourage community involvement in water resource management through open-access initiatives
- Strengthen regulatory measures for micro-level hydrological structures
- Foster cooperation among stakeholders for sustainable water management practices

ANNEXURE - I

CAPACITY BUILDING PROGRAMME

CLIMATE CHANGE RISK ASSESSMENT AND ADAPTATION PLAN TAMIL NADU - WATER RESOURCES

Organised by Centre for Climate Change and Disaster Management (CCCDM), Anna University and funded by the Department of Environment and Climate Change, Government of Tamil Nadu

Agenda

Day 1 (June 27, 2023)	
INAUGURAL SESSION	
9:30 – 9.45 A.M	**REGISTRATION**
9.45 – 10:00 A.M	**Welcome Address** **Prof. Dr. Kurian Joseph** Director, CCCDM, Anna University, Chennai
10:00 – 11:00 A.M	**An Outlook of Climate Change Research in Tamil Nadu** **Prof. Dr. A. Ramachandran D.Sc.** Emeritus Professor, CCCDM, Anna University, Chennai
11:00 – 11:15 A.M	**TEA BREAK**
TECHNICAL SESSIONS	
SESSION – I: Status of Water Resources in Tamil Nadu	
11:15 – 12:15 P.M	**Er. S. Raja** Joint Chief Engineer (Retd.), WRD
SESSION – II: Climate Risk and Resilience	
12:15 – 1:15 P.M	**Dr. Kurian Joseph** Director, CCCDM, Anna University, Chennai
1:15 – 2:15 P.M	**LUNCH**
SESSION – III: Climate Change Risk Assessment on Water Resources	
2:15 – 3:00 P.M	**Dr. L. Balaji** Project Scientist-Water Resources, CCCDM, Anna University, Chennai
SESSION – IV: Demonstration of Hydrological Modelling	
3.00 – 3.45 P.M	**Dr. L. Balaji & Dr. R. Malarvizhi** Water Resources Team, CCCDM, Anna University, Chennai
3:45 – 4.00 P.M	**TEA BREAK**
SESSION – V: Demonstration of Hydrological Modelling	
4.00 – 5.00 P.M	**Dr. L. Balaji & Dr. R. Malarvizhi** Water Resources Team, CCCDM, Anna University, Chennai

CAPACITY BUILDING PROGRAMME

CLIMATE CHANGE RISK ASSESSMENT AND ADAPTATION PLAN TAMIL NADU - WATER RESOURCES

Organised by Centre for Climate Change and Disaster Management (CCCDM), Anna University and funded by the Department of Environment and Climate Change, Government of Tamil Nadu

Day 2 (June 28, 2023)	
SESSION – I: Hands-on Training at Climate Studio	
9:30 – 11:00 A.M	**Dr. L. Balaji** Project Scientist-Water Resources, **&** **Dr. R. Malarvizhi** Project Associate-Water Resources, CCCDM, Anna University, Chennai
11:00 – 11:15 A.M	**TEA BREAK**
SESSION – II: Hands-on Training at Climate Studio	
11:15 – 1:15 P.M	**Dr. L. Balaji** Project Scientist-Water Resources, **&** **Dr. R. Malarvizhi** Project Associate-Water Resources, CCCDM, Anna University, Chennai
1:15 – 2.15 P.M	**LUNCH**
SESSION – III: Climate Adaptation in Water Resources – WASCA Case Study	
2:15 – 3.15 P.M	**Dr. P. Radha Priya** Climate Change Advisor, WASCA, GIZ, New Delhi
SESSION – IV: Group Discussion on Adaptation Strategies	
3:15 – 4.00 P.M	**Participants Feedback on Ongoing and Proposed Adaptation Actions**
4.00 – 4.15 P.M	**TEA BREAK**
VALEDICTORY SESSION & CERTIFICATE PRESENTATION: 4.15 - 5.00 P.M	

Office of the Engineer-in-Chief,
and Chief Engineer (GI), WRD, Chepauk, Chennai – 600 005.

Present:

Er. A. Muthaiya, B.E.,
Engineer-in-Chief, and Chief Engineer (General), WRD
Chepauk, Chennai – 600 005.

Proceeding No. AEE / T1 / AE- 2 / 48930 / 2014, dated. 23.06.2023

Sir,

Sub : Centre for Climate Change and Disaster Management – Climate Studio – Capacity Building Programme – 27th & 28th June, 2023 – Nominations of Engineers – Communicated – regarding.

Ref :
1. Director, Department of Environment and Climate Change, Chennai, letter no: P4/1829/2019/DoE&CC/2022, dated: 17.05.2023.
2. This office letter no: AEE / T1 / AE-2 / 48930 / 2023, Dated: 22.05.2023.
3. Director, Centre for Climate Change and Disaster Management, Anna University, Chennai, letter no: CCCDM/CS/Capacity Building/Water/2023 Dated: 15.06.2023.
4. This office letter no: AEE / T1 / AE-2 / 48930 / 2014, dated: 19.06.2023.

****

In continuation to this office letter 4th cited, the revised list of Engineers (list enclosed) nominated to attend the **"Capacity Building Programme on Climate Change Risk Assessment and Adaptation Plan – Tamil Nadu – Water Resources"** scheduled on **27th & 28th June 2023** at the Centre for Climate Change and Disaster Management, CEG Campus, Anna Universtiy, Guindy, Chennai is enclosed herewith for reference.

Enclosure: Revised List of Engineers

23/6/23

for **Engineer-in-Chief, &**
Chief Engineer (GI), WRD,
Chepauk, Chennai- 5

23/06/23

To: The Director, Centre for Climate Change and Disaster Management, Anna University, Guindy, Chennai – 25.

Copy to:

1. The Individual listed in the above table (through e mail).
2. **The Director**, Department of Environment and Climate Change, Ground Floor, Panagal Maligai, Saidapet, Chennai – 15.
3. **The Chief Engineer, WRD, Chennai Region**, Chennai -05 for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
4. **The Chief Engineer, WRD, State Ground and Surface Water Resources Data Centre**, Tharamani, Chennai – 600 113 for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
5. **The Chief Engineer, WRD, Coimbatore Region**, Coimbatore – 641 001 for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
6. **The Chief Engineer, WRD, Madurai Region**, Madurai for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
7. **The Chief Engineer, WRD, Trichy Region**, Trichy for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.

"Capacity Building Programme on Climate Change Risk Assessment and Adaptation Plan - Tamil Nadu - Water Resources"

List of Engineers

S. No	Name of the District	Name & Designation	Office Address	Phone Number & Email Id
1	Ariyalur	Er. C. Senthilkumar, Assistant Eexcutive Engineer, WRD	O/o the Assistant Executive Engineer, WRD, Mardaiyaru Basin Division, Ariyalur	9443137392 eemarudaiyaru@yahoo.com
2	Chengalpattu	Er. R. Rajathilak, Assistant Engineer, WRD	Irrigation section, Acharapakkam, O/o the Executive Engineer, WRD, Lower Palar Basin Division, Kancheepuram.	9003430542 aewrdcharpakkam603301@gmail.com
3	Chennai	Er. G. Brindha Sangeetha, Assistant Eexcutive Engineer, WRD	O/o the Executive Engineer, WRD, Gauging Division, Tharamani, Chennai.	9442025700 cegwchennai@gmail.com
4	Coimbatore	Er. D. Dinesh Anand, Assistant Engineer, WRD	Irrigation Section, Negamam.	8148742802 eeabdivision@yahoo.com
5	Cuddalore	Er. V. Gowthaman, Assistant Engineer, WRD	Irrigation Section, Bhuvanagiri, O/o the Executive Engineer, WRD, Coleroon Basin Division, Chidambaram.	8122110626 gowthamcs86@gmail.com
6	Dharmapuri	Er. M. Mohanapriya, Assistant Engineer, WRD	Nagavathy section, O/o the Executive Engineer, WRD, Upper Pennaiyar Basin Division, Dharmapuri.	9486686088 priyaaepwd@gmail.com
7	Dindigul	Er. E. Balu, Assistant Engineer, WRD	O/o the Assistant Executive Engineeer, WRD, Nanganjiyar Project Sub Division, Palani.	9500516510 baluaepwd@gmail.com
8	Erode	Er. S. Thinakaran, Assistant Engineer, WRD	Irrigation Section, Kalingarayanpalayam, O/o the Executive Engineer, WRD, Lower Bhavani Basin Division, Erode.	9894761764 eelbperode@gmail.com
9	Kancheepuram	Er. N. Pugazhendhi, Assistant Engineer, WRD	Tank Restoration Scheme, Section-1, O/o the Executive Engineer, WRD, Lower Palar Basin Division, Kancheepuram.	8344534372 trssubdivisionkpm@gmail.com

S. No	Name of the District	Name & Designation	Office Address	Phone Number & Email Id
10	Karur	Er. N. Subbaiyan, Assistant Engineer, WRD	Uppar Dam Section-1, O/o the Assistant Executive Engineer, WRD, Amaravathi Basin Sub Division-1, Koneripatty.	8610055853 eeamaravathi@gmail.com
11	Madurai	Er. K. Hariharasudhan, Assistant Engineer, WRD	Section-2, Thaniyamangalam, O/o the Executive Engineer, WRD, Periyar Main Canal Division, Melur.	9159154090 eepmcmelur@gmail.com
12	Mayiladuthurai	Er. K. Manoharan, Assistant Executive Engineer, WRD	O/o the Executive Engineer, WRD, Cauvery Basin Division (East), Mayiladuthurai.	9443585121 eewrocbdmyla@
13	Namakkal	Er. M. Yuvaraj, Assistant Engineer, WRD	O/o the Assistant Executive Engineer, WRD, Sarabanga Basin Division, Namakkal	9751751541 eesarankl@gmail.com
14	Salem	Er. V. Rajenthiran, Deputy Superintending Engineer, WRD	O/o the Superintending Engineer, Upper Cauvery Basin Circle, Salem	9442621721 uppercauvery@gmail.com
15	Sivagangai	Er. B. Dinesh Babu, Assistant Engineer, WRD	O/o the Executive Engineer, WRD, Ground Water Disivion, Karaikudi.	8428530307

23/6/23.

for **Engineer-in-Chief &**
Chief Engineer (General), WRD,
Chepauk, Chennai-05.

23/06/23

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT
"Operationalization of Climate Studio"
Funded by Department of Environment and Climate Change, Government of Tamil Nadu
27th & 28th June 2023
on
CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT ADAPTATION PLAN OF TAMIL NADU-WATER RESOURCES
REGISTRATION FORM

S.No	Name	Designation	Basin, District	Phone number	Email id	Signature
1	**Er. M.Yuvaraj**	Assistant Engineer	Cauvery Basin, Namakkal.	9751751541	yuvaraj159@gmail.com	27/06/23
2	**Er. G. Parthiban,**	Assistant Engineer				
3	**Er. V.Rajenthiran**	Deputy Superintending Engineer	Cauvery Basin Salem	9442621721	rajenthiran1969@gmail.com	
4	**Er. K.Manoharan**	Assistant Executive Engineer	Cauvery basin Mayiladuthurai	9443586121	kman1970@gmail.com	
5	**Er. M.Mohanapriya**	Assistant Engineer	Upper Penaiyar Basin, Dharmapuri	9486686088	priyaaepwd@gmail.com	27/6/23
6	**Er. N.Subbaiyan**	Junior Engineer	Amaravathi Basin Tiruppur.	94861-61745	Subbaiyan.pwd@gmail.com	
7	**Er. D.Dinesh Anand**	Assistant Engineer	Aliyar Basin, Coimbatore	8148742802	eeabdivision@yahoo.com aenegaman@gmail.com	27/6/23
8	**Er. N.Pugazhendhi**	Assistant Engineer	Lower Palar Basin, Kanchipuram	8344534372	trsaes1kpm@gmail.com	27/06/23
9	**Er. B.Dinesh Babu**	Assistant Engineer	Lower Vaigai Basin Ramanathapuram	8220598920	dinesh141737@gmail.com	
10	**R. Ramesh kumar,**	Assistant Engineer	Thamirabarani Basin Tirunelveli	9750882661	eetbdnit@gmail.com	27/06/23
11	**T.Dhinakaran**	Assistant Engineer	Manudaiyaru basin Ariyalur	9790456633	Sakthikaran82@gmail	27/06/23

CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU-WATER RESOURCES

REGISTRATION FORM

S.No	Name	Designation	Basin, District	Phone number	Email id	Signature
12	Er. E. Balu	Assistant Engineer	Lower Bhavani Basin Division, Erode	9500516510	baluaepwd@gmail.com	
13	Er. P. Srilekha.	Asst. Engineer	Cauvery Sewaging Division, Tharamani, Ch-113	7010858718	srilekhaaes@gmail.com	
14						
15						

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT
"Operationalization of Climate Studio"
Funded by Department of Environment and Climate Change, Government of Tamil Nadu
27th & 28th June 2023
on

CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU - WATER RESOURCES

ATTENDANCE SHEET

S.No	Name	Designation	27/06/2023		28/06/2023	
			FN	AN	FN	AN
1	**Er. M.Yuvaraj**	Assistant Engineer				
2	**Er. V.Rajenthiran**	Deputy Superintending Engineer				
3	**Er. K.Manoharan**	Assistant Executive Engineer				
4	**Er. M.Mohanapriya**	Assistant Engineer	27/6/23 FN	27/6/23 AN	28/6/23 FN	28/6/23 AN
5	**Er. N.Subbaiyan**	Junior Engineer	27/6/23	27/6/23	28/6/23	28/6/23
6	**Er. D.Dinesh Anand**	Assistant Engineer	27/6/23	27/6/23	28/6/23	28/6/23 AN
7	**Er. N.Pugazhendhi**	Assistant Engineer				
8	**Er. P.Dinesh Babu**	Assistant Engineer				
9	**Er. R. Ramesh kumar,**	Assistant Engineer				
10	**Er. T.Dhinakaran**	Assistant Engineer	27/6/23	27/6/23	28/6/23	28/6/23

CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU-WATER RESOURCES

ATTENDANCE SHEET

S.No	Name	Designation	27/06/2023		28/06/2023	
			FN	AN	FN	AN
11	Er.E.Balu	Assistant Engineer				
12	Er.P.Srilekha	Assistant Engineer				

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Trainers	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

1. I learned awarness of climate change in tamilnadu.

~~I Executed~~ I will be execution of works with new dimension of climate change and disaseter mangement. after attended this training.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Trainers	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

This training programme is very useful for Implementation of new projects and implementation.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent)	✓ 2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	✓ 1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent)	✓ 2 (Good)	3 (Fair)	4 (Not Satisfactory)
Trainers	1 (Excellent)	✓ 2 (Good)	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent)	✓ 2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent)	✓ 2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

This trainning is very useful to know about climatic change in next upcoming years and how to handle the situations & actions taken Policies. and got an greater idea in Future vision in change in climate

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT
"Operationalization of Climate Studio"
Funded by Department of Environment and Climate Change, Government of Tamil Nadu
27th &28th June 2023
On
CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
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Trainers	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

I personaly thanks. Giving this opertunity.
I improve and occuur knowledge in climate change.
I future course duration increase. for one weak.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
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Trainers	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

This training was very useful.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
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Trainers	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Excellent

It is a good opportunity for us to know about climate change.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
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Presentations	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

1.) Training and Capacity Building provided an opportunity to develop awareness on Climate change and its Risk assessment.

2) We will be helpful to provide awareness Stakeholders (farmers) so that it provide holistic approach for the development.

3) Introduction to Sustainable Development goal and its significance is well learnt in this training programme.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT
"Operationalization of Climate Studio"
Funded by Department of Environment and Climate Change, Government of Tamil Nadu
27th &28th June 2023
On
CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
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Trainers	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

* This trainining gives me a detailed understanding about climatic changes and future predictions about the change in climatic condition and to prevent/reduce the effect.
* Accomodation may be provided.
* Since QGIS is a large software, it is hard for me to understand, bcoz there is no idea about the databas which are previously prepared.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
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Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Training has conducted with Excelent trainers.

The Trainers has clearede each doubts.

Lab time is not enouth.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Trainers	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

- Training aspects are excellent and useful to know about climate case study
- know about toolsused by projectassociates practically
- Excellent presentation by Prof. Dr. Ramachandran sir & Dr. Kumar Josephsir, friendly approach.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Trainers	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	~~2 (Good)~~	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

frequently arrange workshop on climate change with all line departments (WRD, Agriculture, Forest, farmers, Agri Engg., Rural development etc)

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

27th &28th June 2023

On

CAPACITY BUILDING PROGRAM ON CLIMATE RSIK ASSESSMENT AND ADAPTATION PLAN OF TAMILNADU - WATER RESOURCES

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Trainers	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Prof. Dr. Ramachandran class is nice. I want him to take more classes.

Dr. Balaji Presentation was nice.

CAPACITY BUILDING PROGRAMME
CLIMATE CHANGE RISK ASSESSMENT AND ADAPTATION PLAN
TAMIL NADU - WATER RESOURCES

Organised by Centre for Climate Change and Disaster Management (CCCDM), Anna University and funded by the Department of Environment and Climate Change, Government of Tamil Nadu

Agenda

Day 1 (July 25, 2023)	
INAUGURAL SESSION	
9:30 – 9.45 A.M	**REGISTRATION**
9.45 – 10:00 A.M	**Welcome Address** **Prof. Dr. Kurian Joseph** Director, CCCDM, Anna University, Chennai
10:00 – 11:00 A.M	**An Outlook of Climate Change Research in Tamil Nadu** **Prof. Dr. A. Ramachandran D.Sc.** Emeritus Professor, CCCDM, Anna University, Chennai
11:00 – 11:15 A.M	**TEA BREAK**
TECHNICAL SESSIONS	
SESSION – I: Status of Water Resources in Tamil Nadu	
11:15 – 12:15 P.M	**Er. S. Raja** Joint Chief Engineer (Retd.), WRD
SESSION – II: Climate Risk and Resilience	
12:15 – 1:15 P.M	**Dr. Kurian Joseph** Director, CCCDM, Anna University, Chennai
1:15 – 2:15 P.M	**LUNCH**
SESSION – III: Demonstration of Hydrological Modelling	
2:15 – 3:45 P.M	**Dr. L. Balaji & Dr. R. Malarvizhi** Water Resources Team, CCCDM, Anna University, Chennai
3:45 – 4.00 P.M	**TEA BREAK**
SESSION – IV: Demonstration of Hydrological Modelling	
4.00 – 5.00 P.M	**Dr. L. Balaji & Dr. R. Malarvizhi** Water Resources Team, CCCDM, Anna University, Chennai

CAPACITY BUILDING PROGRAMME
CLIMATE CHANGE RISK ASSESSMENT AND ADAPTATION PLAN
TAMIL NADU - WATER RESOURCES

Organised by Centre for Climate Change and Disaster Management (CCCDM), Anna University and funded by the Department of Environment and Climate Change, Government of Tamil Nadu

Agenda

Day 2 (July 26, 2023)	
SESSION – V: Climate Change Risk Assessment on Water Resources	
9:30 – 11:00 A.M	**Dr. L. Balaji** Project Scientist-Water Resources, **&** **Dr. R. Malarvizhi** Project Associate-Water Resources, CCCDM, Anna University, Chennai
11:00 – 11:15 A.M	**TEA BREAK**
SESSION – VI: Interactive Portal - Hands-on Training at Climate Studio	
11:15 – 1:15 P.M	**Dr. L. Balaji** Project Scientist-Water Resources, **&** **Dr. R. Malarvizhi** Project Associate-Water Resources, CCCDM, Anna University, Chennai
1:15 – 2.15 P.M	**LUNCH**
SESSION – VII: Climate Change Adaptation Plan for Water Resources	
2:15 – 3.15 P.M	**Dr. R. Saravanan** Professor, Centre for Water Resources, Anna University
SESSION – VIII: Climate Adaptation in Water Resources – WASCA Case Study	
3:15 – 4.00 P.M	**Dr. P. Radha Priya** Climate Change Advisor, WASCA, GIZ, New Delhi
4.00 – 4.15 P.M	**TEA BREAK**
VALEDICTORY SESSION & CERTIFICATE PRESENTATION: 4.15 - 5.00 P.M	

Office of the Engineer-in-Chief,
and Chief Engineer (GI), WRD, Chepauk, Chennai – 600 005.

Present:

Er. A. Muthaiya, B.E.,
Engineer-in-Chief, and Chief Engineer (General), WRD
Chepauk, Chennai – 600 005.

Proceeding No. AEE / T1 / AE- 2 / 48930 / 2014, dated. 21.07.2023

Sir,

Sub : Centre for Climate Change and Disaster Management – Climate Studio – Capacity Building Programme – 2nd batch – Nomination of Engineers – regarding.

Ref :
1. This office letter no: AEE / T1 / AE-2 / 48930 / 2023, Dated: 22.05.2023.
2. Director, Centre for Climate Change and Disaster Management, Anna University, Chennai, letter no: CCCDM/CS/Capacity Building/Water/2023 Dated: 12.07.2023.
3. Director, Centre for Climate Change and Disaster Management, Anna University, Chennai, letter no: CCCDM/CS/Capacity Building/Water/2023 Dated: 20.07.2023.

****

With reference to the letter vide reference cited, the revised list of Engineers (list enclosed) are nominated to attend the second batch of **"Capacity Building Programme on Climate Change Risk Assessment and Adaptation Plan"** scheduled on **25th & 26th July 2023** at the Centre for Climate Change and Disaster Management, CEG Campus, Anna Universtiy, Guindy, Chennai. The participants are informed to be present at the premises of the above venue at **09.30 am** on the first day of the training (i.e on 25.07.2023).

The period of absence during the above said period shall be treated as on official duty as per FR 9(6) b (i) and the participating officials are eligible to draw Travelling Allowance and Dearness Allowance in connection with the said training at the rate admissible as per rules in force.

Enclosure: Revised List of Engineers

for **Engineer-in-Chief, &**
Chief Engineer (GI), WRD,
Chepauk, Chennai- 5

21/07/23

To: The Director, Centre for Climate Change and Disaster Management, Anna University, Guindy, Chennai – 25.

Copy to:

1. The Individual listed in the above table (through e mail).
2. **The Director**, Department of Environment and Climate Change, Ground Floor, Panagal Maligai, Saidapet, Chennai – 15.
3. **The Chief Engineer, WRD, Chennai Region**, Chennai -05 for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
4. **The Chief Engineer, WRD, State Ground and Surface Water Resources Data Centre**, Tharamani, Chennai – 600 113 for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
5. **The Chief Engineer, WRD, Coimbatore Region**, Coimbatore – 641 001 for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
6. **The Chief Engineer, WRD, Madurai Region**, Madurai for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
7. **The Chief Engineer, WRD, Trichy Region**, Trichy for reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.

"Capacity Building Programme on Climate Change Risk Assessment and Adaptation Plan"

List of Engineers

S. No	Name & Designation	Office Address	Phone Number & Email Id
1	Er. J. Karthikeyan., Assistant Executive Engineer, WRD	O/o the Executive Engineer, WRD, Project management Unit, Thanjavur.	9443694235 eepmutnj@gmail.com
2	Er. B. H. Fazithkhan, Assistant Engineer, WRD	Theni Section, O/o the Executive Engineer, WRD, Manjalar Basin Division, Periyakulam.	9655223786 eemanjalar@gmail.com
3	Er. K. Kannan, Assistant Engineer, WRD	Irrigation Section, Lakshmipuram Anicut, Kaverapettai, O/o the Executive Engineer, WRD, Araniyar Basin Division, Chennai.	9962064062 aeewrdponneri@gmail.com
4	Er. D. Ananth, Assistant Engineer, WRD	Irrigation Section, Kovilpatti, O/o the Executive Engineer, WRD, Korampallam Aru Basin Division, Thoothukudi.	9443508933 eepwdwrotuticorinitcell@gmail.com
5	Er. G. Kannadasan, Assistant Engineer, WRD	O/o the Executive Engineer, WRD, Project Management Unit, Trichy.	9159192855 eepmuadb@gmail.com
6	Er. A. Priyadharshini, Assistant Engineer, WRD	Irrigation Section, Pethappampatti.	8838543038 eewroudt@gmail.com
7	Er. K. Madhusoothanan, Assistant Engineer, WRD	Sathanur Dam Section, Tiruvannamalai	9486440521 eepwdwrotvm@gmail.com
8	Er. J. Dhivya, Assistant Engineer, WRD	Irrigation Section Udhagamandalm, Nilgiris.	9842052704 eewrobsr@gmail.com
9	Er. G. Parthiban, Assistant Engineer, WRD	Irrigation Section, Khan Sahib Canal, Cuddalore	9786540644 guruparthiban@gmail.com
10	Er. K. Hariharasudhan, Assistant Engineer, WRD	Section-2, Thaniyamangalam, O/o the Executive Engineer, WRD, Periyar Main Canal Division, Melur.	9159154090 eepmcmelur@gmail.com
11	Er. M. Malini Preetha, Assistant Engineer, WRD	O/o the Assistant Executive Engineer, WRD, Environmental Cell Sub Division-1, Tharamani, Chennai	9445331685 mmalinipreetha@gmail.com
12	Er. R. Vinod Kumar, Assistant Engineer, WRD	O/o the Assistant Executive Engineer, WRD, Environmental Cell Sub Division-2, Tharamani, Chennai	9790829022 vinodcivil92@gmail.com

S. No	Name & Designation	Office Address	Phone Number & Email Id
13	Er. M. Dhanasekarapandian, Assistant Engineer, WRD	O/o the Assistant Executive Engineer, WRD, Environmental Cell Sub Division, Madurai	9486663680 dhanasekarapandian@rediffmail.com
14	Er. G. Brindha Sangeetha, Assistant Executive Engineer, WRD	O/o the Executive Engineer, WRD, Gauging Division, Tharamani, Chennai.	9442025700
15	Er. R. Thilagam, Assistant Engineer, WRD	O/o the Executive Engineer, WRD, Ground Water Division, Chennai	9952617666
16	Er. T. Karthikeyan, Assistant Engineer, WRD	O/o the Executive Engineer, WRD, Ground Water Division, Madurai.	9486153081

for Engineer-in-Chief &
Chief Engineer (General), WRD,
Chepauk, Chennai-05.

21/07/23

Office of the Engineer-in-Chief,
and Chief Engineer (GI), WRD, Chepauk, Chennai – 600 005.

Present:

Er. A. Muthaiya, B.E.,
Engineer-in-Chief, and Chief Engineer (General), WRD
Chepauk, Chennai – 600 005.

Proceeding No. AEE / T1 / AE- 2 / 48930 / 2014, dated. 21.07.2023

Sir,

Sub : Centre for Climate Change and Disaster Management – Climate Studio – Capacity Building Programme – 2nd batch – Nomination of Engineers – regarding.

Ref : This office letter no: AEE / T1 / AE-2 / 48930 / 2014, Dated: 21.07.2023.

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In continuation to this office letter vide reference cited, the following two Engineers are nominated to attend the second batch of **"Capacity Building Programme on Climate Change Risk Assessment and Adaptation Plan"** scheduled on **25th & 26th July 2023** at the Centre for Climate Change and Disaster Management, CEG Campus, Anna Universtiy, Guindy, Chennai. The participants are informed to be present at the premises of the above venue at **09.30 am** on the first day of the training (i.e on 25.07.2023).

Sl. No	Name & Designation	Office Address	Phone number & Email.id
1.	**Er. G. Thiruvalluvan,** Assistant Executive Engineer, WRD	O/o the Executive Engineer, WRD, Agniar Basin Division, Pattukottai.	9442629925 agniarbasindivision @yahoo.com
2.	**Er. P. Parthiban,** Assistant Executive Engineer, WRD	O/o the Executive Engineer, WRD, Special Project Division-III, Thiruthuraipoondi.	9443352324 eespdtnj@gmail.com

21/7/23.

for **Engineer-in-Chief &**
Chief Engineer (General), WRD
Chepauk, Chennai.

21/07/23

To: The Director, Centre for Climate Change and Disaster Management, Anna University, Guindy, Chennai – 25.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT

"Operationalization of Climate Studio"

Funded by Department of Environment and Climate Change, Government of Tamil Nadu

25th & 26th July 2023

on

CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU- WATER RESOURCES

REGISTRATION FORM

S.No	Name	Designation	Office Address	Phone number	Email id	Signature
1	**Er. J. Karthikeyan**	Assistant Executive Engineer	Project Management Unit Thanjavur	9443694255	eepipmuctnj@gmail.com	
2	**Er. B. H. Fazith Khan**	Assistant Engineer	Irrigation Section, Theni Manjalar Basin division, Periyakulam	9655223786	fazith91@gmail.com	
3	**Er. K. Kannan**	Assistant Engineer				
4	**Er. D. Ananth**	Assistant Engineer	Irrigation Section Kovilpatti	9443508933	ananthaepwd@gmail.com	
5	**Er. G. Kannadasan**	Assistant Engineer	Project Management Unit WRD Trichy – 620 020	9159192855	kannadasan69@gmail.com	
6	**Er. A. Priyadharshini**	Assistant Engineer	Irrigation Section Pethampatti	9445425493	Priyaanbu27@gmail.com	
7	**Er. K. Madhusoothanan**	Assistant Engineer	o/o Executive Engineer, WRD., Middle Pennaiyar Basin Division, Thiruvannamalai	9486440521	Madhucivilengg@gmail.com	25/7/23
8	**Er. J. Dhivya** J. DIVYA	Assistant Engineer	Assistant Executive Engineer, WRD, Irrigation Sub Division, Udhagamandalam	9884333222	aewrdooty@gmail.com	25/7/2023
9	**Er. G. Parthiban**	Assistant Engineer	Khansahib canal Section, Lower Anicut sub Division, Coleroon Basin Division, Chidambaram.	9786540644	guruparthiban@gmail.com	
10	**Er. K. Hariharasudhan**	Assistant Engineer				
11	**Er. Ziona Amalraj**	Assistant Engineer	o/o the Executive Engineer, WRD, Environmental Cell Division, Tharamani	7358200440	zionaamalraj@gmail.com	

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CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU-WATER RESOURCES

REGISTRATION FORM

S.No	Name	Designation	Office Address	Phone number	Email id	Signature
12	**Er. R. Vinod Kumar**	Assistant Engineer	O/o AEE, WRD, Environment cell Division, Thiyagarayanagar, Chennai	9790829022	vinodcivil92@gmail.com	
13	**Er. M. Dhanasekarapandiyan**	Assistant Engineer	O/o. AEE, WRD, EC sub division, Tirunelveli	9486663680	dhanaseleara Pandian@rediffmail.com	
14	**Er. R. Thilagam**	Assistant Engineer	O/o EE WRD Groundwater Divn Chennai	9952617666	Thilagam79vkumar@gmail.com	
15	**Er. G. Thiruvalluvan**	Assistant Executive Engineer	Irrigation Sub Division. Agniyar Basin Division. Poompuhar.	9442629925	thiruvalluvan531@gmail.com.	
16	**Er. P. Parthiban**	Assistant Executive Engineer	Project Implementation Unit-III Thiruthuraipoondi	9443358324	parthibanswetha2014@gmail.com	
17	**Er. T. Karthikeyan**	Assistant Engineer	WRD, Ground water Division, Madurai	9486153081	Karthikrajan1977@gmail.com	
18	Er. S. Muthukumar	Assistant Engineer	WRD, PMC Division Melur	8778269900	muthukumaarsubramanian75@gmail.com	

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CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU - WATER RESOURCES

ATTENDANCE SHEET

S.No	Name	Designation	25/07/2023		26/07/2023	
			FN	AN	FN	AN
1	**Er. J. Karthikeyan**	Assistant Executive Engineer				
2	**Er. B. H. Fazith Khan**	Assistant Engineer				
~~3~~	**Er. K. Kannan**	Assistant Engineer	ABSENT			
4	**Er. D. Ananth**	Assistant Engineer	D. Ananth	D. Ananth	D. Ananth	D. Ananth
5	**Er. G. Kannadasan**	Assistant Engineer				
6	**Er. A. Priyadharshini**	Assistant Engineer				
7	**Er. K. Madhusoothanan**	Assistant Engineer	25/7/23	25/7/23	26/7/23	26/7/23
8	**Er. J. ~~Dhivya~~ J. DIVYA**	Assistant Engineer	25/7/2023	25/7/2023	26/7/2023	26/7/2023
9	**Er. G. Parthiban**	Assistant Engineer				
~~10~~	**Er. K. Hariharasudhan**	Assistant Engineer		REPLACEMENT		

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12	**Er. R. Vinod Kumar**	Assistant Engineer				
13	**Er. M. Dhanasekarapandiyan**	Assistant Engineer				
14	**Er. R. Thilagam**	Assistant Engineer				
15	**Er. G. Thiruvalluvan**	Assistant Executive Engineer				
16	**Er. P. Parthiban**	Assistant Executive Engineer				
17	**Er. T. Karthikeyan**	Assistant Engineer				
10	Er. S. Muthukumaran	Assistant Engineer		ABSENT.		

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Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

~~Usefulness~~
Very useful for now days life style and give more training to others and extended one more days.

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Got well knowledge about climate change and its effects to our environment.

overall Good training

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Training Venue and its Hospitality	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Very useful and essential, training.
Already knowledge in climate adaptation is updation.

[illegible]

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Training Venue and its Hospitality	1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

This training gave a very useful insight on climate change and its impact on water resources of our state. The trainers were highly informative and kept the sessions lively and interactive. The trainings could a bit more longer (than 2 days) with more case studies and current challenges faced in the field.

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Other comments
Please write your comments regarding this training:

The Hands on training experience was good. But the period of training (2 days) it might be comfortable to cover the subject in very clear manner.

Thanks a lot for the training & support team, making us to get exposed on study about climate change in a easy way.

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Other comments
Please write your comments regarding this training:

- Very good opportunities to learn Hydrology models, climate models

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Other comments **Please write your comments regarding this training:**				

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Other comments
Please write your comments regarding this training:

If could provide accomodation it could be better.

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Other comments **Please write your comments regarding this training:**				
Overall very Good.				

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

class room environment, teaching, hospitality, and objective of the programme is excellent.

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Other comments
Please write your comments regarding this training:

* the training was very interactive and useful.
* we were able to do Hydrological modelling using SWAT (QGIS).
* It would have been good if we were able to project the data for the future using Modelling during Hands on session.

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Congratulations!
This Traing is very useful to me. I am executing this QGIS, SWAT in my project

Thanking you.
AE | WRD

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Other comments
Please write your comments regarding this training:

— NIL —

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

This traing is very useful to learn new things
The traing duration may be extended., two day is very short

CAPACITY BUILDING PROGRAMME
CLIMATE CHANGE RISK ASSESSMENT AND ADAPTATION PLAN
TAMIL NADU - WATER RESOURCES

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Agenda

Day 1 (August 8, 2023)	
INAUGURAL SESSION	
9:30 – 9.45 A.M	**REGISTRATION**
9.45 – 10:00 A.M	**Welcome Address** **Prof. Dr. Kurian Joseph** Director, CCCDM, Anna University, Chennai
10:00 – 11:00 A.M	**Climate Risk and Resilience** **Dr. Kurian Joseph** Director, CCCDM, Anna University, Chennai
11:00 – 11:15 A.M	**TEA BREAK**
TECHNICAL SESSIONS	
SESSION – I: Status of Water Resources in Tamil Nadu	
11:15 – 12:15 P.M	**Er. S. Raja** Joint Chief Engineer (Retd.), WRD
SESSION – II: An Outlook of Climate Change Research in Tamil Nadu	
12:15 – 1:15 P.M	**Prof. Dr. A. Ramachandran D.Sc.** Emeritus Professor, CCCDM, Anna University, Chennai
1:15 – 2:15 P.M	**LUNCH**
SESSION – III: Demonstration of Hydrological Modelling	
2:15 – 3:45 P.M	**Dr. L. Balaji & Dr. R. Malarvizhi** Water Resources Team, CCCDM, Anna University, Chennai
3:45 – 4.00 P.M	**TEA BREAK**
SESSION – IV: Demonstration of Hydrological Modelling	
4.00 – 5.00 P.M	**Dr. L. Balaji & Dr. R. Malarvizhi** Water Resources Team, CCCDM, Anna University, Chennai

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Agenda

Day 2 (August 9, 2023)	
SESSION – V: Climate Change Risk Assessment on Water Resources	
9:30 – 11:00 A.M	**Dr. L. Balaji** Project Scientist-Water Resources, **&** **Dr. R. Malarvizhi** Project Associate-Water Resources, CCCDM, Anna University, Chennai
11:00 – 11:15 A.M	**TEA BREAK**
SESSION – VI: Interactive Portal - Hands-on Training at Climate Studio	
11:15 – 1:15 P.M	**Dr. L. Balaji** Project Scientist-Water Resources, **&** **Dr. R. Malarvizhi** Project Associate-Water Resources, CCCDM, Anna University, Chennai
1:15 – 2.15 P.M	**LUNCH**
SESSION – VII: Climate Change Adaptation Plan for Water Resources	
2:15 – 3.15 P.M	**Dr. R. Saravanan** Professor, Centre for Water Resources, Anna University
SESSION – VIII: Climate Adaptation in Water Resources – WASCA Case Study	
3:15 – 4.00 P.M	**Dr. P. Radha Priya** Climate Change Advisor, WASCA, GIZ, New Delhi
4.00 – 4.15 P.M	**TEA BREAK**
VALEDICTORY SESSION & CERTIFICATE PRESENTATION: 4.15 - 5.00 P.M	

Office of the Engineer-in-Chief,
and Chief Engineer (GI), WRD, Chepauk, Chennai – 600 005.

Present:

Er. A. Muthaiya, B.E.,
Engineer-in-Chief, and Chief Engineer (General), WRD
Chepauk, Chennai – 600 005.

Proceeding No. AEE / T1 / AE- 2 / 48930 / 2014, dated. 04 .08.2023

Sir,

Sub : CCCDM – Climate Studio – Capacity Building Programme – Water Resources – Nomination sent – reg.

Ref : Professor of Environmental Engineering & Director, Center for Climate Change and Disaster Management Department of Civil Engineering, Kalanjiyam Building CEG Campus Anna University Chennai – 25 Lr. No. CCCDM/CS/Capacity Building / Water / 2023.

****

With reference to the letter cited, the Engineers (list enclosed) are nominated to attend the third training programme **"Capacity Building Programme on Climate Change Risk Assessment and Adaptation Plan – Tamil Nadu – Water Resources"** scheduled on 8th and 9th August, 2023 at the Centre for Climate Change and Disaster Management, CEG Campus, Anna University, Guindy, Chennai. The Participants are informed to be present at the premises of the above venue at 09.30 am on the first day of the training (i.e on 08.08.2023).

The period of absence during the above said period shall be treated as on official duty as per FR 9(6) b (i) and the participating officials are eligible to draw Travelling Allowance and Dearness Allowance in connection with the said training at the rate admissible as per rules in force.

Encl: List of Engineers -15 Nos.

4/8/23

for **Engineer-in-Chief &**
Chief Engineer (General), WRD
Chepauk, Chennai.

To: The Director, Centre for Climate Change and Disaster Management, Anna University, Guindy, Chennai – 25.

Copy to:

1. The Individual listed in the above table (through e mail).
2. **The Director**, Department of Environment and Climate Change, Ground Floor, PanagalMaligai, Saidapet, Chennai – 15.

3. **The Chief Engineer, WRD, Trichy Region**, Trichyfor reference and to inform the participants to be present at the training venue at 09.30am & to make their own arrangements for accommodation.
4. **The Chief Engineer, WRD, Operation & Maintenance and State Dam Safety Organisation, Chennai** for reference and to inform the participants to be present at the training venue at 09.30 am & to make their own arrangements for accommodation.
5. **The Chief Engineer, WRD, Coimbatore Region**, Coimbatorefor reference and to inform the participants to be present at the training venue at 09.30 am & to make their own arrangements for accommodation.
6. **The Chief Engineer, WRD, Madurai Region**, Maduraifor reference and to inform the participants to be present at the training venue at 09.30 am & to make their own arrangements for accommodation.
7. **The Chief Engineer, WRD, Plan Formulation**, Chennaifor reference and to inform the participants to be present at the training venue at 09.30 am & to make their own arrangements for accommodation.
8. **The Chief Engineer, WRD,Design Research and Construction Support**, Chennai for reference and to inform the participants to be present at the training venue at 09.30 am & to make their own arrangements for accommodation.
9. **The Chief Engineer, WRD,State Ground and Surface Water Resources Data Centre**, Chennai for reference and to inform the participants to be present at the training venue at 09.30 am & to make their own arrangements for accommodation.
10. **The Chief Engineer, WRD & Director General, Irrigation Mangament Training Institute,** Trichyfor reference and to inform the participants to be present at the training venue at 09.30 am & to make their own arrangements for accommodation.

"Capacity Building Programme on Climate Change Risk Assessment and Adaptation Plus"

List of Engineers

Sl. No.	Name & Designation	Office Address	Phone No & Email ID
1.	Er. A. Arun Prasanth, Assistan Engineer, WRD	O/o the Special Chief Engineer & Project Director, WRD., State Project Management Unit, DRIP, IWS Campus, C.S.I.R Road, Taramani, Chennai-113	Ph: 96774 52075 aruncivitec@gmail.com
2.	Er. A.M. Gokula Santhanakrishnan, Assistant Engineer, WRD	Amaravathy Basin Division, Dharapuram, Amaravathy Basin Circle, Palani	Ph: 98420-42355 gokul.civil80@gmail.com
3.	Er. T. Senthil Kumar, Assistant Engineer, WRD	Thirumurthi Division, Udumalpet, Parambikulam Aliyar Basin Circle, Pollachi	Ph: 94422-15249 eewroudt@gmail.com
4.	Er. P. Karthikeyan, Assistant Executive Engineer, WRD	ETS Sub Division, Devakottai, ETS Division, Karaikudi.	Ph:73585 13768. **eeetskkd@gmail.com**
5.	Er. R.S. Ramkumar, Assistant Engineer, WRD	Section-1, Madurai, Mining and Monitoring Sub Division, Madurai, Mining and Monitoring Division, Madurai.	Ph: 95786 72350. **eemmmdu@gmail.com**
6.	Er.A.R. Subhalakshmi, Assistant Engineer, WRD	Pudhur Section Vaippar Basin Sub Division, Vilathikulam, Vaippar Basin Division, Virudhuanagar	Ph: 93455 52152. **eevbdwrovnr@gmail.com**
7.	Er. S.Santhosh, Assistant Engineer, WRD	O/o the Executive Engineer WRD Project Management Unit, ADB, Trichy.	Ph: 97896 65863
8.	Er. I. Surya Prakash, Assistant Engineer, WRD	O/o the Executive Engineer, WRD, Project Management Unit, ADB, Trichy.	Ph: 86672 73465
9.	Er. S. Senthil Raj, Assistant Engineer, WRD	O/o the Executive Engineer, WRD., Special Project Division, Trichy	Ph: 95002 30955
10.	Er. M. Malini Preetha, Assistant Engineer, WRD	O/o the Assistant Executive Engineer, WRD., Environmental Cell Sub Division-1, Tharamani, Chennai	Ph: 94453 31685 mmalinipreetha@gmail.com

Sl. No.	Name & Designation	Office Address	Phone No & Email ID
11.	Er. A.R.Aashmi, Assistant Engineer, WRD	O/o the Assistant Executive Engineer, WRD., Environmental Cell Sub Division, Coimbatore	Ph: 94452 57565 eeecdcbe@yahoo.com
12.	Er. K. Latha, Assistant Engineer, WRD	O/o the Assistant Executive Engineer, WRD., Environmental Cell Sub Division, Karur	Ph: 94425 78082 aeeecsdkrr@gmail.com
13.	Er. A. Anto Geetha Assistant Engineer, WRD	O/o the Chief Engineer, WRD., SG & SWRDC, Tharamani, Chennai	Ph: 95008 17291
14.	Er. P. Nagaraj, Assistant Engineer, WRD	O/o the Chief Engineer, WRD., SG & SWRDC, Tharamani, Chennai	Ph: 86758 68094
15.	Er. Aishwarya Srikumar Assistant Engineer, WRD	O/o the Chief Engineer, WRD., SG & SWRDC, Tharamani, Chennai	Ph: 80152 90188

4/8/23

for **Engineer-in-Chief &**
Chief Engineer (General), WRD
Chepauk, Chennai.

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT
"Operationalization of Climate Studio"
Funded by Department of Environment and Climate Change, Government of Tamil Nadu
8th & 9th August 2023
on

CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU - WATER RESOURCES

REGISTRATION FORM

S.No	Name	Designation	Office Address	Phone number	Email id	Signature
1	**Er. A. Arun Prasanth**	Assistant Engineer	O/o The Project Director, SAMU, DRIP, Tharamani-113	9677452075	arunciviltec@gmail.com	
2	**Er. A. M. Gokula Santhanakrishnan**	Assistant Engineer	Uppar dam section no.1 Amaravathy Basin Subdivn. Dharapuram, no.2	9842042355	gokul.civil80@gmail.com	
3	**Er. T. Senthil Kumar**	Assistant Engineer	O/o Thirumurthy division Udumalpet	9443215249	udumalpetcomplex2@gmail.com	
4	**Er. P. Karthikeyan**	Assistant Executive Engineer	ASSISTANT EXECUTIVE ENGINEER WRD CX-2 AMIN TANKS STANDARDISATION SUB-DIVISION DEVAKOTTAI	7358513768	pkarthitn@gmail.com	
5	**Er. R. S. Ramkumar**	Assistant Engineer	O/o Executive Engineer, WRD Mining and monitoring Division Madurai	9578678350	rsramkumar93@gmail.ca	
6	**Er. A. R. Subhalakshmi**	Assistant Engineer	O/o Executive Engineer, Vaipar Basin Dn, Virudhunagar	9345552152	subhalakshmirajendran@gmail.com	
7	**Er. S. Santhosh**	Assistant Engineer	O/o The Executive Engineer, WRD Project Management Unit, Trichy	9789665863	santhoshsevaiya@gmail.com	
8	**Er. I. Surya Prakash** P	Assistant Engineer	O/o Executive Engineer WRD, Project Management Unit, Trichy 620020	8667273465	suryaprakash.civil@gmail.com	
9	**Er. S. Senthil Raj**	Assistant Engineer	O/o Executive Engineer WRD Spl. Project Division, Trichy 620001	9500230955	spsenthilraj@yahoo.com	
10	**Er. M. Malini Preetha**	Assistant Engineer	O/o THE EXECUTIVE ENGINEER, ENVIRONMENTAL CELL DIVISION, TARAMANI, CH-113	9445331685	mmalinipreetha@gmail.com	
11	**Er. A. R. Aashmi**	Assistant Engineer	ASSISTANT ENGINEER, WRD, O/o EXECUTIVE Engineer, WRD, Environmental Cell Division, Coimbatore	9445259565	aashmi1980@gmail.com	

CENTRE FOR CLIMATE CHANGE AND DISASTER MANAGEMENT
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CAPACITY BUILDING PROGRAM ON CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU - WATER RESOURCES

REGISTRATION FORM

S.No	Name	Designation	Office Address	Phone number	Email id	Signature
12	**Er. K. Latha**	Assistant Engineer	O/o the Assistant Executive Engineer, Environmental Cell Sub Division, Karur	9442578082	lattak@gmail.com	8/8/23
13	**Er. A. Anto Geetha**	Assistant Engineer	O/o Chief Engineer, WRD SG&SWRDC Thiruvanmiyur, Ch-113	9500817291	antogeetha2@gmail.com	
14	**Er. P. Nagaraj**	Assistant Engineer	O/o the Chief Engineer SG&SWRDC, Thiruvanmiyur Chennai-113	8675868094	raj.naga607@gmail.com	
15	**Er. Aishwarya Srikumar**	Assistant Executive Engineer	O/o the Chief Engineer, WRD State Ground & Surface Water Resources Data Centre, Taramani	8015290158	aishwaryasrikumarwrd@gmail.com	08/08/23

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ATTENDANCE SHEET

S.No	Name	Designation	08/08/2023		09/08/2023	
			FN	AN	FN	AN
1	**Er. A. Arun Prasanth**	Assistant Engineer				
2	**Er. A. M. Gokula Santhanakrishnan**	Assistant Engineer				
3	**Er. T. Senthil Kumar**	Assistant Engineer				
4	**Er. P. Karthikeyan**	Assistant Executive Engineer				
5	**Er. R. S. Ramkumar**	Assistant Engineer				
6	**Er. A. R. Subhalakshmi**	Assistant Engineer				
7	**Er. S. Santhosh**	Assistant Engineer				
8	**Er. I. Surya Prakash**	Assistant Engineer				
9	**Er. S. Senthil Raj**	Assistant Engineer				
10	**Er. M. Malini Preetha**	Assistant Engineer				

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ATTENDANCE SHEET

S.No	Name	Designation	08/08/2023		09/08/2023	
			FN	AN	FN	AN
11	**Er. A. R. Aashmi**	Assistant Engineer	8/8/2023	8/8/2023	9/8/2023	9/8/2023
12	**Er. K. Latha**	Assistant Engineer	8/8/23	8/8/23	9/8/23	9/9/23
13	**Er. A. Anto Geetha**	Assistant Engineer	8/8/23	8/8/23	← ABSENT →	
14	**Er. P. Nagaraj**	Assistant Engineer	08/08/2023	08/08/2023	09/08/2023	09/08/2023
15	**Er. Aishwarya Srikumar**	Assistant Engineer	08/08/23	08/08/23	09/08/23	09/08/23

CAPACITY BUILDING PROGRAMME
CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU - WATER RESOURCES
Organized by Centre for Climate Change and Disaster Management, Anna University
Funded by Department of Environment and Climate Change, Government of Tamil Nadu
8th & 9th August 2023 at Climate Studio, Anna University, Chennai

Training Evaluation

Please tick according to the performance: (✓)

Training Relevance	1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)
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Presentations	1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

The training program was very useful. Came to know about many new terms related to SWAT model. Punctuality was much more maintained. Teaching staffs ~~were~~ excellent and ~~was very helping~~ helped us much in the practical sessions.

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Training session on Hydrological Modelling (Hands-On) was very informative and good. In future, if the training (hands-on) session could be more informative if it spans for another few sessions.

Presentation could be more crispier.

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

This training programme was very useful for all Uds.

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Received an overall idea on climate change impacts and its mitigation measures. Introduction to SWAT software was beneficial.

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Other comments
Please write your comments regarding this training:

Being an Engineer, attending the training related to Modelling for the first time, got exposed to it and hope will apply the relevance in water Resources sector.

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Other comments
Please write your comments regarding this training:

The Training is good enough to learn about climate change. But 2 days are not sufficient. Kindly increase the no. of days of the Training. Chennai is too far for people from southern dgn. So, please provide this training at coimbatore or Trichy Dts.

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Other comments
Please write your comments regarding this training:

Training period may be increased to one or two weeks, so that the technical terminologies are more prone to us.

CAPACITY BUILDING PROGRAMME
CLIMATE RISK ASSESSMENT AND ADAPTATION PLAN OF TAMIL NADU - WATER RESOURCES
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Other comments
Please write your comments regarding this training:

A very good training programme must try to impart the appetite to learn more on the topic by the participants on their own. This programme has certainly achieved this objective. I can very well relate the topic to my own project. Thank you. SWAT training is very informative.

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Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

Useful for our carrier and community as water management Engineer.

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Please tick according to the performance: (✓)

Training Relevance	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Content	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Method	1 (Excellent)	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Trainers	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)
Presentations	1 (Excellent)	2 (Good) ✓	3 (Fair)	4 (Not Satisfactory)
Training Venue and its Hospitality	1 (Excellent) ✓	2 (Good)	3 (Fair)	4 (Not Satisfactory)

Other comments
Please write your comments regarding this training:

~~H D 2 days training is not ...~~
(1) Please increase the training time
(2) Field visit to subject oriented.

ANNEXURE - II

An Outlook on Climate Change Research

Prof. A. Ramachandran Ph.D, D.Sc.,
Emeritus Professor
Centre for Climate Change and Disaster Management
Anna University, Chennai-600025

1

Family in the dining room Bargteheide, Germany, with a week's worth of food $350.45

2

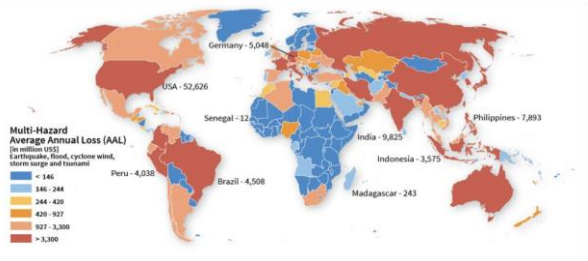
Family at Darfur province, Sudan in front of their tent of Breidjing Refugee Camp, week's worth of food ($24.37)

3

4

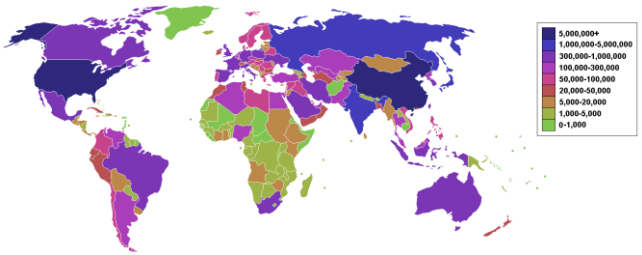
5

Disasters and Risky world



6

Country wise CO_2 Emissions



(In thousands of tonnes per annum)

7

Origin of Problem - Increased GHGs

Period	Atmospheric Concentration		
	CO_2	Methane	NO_X
Before 1800 AD	280 PPM	750 PPB	270 PPB
1800 AD	300 PPM	775 PPB	280 PPB
2023 AD	420 PPM	1650 PPB	310 PPB

8

Kyoto Protocol - 1997

- **Energy efficiency**
- **Zero carbon energy sources**
  (gas, nuclear, biomass, wind, solar)
- **CO2 Capture and storage**
- **Enhancing Carbon Sink**
- **Reducing GHGs from Waste management**

9

Paris Agreement 2015 and India's Commitment

Mitigation Component

- **To Reduce the emissions intensity of its GDP By 33 - 35% from 2005 level and Increase the Share of Non Fossil Fuel to achieve 40% by 2030**
- **Enhancing Forests Carbon Sink to 2.5 -3 billion tonnes of CO_2 equivalent through forest tree cover (680 - 817 MT-C)**

Adaptation Component

- Vulnerable sector in Climate Change such as Water, Agriculture Forestry, Costal Ecosystem, Health, Etc.
- Transfer of Technology, R&D, Lifestyle Management

10

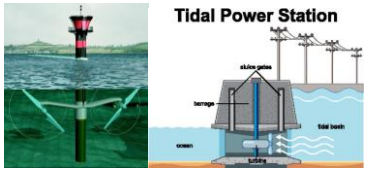
SDG and Paris Agreement

- UNFCC committed collaborative funding and transfer of technologies to reach the emission targets through
  - Tidal energy
  - Wind Energy
  - Solar Energy
  - Pumped Storage hydroelectricity (PSH) System
  - Compressed air generations Storage (CAES)

11

Emission reduction through Clean Green Technology

- **Many recent technological developments indicates that the total availability of Tidal Power higher in Tamil Nadu Coast**
- **Tidal stream extract energy from the kinetic movement of water much as wind turbines**
- **Cheaper technologies are emerging to suit the developing countries**
- **Per turbine has the capacity 25 MW per year which may support 2-3 households per year**



12

Emission reduction through Clean Green Technology

- Wind turbines is used to convert the kinetic energy to mechanical or electricity power
  - 2-3 MW per day
- 2 MW × 365 days × 24 hours × 25% = 4,380 MWh = 4,380,000 kWh per year.
- One wind turbine provides clean energy for 400 households per year
  - The typical home uses 10800 kWh per year. (@ the rate of 900 kWh per month)

13

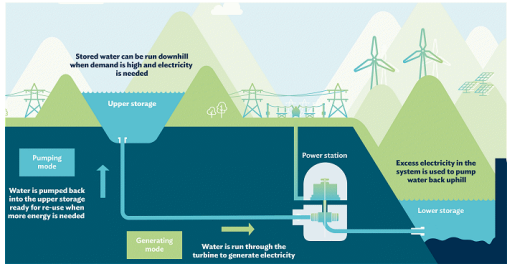
Emission reduction through Clean Green Technology

- Solar Panel is used to convert the solar energy/photon to electricity power
  - Average of 2 kwh per day per panel
- 1100 – 1600 kWh per year.
- 15 solar panel are sufficient to provide clean energy per households per year with adequate storage facility

14

Emission reduction through Clean Green Technology

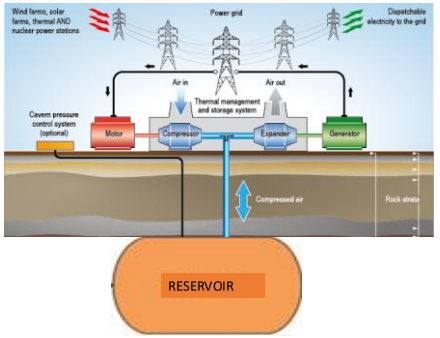
- Pumped Storage Hydroelectricity (PSH) – An emerging technology
  - It is a system where in two water reservoirs at different elevation that reuse the water repeatedly to generate power using the power generated from other sources



15

Emission reduction through Clean Green Technology

- Compressed air generations Storage
  - It is a way to store energy generated at one time for use at another time as need based system



16

CLIMATE CHANGE RISKS AND RESILIENCE WATER SECTOR

Dr.KURIAN JOSEPH
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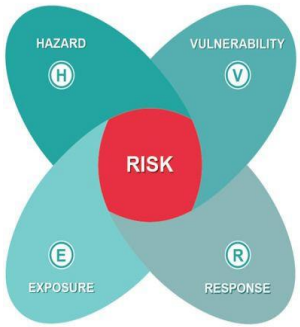
Director, Centre for Climate Change and Disaster Management
Dept. of Civil Engg, Anna University, Chennai- 600 025
E Mail: kurianj@gmail.com

1

Disaster Risk = PROBABILITY OF A HARMFUL CLIMATE EVENT OR TREND X IMPACT



Hazard
(likelihood x magnitude)

X Exposure X Vulnerability

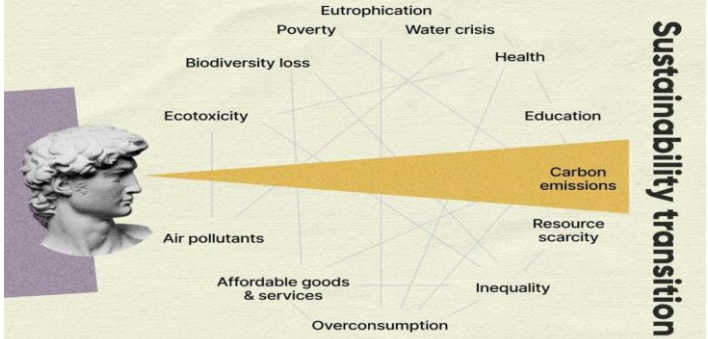
Sensitivity - Adaptive capacity

Hazard: the threatening event, including its probability and geographical extent
Exposure: the elements present in affected areas, such as citizens, flora & fauna, buildings or infrastructure
Vulnerability: the resistance or lack of resistance of these exposed elements to the hazard

2

Carbon Tunnel Vision

Realize that global warming is not our only problem



Blind focus on climate change, divert our attention away from the real problem: overconsumption and inequity.

Adapted from Jan Konietzko's graphic

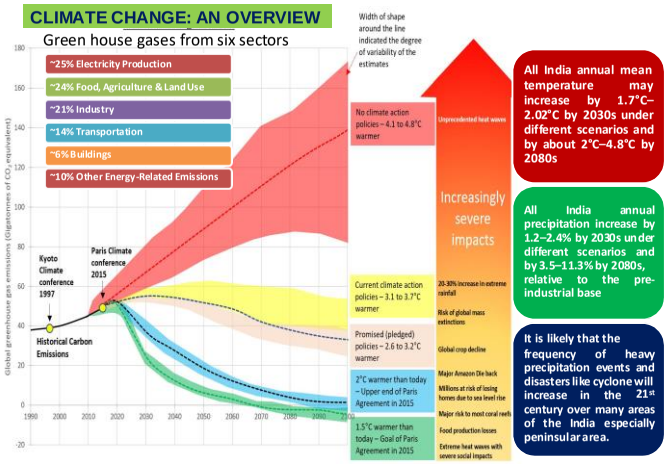
AIMHI EARTH

3

There are 25 targets related to DRR, CCA and Resilie 10 of the 17 SDGs

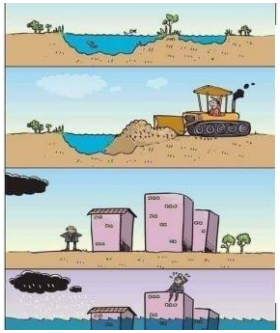
Resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters (SDG 1, Target 1.5).

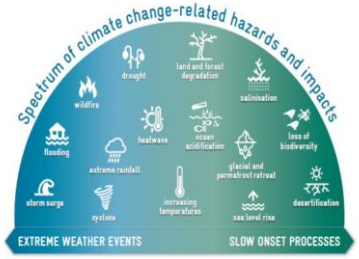
4



5

We are facing the effects of Unsustainable Development





Any further delay in concerted global action will miss a brief and rapidly closing window to secure a liveable future.

6

Climate Risk Assessment (CRA) and Disaster Risk Reduction (DRR)

7

Resilience?

'The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions' (UNISDR, 2009).

Technological capacity	Skills and education levels	Economic status and growth prospects
Environment and natural resource management institutions	Livelihood assets	Political structures and processes
Infrastructure	Flows of knowledge and information	Speed and breadth of innovation

8

Resilience Thinking--- evolution over time

	NUMBER OF EQUILIBRIUMS	MEASURE FOR RESILIENCE	NATURE OF DISTURBANCES	EMPHASIS
Engineering resilience	one	speed of return to the single equilibrium	- predictable - external - shocks	- resistance and recovery - efficiency, predictability
Ecological resilience	multiple	magnitude of shocks that can be absorbed, before the threshold to enter a new equilibrium is crossed, as well as degree of self-organisation and capacity for learning	- predictable and unpredictable - external - shocks	- persistence - adaptability, flexibility - resourcefulness, efficiency, diversity
Social-ecological resilience	none, continuously changing	magnitude of shocks and stresses that are continuously absorbed, as well as advanced degree of self-organisation and capacity for learning by social-ecological systems	- predictable and unpredictable - internal and external - shocks and stresses	- persistence - adaptability, flexibility - human potential to transform its surroundings (human agency)

Source: Trends in Urban Resilience 2017, UN-Habitat

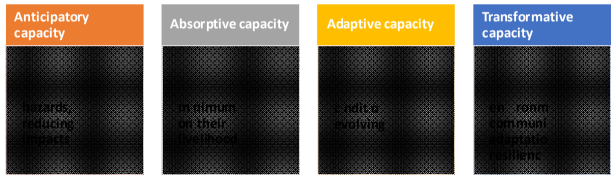
"Adaptation is a means to resilience building"

9

Vulnerability and Capacity Building

The **conditions** determined by physical, social, economic and environmental factors or processes, which **increase the susceptibility** of a community/individual to the impacts of hazards.

- **Physical:** lack of protective infrastructure, adequate housing or inaccessible shelter
- **Environmental:** degraded ecosystems
- **Financial:** lack of savings or access to credit
- **Social/human:** lack of disaster awareness or lack of a support network due to marginalization or discrimination
- **Political:** lack of policies and regulation



10

Climate Change and Disaster Risks

Cyclones	• Under 2.5°C of global warming, the most devastating storms are projected to occur up to twice as often as today. (Bacmeister et al., 2018)
Drought	• The number of people suffering extreme droughts across the world could double in less than 80 years (Pokhrel, 2021).
Floods	• For each 1°C of global warming, extreme daily precipitation events may intensify by about 7% (IPCC, 2021).
Heatwave	• Heat stress from extreme heat and humidity could annually affect 1.2 billion people by 2100 (Li, Yuan & Kopp, 2020).
Infectious diseases	• By 2050, mosquitoes that carry vector-borne diseases like Malaria could reach an estimated 500 million more people (Ryan et al., 2019).
Sea level rise	• Coastal flooding events could threaten assets worth up to 20% of the global GDP by 2100 (Kirezci et al., 2020).
Wildfire	• By 2030, fire season could be three months longer in areas already exposed to wildfires (Ross, Gannon & Steinberg, 2020).

Source: https://www.undrr.org/climate-action-and-disaster-risk-reduction

11

For Example: Drought intensity and severity is expected to increase

- Longer, warmer growing seasons
- Warming surface waters
- Intense droughts
- Increased insect and disease
- Decreased forest growth and ecosystem productivity
- Longer and more severe fire seasons

12

Climate risks and Environmental Vulnerability Indicators - Tamil Nadu, India

- **Rainfed area proportion**
  - Likely to be adversely affected during droughts; **increases sensitivity**
- **Coastal length**
  - Likely to be adversely affected by floods, cyclones, sea-level rise; **increases sensitivity**
- **Heat waves**
  - Affects health, soil moisture, evapotranspiration; **increase sensitivity**
- **Very heavy rainfall events**
  - More possibility of flood occurrence; **increases sensitivity**
- **Deficient rainfall years**
  - Affects water resources availability; **increase sensitivity**
- **Forest cover**
  - Provide safeguard ecological processes, provide biophysical stability and alternate livelihood options; **enhances adaptive capacity**

Source : Anushiya Jeganathan et.al (2021)Climate risks and socio-economic vulnerability in Tamil Nadu, India

13

Climate risks and Social Vulnerability Indicators - Tamil Nadu, India

- **Population density**
  - Pressure on available natural resources; **increases sensitivity**
- **Rural proportion**
  - Highly dependent upon natural resources affected by climate change and are subjected to multiple non-climate stressors, including under-investment in agriculture, problems with land and natural resource policy, and processes of environmental degradation; **increases sensitivity**
- **Marginal and small land holdings**
  - With high dependence on agriculture with poor coping mechanisms, excessive pressure on natural resources raising income is a major challenge; **increases sensitivity.**
- **Households in dilapidated condition**
  - Likely to be adversely affected during heavy rainfall, floods, cyclones and **increases sensitivity**
- **Slum population**
  - With minimal civic facilities, with irregular water supply, no drainage, frequent water logging and narrow unpaved roads **increase sensitivity**
- **Disabled persons**
  - Are disadvantage in social status and resource distribution; **increases sensitivity**
- **Gender inequality index**
  - Indicator of the overall state of the female health, literacy, empowerment, and labor market; lower value implies lack of adaptive capacity.

Source : Anushiya Jeganathan et.al (2021)Climate risks and socio-economic vulnerability in Tamil Nadu, India

14

Climate risks and Economic Vulnerability Indicators - Tamil Nadu, India

- **Annual average growth rate**
  - Indicator of overall economic growth and **enhance adaptive capacity**
- **Multidimensional poverty index**
  - Indicator overall education, health, and living standard. **Higher value implies lack of adaptive capacity**
- **Food security index**
  - Indicator food security through availability, accessibility, and adsorption; **lower value implies lack of adaptive capacity**
- **Households not having drinking water at their home premises**
  - Lack of this facility implies lack of adaptive capacity
- **Households wastewater outlet connected to closed drainage**
  - Proper discharge of wastewater ensures good health and enhance adaptive capacity
- **Healthcare infrastructure**
  - Proxy indicator for healthcare for all and shows adaptive capacity Population and doctor ratio. Shortage of adequate number of qualified medical doctors and other healthcare professionals implies lack of adaptive capacity
- **Road density**
  - Proxy indicator of developmental activity for economic growth denotes adaptive capacity

Source : Anushiya Jeganathan et.al (2021)Climate risks and socio-economic vulnerability in Tamil Nadu, India

15

Climate change impact on water resources or water bodies

River

- **Drought and flood risks caused by rainfall patterns and extreme river flow**
- **Sedimentation issues such as riverbank erosion, river flow capacity, and saltwater intrusion.**

Reservoir

- **Water depth variation, water stress potential during drought season, eutrophication, and decrease in water quality.**

Sea

- **Sea level rise, flood and erosion in the coastal area, increased sea surface temperature, and acidification.**

Groundwater

- **Effect on groundwater recharge, especially during drought season, saltwater intrusion into aquifer, and decrease in groundwater capacity.**

16

Climate change impact on water utilization

Domestic and industrial water supply:

- Water availability issue due to changes in river discharge, water supply crisis during low flow, saltwater intrusion, and decrease in water quality which will affect abstraction operation and water treatment.

Sewerage

- Extreme weather may result in frequent overflow of sewage as the design size of sewage pipes was determined based on historical rainfall.

Water supply for irrigation

- Climate change will affect irrigation infrastructure and operation, crop yield, and agriculture activities.

Hydropower

- Increase in extreme rainfall and river flow will affect the operation and productivity of the hydropower system.

Fisheries

- An increase in water temperature and saltwater intrusion will affect the aquaculture industry, fish migration, and the destruction of vulnerable marine ecosystems, especially coral reefs, due to the mass coral bleaching and erosion of organisms with calcium carbonate components such as corals and molluscs.

17

Impacts of Climate and Disaster Risk on WASH (water, sanitation and hygiene),

- Increase of extreme weather events –such as droughts, floods – which damage WASH infrastructure and deteriorate available water resources.
- Decrease of quality and quantity of water resources due to climate change, pollution, loss in the distribution system, salinization.
- Outbreak of water related post-disaster diseases (e.g. cholera) related to inappropriate health and hygiene practices.
- Increase in water demand due to population growth and expansion of industry.

18

Impact of Climate Change on Water for Agriculture

- **Groundwater resources are reducing due to high extraction by tube wells** –for agriculture and urban habitations.
- **Increase in temperature results in higher evaporation rate and reduced water availability** reducing "Soil Moisture" directly impacting crop productivity and its sustainability.
- **Inundation from flood** – reduces arable land or wipe out surface soil.

19

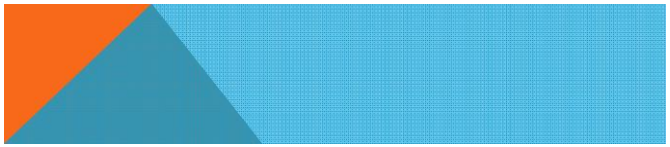
WATER – DISTRIBUTIONAL AND EQUITY ISSUES

- **What is the best allocation of water across users in each major water basin today?**
- **How should water allocation change as the demand by different types of users changes over time?**
- **How should water allocation be adjusted in years with abundant water and with water shortages?**
- **What water investments would be efficient (dams, canals, levees) and where and when should they be made?**
- **How would climate change alter these water investments and water allocation plans above?**

20

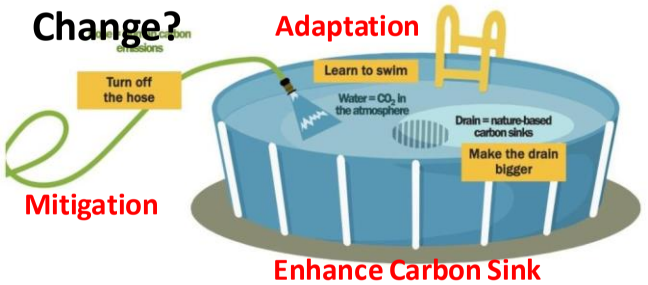
HOW PEOPLE AND ECOSYSTEMS CAN AD TO CLIMATE CHANGE IMPACTS ON WATI RESOURCES?

BEST MANAGEMENT PRACTICES ???



21

How to Deal with Climate Change?



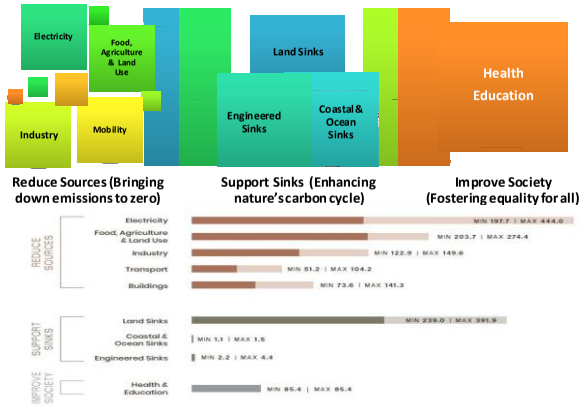
" *Panchamrit*" - Nationally Determined Contributions (NDC) – India

- Increase non-fossil fuel energy capacity to 500 GW by the year 2030
- Meet 50% of energy requirements from "Renewable Energy" by the year 2030
- Reduce projected carbon emissions by one billion tonnes till the year 2030
- Reduce Carbon intensity of Economy by more than 45% by the year 2030

Achieve the target of "Net Zero" (no net carbon dioxide emitted from energy sources) by the year 2070.

22

Climate Action for Net Zero



23

Sendai Framework for Disaster Risk Reduction

(Adopted by 187 states at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, in March 2015. valid between 2015 and 2030)

1 Goal: **...to prevent new and reduce existing disaster risk...**

4 Priorities:

- **Understand Disaster Risk**
- **Strengthen Disaster Risk Governance**
- **Invest in Disaster Risk Reduction**
- **Enhance disaster preparedness for response and to "build back better**

Seven Targets

- Reduce Disaster mortality
- Reduce Number of affected people
- Reduce Economic losses
- Reduce Infrastructure damage
- Enhance National/ Local structures for DRR
- Enhance International cooperation
- Enhance Early Warning and Disaster Risk Information

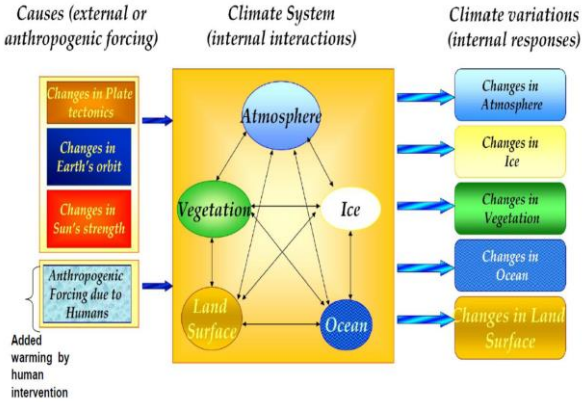
24

CCCDM- Five Action Strategies

- **Strategy 1: Research and development** to enhance understanding of climate change vulnerability and risks
- **Strategy 2: Support to build adaptive capacity** to cope with climate change and to reduce vulnerability of various sectors
- **Strategy 3: Support reduction of GHG emissions and increase GHG sinks** on the basis of sustainable development
- **Strategy 4: Build capacity of personnel and institutions** engaged in climate actions
- **Strategy 5: Raise awareness and participation** in climate change and disaster risk reduction action agenda

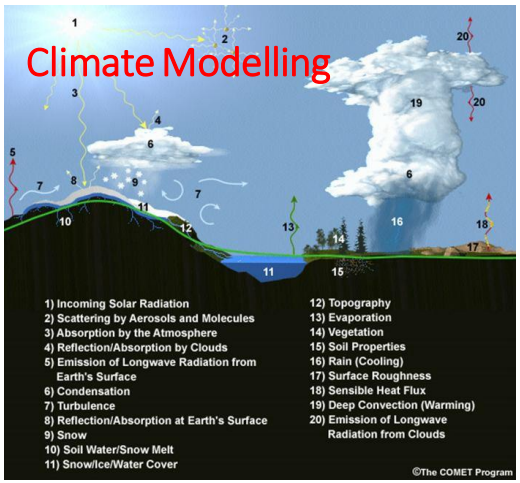
25

Climate Change - Causes



26

Climate Modelling



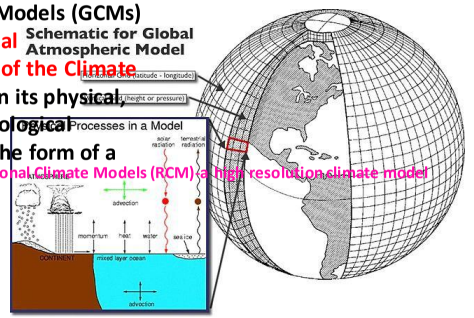
A list of 20 climate processes and properties that typically need to be parameterised within global climate models.

Image courtesy of MetEd, The COMET Program, UCAR.

27

Global Climate Modelling

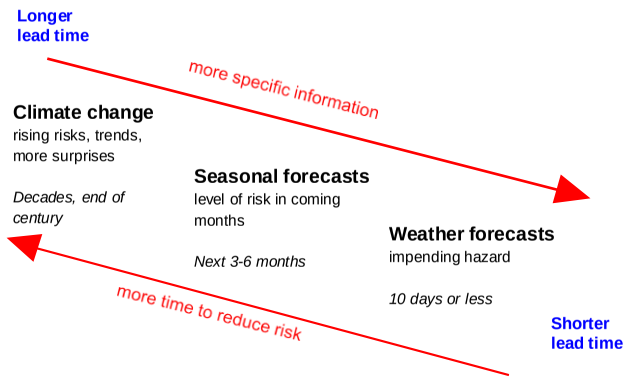
Global Climate Models (GCMs) are Mathematical Representation of the Climate System based on its physical, chemical and biological components in the form of a computer program



Regional Climate Models (RCM) a high resolution climate model that covers a limited area of the globe (5,000 x 5,000 km) with horizontal resolution of 50 km or less

28

Using information across timescales…



29

Climate Scenario SRES's RCP's and SSP's Recommended by IPCC

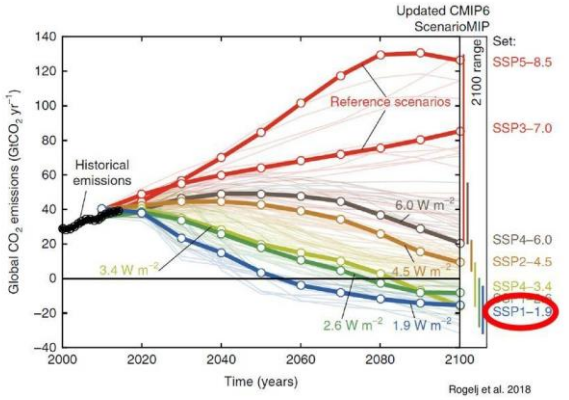
- **AR4 - SRES** (Special Report on Emission Scenarios) - Emissions A1F1, A1B, A1T1, A2. B1, B2
- **AR5 - RCP** (Representative Concentration Pathway) - Concentration produce radiative forcing values in year 2100 compared to pre-industrial values of +2.6, +4.5, +6.0 & +8.0 W/m² (RCP2.6, RCP4.5, RCP6.0, RCP8.5)
- AR6- Shared Socio economic pathways (SSP 1 to 5) - how the world might change over the rest of the 21st century ?.

30

SSP overview

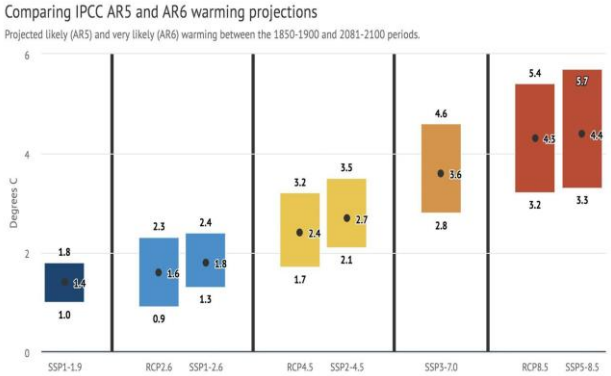
31

SSP CMIP6 pathways



32

Projected Global Temperature Change under AR5 and scenarios



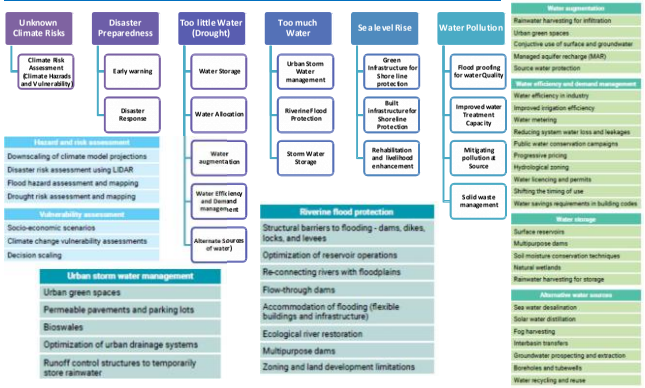
33

Climate change impact on Water Sector – Way forward

- Establish studies on Environmental Flow based on historical and future flows data
- Establish studies on impact of climate change on water reserves
- Develop high resolution coastal inundation maps
- Establish studies on dry spell impact on dams and reservoirs
- Enhance Reservoir Capacities through Disiltation
- Improve on existing irrigation infrastructure
- Implement water recycling system

34

Climate Change Adaptation Technologies – Water sector



35

Examples of Technology Interventions for Water Resources Sector

Short term	Mid Term/Long term
Desalinization of seawater, delivery of freshwater	Introduce water supply and wastewater management systems as measures for times of drought
Eutrophication control measures (blue-green algae control fences, aeration equipment, etc.)	Use reclaimed sewage water, grey water, and rainwater, etc.
Promote the use of water-saving devices	Take steps to prevent salinization of groundwater
Provide drought information	Create waterfronts and green space along urban rivers, taking measures against the heat island effect
Improve awareness about water conservation	Restructure networks of dams to manage flood control volume and service water volume
Improve canals, dikes, breakwaters, storm surge barriers, flood-control facilities, and sewerage facilities	Regulate deep groundwater pumping in order to control land subsidence
Improve erosion control facilities on slopes	Regulate wastewater quality
Prepare hazard maps for tsunamis, storm-surges, and inland waters	Reallocate water usage rights
Enhance maintenance and inspection abilities of facilities management personnel	Change land-use regulations on land set back from rivers and coastlines
Research and develop technologies for countermeasures	prevent construction in hazard zones, and to require removal of structures (potential flood areas)

36

Nature Based Disaster Risk Reduction

37

ECOLOGICAL DESIGN: SPONGE CITIES

"spongy city" with the connotations of natural storage, natural infiltration and natural purification.

managing stormwater through increased infiltration, detention, storage, treatment, and drainage.

incorporate urban design that aims to reduce the risk of floods, by enabling cities to 'absorb' water.

Conventional Approach:redirect to drains and then out into the sea as stormwater.

Rain that is redirected to stormwater drains could become a vital resource for drought period

38

Monitoring for Water Resources Sector Critical - Examples

Changes in river environments and river flows

- Changes in water temperature, water quality, turbidity
- River water levels, flow volumes, flow patterns, occurrence of drought
- Amount of sediment discharge from heavy rains, typhoons, etc. changes in river channel shape, etc.
- Damage (human impacts, economic damage) from heavy rains, typhoons, etc
- Habitat conditions and distribution of fish, benthos, etc., changes in zooplankton and phytoplankton, establishment of alien species

39

Monitoring for Water Resources Sector Critical - Examples

Changes in Climate

- Changes in annual average temperature
- Changes in annual precipitation and changes in frequency and intensity of heavy rain

Changes in lake and reservoir environment

- Water temperature, water quality, dissolved oxygen, changes in turbidity, occurrence of thermal stratification
- Changes in water level and water volume, occurrence of drought
- Habitat conditions and distribution of fish, etc., changes in zooplankton and phytoplankton, establishment of alien species

40

Deciding on Adaptation Actions to achieve Resilience

(1) *Efficiency* – are the outputs achieved optimal relative to the resources allocated?
(2) *Effectiveness* – will the option meet the objectives?
(3) *Equity* – will the option benefit vulnerable groups and communities?
(4) *Urgency* – how soon does the option need to be implemented?
(5) *Flexibility* – is the option flexible, and will it allow for adjustments and incremental implementation and reiteration depending on the level and degree of climate change?
(6) *Robustness* – is the option robust under a range of future climate projections?
(7) *Practicality* – can the option be implemented on relevant timescales?
(8) *Legitimacy* – is the option politically, culturally and socially acceptable?
(9) *Synergy/Coherence with other strategic objectives* – does the option offer co-benefits (for example, improving agricultural land management practices could lead to reduced erosion/siltation and carbon sequestration).

Reduce vulnerability and exposure to climate variability through strategic actions with co-benefits.

Place and context-specific Adaptation, with no single approach for reducing risks appropriate across all settings.

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Status of Water Resources in Tamilnadu

Er.S. Raja, B.E., MIE, GWM (USA), IWRM (Denmark)
Joint Chief Engineer,
WRD (Retd..)

1

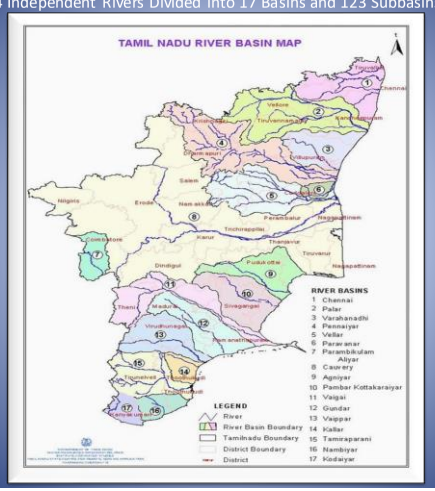
Tamil Nadu State A Glance…

Total Geographical Area	-	13.01 M ha m
	-	Tenth Largest State By Area &
	-	Sixth Largest State By Population.
	-	(4% Of India)
Water Resources Of Tamil Nadu	-	1555.06 TMC (3% Of India)
Population As On 2023	-	76.48 Million (India 1428.6 Million)
District	-	38
Taluks	-	313
Blocks	-	386
Villages	-	17643
Coastal Line	-	980km
Average Rainfall	-	965mm

2

Basins & Sub Basins Of The State

34 Independent Rivers Divided into 17 Basins and 123 Subbasins



3

SURFACE WATER POTENTIAL OF TAMIL NADU

Sl.No.	Basin	Basin Area	Surface Water Potential (TMC)
1	Agniyar	4802.58	22.30
2	Cauvery	47249.51	205.00
3	Chennai	5846.88	37.17
4	Gundar	5684.32	19.22
5	Kallar	1539.18	4.48
6	Kodaiyar	1502.57	32.06
7	Nambiyar	1937.83	7.11
8	Palar	10217.18	48.76
9	Pambar Kottakaraiyar	5706.65	22.68
10	Parambikulam Aliyar	2353.26	26.92
11	Paravanar	864.06	5.64
12	Ponnaiyar	11387.70	46.19
13	Tamiraparani	5555.26	30.91
14	Vaigai	6935.13	29.47
15	Vaippar	5266.18	25.03
16	Varahanadhi	4592.11	14.98
17	Vellar	7530.53	34.34
		Sub Total	**612.21**
18	Surface Water Potential expected release from Andhra Pradesh		7.70
19	Surface Water Potential expected release from Kerala		59.00
20	Surface Water Potential expected release from Karnataka		202.00
		Sub Total	**268.70**
		Total	**880.91**

4

SURFACE WATER CONTRIBUTION EXPECTED FROM NEIGHBOURING STATES

SN	State	River	In MCM	In TMC
1	Andhra Pradesh	Aranar (Average inflow based on the observed data at the A.P-T.N Borde)	28.32	1
		Kosathalayar (Average inflow based on the observed data at the Andhra Pradesh-Tamil Nadu Border)	14.16	0.5
		Krishna (Tolal contribution -12.0TMC) (As per the inter State Agreement, 1986)	113.28	4
		Palar(Average inflow as per the data observed by CWC at its gauging site at Avaramkuppam)	62.3	2.2
		Sub total	218.06	7.7
2	Karnataka	Pennaiyar (Average inflow based on the observed date at Kodiyalam Anicut, which is nearer to the Karnataka -Tamil Nadu border)	169.9	6
		Krishna (Tolal contribution -12.0TMC) (As per the inter State Agreement, 1986)	113.28	4
		Cauvery @ Billigundulu or at any other common border(As per the final order of the CWDT, dated 5.2.2007)	5436.86	192
		Sub total	5720.04	202
3	Kerala	Periyar(Average inflow based on the long time data on diversion of flows to vaigai basin)	622.96	22
		Shenbagavalli (Based on the assessment of flows diverted in the past)	56.63	2
		Bhavani (based on the final order of the Cauvery water Dispute Tribunal)	764.55	27
		Amaravathy (based on the final order of the Cauvery water Dispute Tribunal)	141.58	5
		Neyyar (As per the project Report or Neyyar Project,Phase)	84.95	3
		Sub total	1670.67	59
4	Maharashtra	Krishna (Tolal contribution -12.0TMC	113.28	4
		Total	722.05	272.7

5

SURFACE WATER CONTRIBUTION EXPECTED FROM NEIGHBOURING STATES - Contd

- From Krishna, Out of 12 TMC about 6 TMC only received except in one year. Also from Shenbagavalli and Neyyar, the contribution is Nill. After deductions, the contribution is only (272.7-6-2-3) =261.7 TMC (7411 MCM).
- Under the contribution from the State of Kerala, the waters utilized under the PAP complex has not been included, for the reason that 66 percent of the catchment area, up to the tapping points, I.e., up to PAP reservoirs, lines in the State of Tamil Nadu, which is 28.0 TMC as per the Pap INTER State agreement.

6

Groundwater Potential (as per GWRE-2022)

Annual Extractable GW Resources	19.09 BCM (674.16 TMC)
Net Annual Ground Water Availability for Future Use	6.42 BCM (226.72 TMC)

7

Total Potential of the State

In TMC

- Surface water : 880.91
  (including SW contribution from neighboring states of 268.7 TMC)
- Ground water : 674.15
- Total : 1555.06

8

Surface Water Irrigation Infrastructure

Sl. No.	Sources	2021-22	2020-21	2019-20	2018-19
1	2	3	4	5	6
1.	Canals (in numbers)				
a	a) Government	2240	2240	2237	2237
	Length in k.m	9747	9747	9736	9736
b	b) Private	1	1	1	1
	Length in k.m	11	11	11	11
2.	Reservoirs (in numbers)	123 (85 WRD and 38 TNEB)			
	Holding Capacity	232.50 TMC			
3.	Tanks (in numbers)				
	a) with Ayacut of 40 ha. and above *	7987	7986	7986	7986
	b) with Ayacut of less than 40 ha.	33137	33137	33137	33137
	Total	41124	41123	41123	41123

Holding Capacity
Reservoir - 232.50 TMC
Tanks – 178.92 TMC
Total - 411.42 TMC

9

Ground Water Irrigation Infrastructure

Sl. No.	Sources		2021-22	2020-21	2019-20	2018-19	2017-18
1	2		3	4	5	6	7
4.	Wells (in numbers)						
	i) Tube Wells & Others	a)Govt.	593	453	496	496	500
		b)Private	411480	402418	393522	393522	386475
		Total (a+b)	***412073***	***402871***	***394018***	***394018***	***386975***
	ii) Open wells -	a) Govt.	168	226	182	182	185
		b) Private	*1473631*	1477026	1481542	1481542	1482500
		Total (a+b)	***1473799***	***1477255***	***1481724***	***1481724***	***1482685***
	Total No.of Wells (i)+(ii)		1885872	1880126	1875742	1875742	1869660
5	No. of Wells used for Domestic Purposes		746519	739086	726162	726162	755229
6	No. of Wells not in use		6365	3239	6987	6987	14907

10

Net Area Irrigated

Sl. No.	Sources	2021-22	2020-21	2019-20	2018-19	Percentage (2021-22)
1	2	3	4	5	6	7
	NET AREA IRRIGATED BY (in ha.)					
	i) Government Canals	683718	667818	667818	646903	23.3
	ii) Private Canals	88	0	1080	1080	0.003
	iii) Tanks	410214	372316	351484	351484	14.0
	iv) Wells : a) Tube Wells & Other wells	545846	528262	518393	518393	18.6
	b) Open wells	1284933	1191244	1150929	1150929	43.9
	v) Other sources	4703	4254	3614	3614	0.2
	TOTAL	2929502	2763894	2672403	2672403	100

11

WATER SCENARIO IN TAMILNADU

WATER DEMAND (TMC)

- Industry : 487.35
- House hold : 130.67
- Live stock : 35.32
- Other needs : 52.97
- Irrigation need : 1765.75

- Total Demand : 2472.05

WATER RESOURCES AVAILABILITY(TMC)

- Surface water : 880.91 (including SW contribution from neighboring states of 268.7 TMC)
- Ground water : 674.15
- Total : 1555.06

GAP (TMC)

- Supply – Demand Gap : 916.99
- Add for environmental : 88.28
- Total Gap in Management : 1005.27

12

Status of Surface water in Tamilnadu

Almost 95 % has been utilised.

13

Status of Ground water in Tamilnadu

(as per GroundWater Resources Assessment 2022)

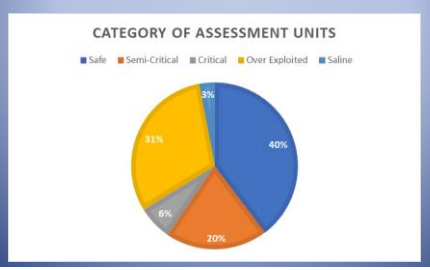
Annual Extractable GW Resources	19.09 BCM
Annual GW Extraction for all uses	14.43 BCM
Net Annual Ground Water Availability for Future Use	6.42 BCM
Stage of GW Extraction	75.59 %

14

Status of Ground water in Tamilnadu

(as per GroundWater Resources Assessment 2022)

Category	No of assessment units
Safe	463
Semi-Critical	231
Critical	78
Over Exploited	360
Saline	34
Total	1166



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Status of Ground water in Tamilnadu

(Comparison with previous Assessment)

Category/ Quantum	No. of AUs as on GWRA 2020	No. of AUs as on GWRA 2022
Over-Exploited	435	360
Critical	63	78
Semi-Critical	225	231
Safe	409	463
Saline	34	34
Annual Extractable (BCM)	17.69	19.09
Total Extraction (BCM)	14.67	14.43
Net Annual Ground Water Availability for Future Use	5.65	6.42
Stage of Extraction (%)	82.9	75.59
Total	1166	1166

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Comparison of Assessments Categorization (2011-2022)

S.No	Category	2011	2013	2017	2020	2022
≤ 70%	Safe	437	429	427	409	463
>70% to ≤ 90%	Semi Critical	235	212	173	225	231
>90 % to ≤100 %	Critical	48	105	109	63	78
> 100%	Over-exploited	374	358	422	435	360
TDS >2000 mgl	Poor Quality/Saline	35	35	35	34	34
	Total	1129	1139	1166	1166	1166

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Comparison of Assessment (2011-2022)

	Ground Water Recharge	Current Annual Ground Water Extraction				Net Ground Water Availability for future use (in Bcm)	Stage of Ground Water Extraction (%)
Year	Annual Extractable Ground Water Resource (in Bcm)	Irrigation (in Bcm)	Industrial (in Bcm)	Domestic (in Bcm)	Total (in Bcm)		
2013	18.59	12.98		1.38	14.36	4.08	77
2017	18.2	13.06		1.67	14.73	5.66	80.94
2020	17.69	13.52	0.17	0.99	14.67	5.65	82.93
2022	19.09	13.68	0.18	0.57	14.43	6.42	75.59

18

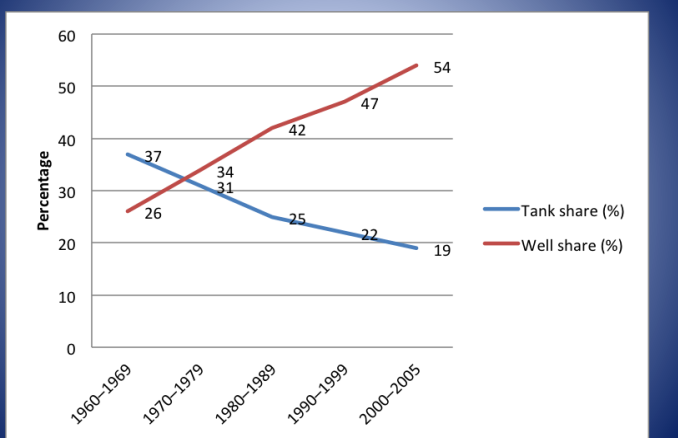
18

TAMILNADU WATER SCENEARIO

- Severe water scarcity and drought in many places
- Major problems in water supply to Chennai and other Cities due to rapid urbanization
- Drastic reduction on Groundwater tables
- Reduction in storage capacity of Tanks
- Growing conflicts between water using Groups
- Disputes with neighboring States in water allocation and sharing
- Pollution threats

19

Change in Irrigation Category



20

PRESENT CHALLENGES

- The problem is not only in the development of water resources, but also the management of the developed resources in a sustainable manner.
- Misplaced and inappropriate policies leading to indiscriminate use of water, lack of appropriate technologies, poor technology transfer mechanisms and inadequate & defective institutional support systems have led to serious agro-ecological and sustainability problems.

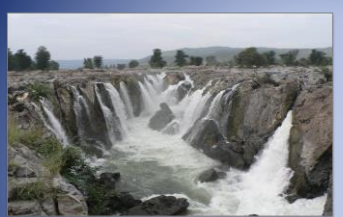
21

PRIMARY CHALLENGES

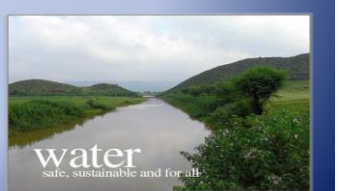
- Unauthorized peripheral encroachment of Water Bodies by the public
- Shrinkage of river and water courses due to authorized encroachment for infrastructure development.
- High degree of pollution in water resources
- Flood Management
- Destruction of cascading topography of the River system
- Environmental degradation

22

FUTURE CHALLENGES



- Availability
- Accessibility
- Sustainability



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Community Collaborative Water Management

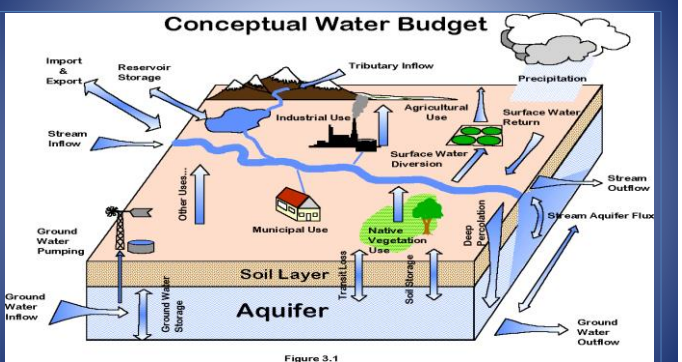


Figure 3.1

WATER BUDGETING

24

STRATEGIES FOR IMPROVING WATER & IRRIGATION MANAGEMENT

SUPPLY MANAGEMENT

- Water conservation
- Water harvesting
- Construction of more storage structures
- Interlinking of rivers
- Reclaiming brackish water, sewage and industrial effluents for ground water recharge and agricultural use (about 30 TMC)
- Desalination of sea water in coastal areas for drinking and industrial use
- Extension Officers for water management in canal/tank irrigation.
- Reclaim the polluted land and water in Palar, Bhavani and Noyyal river basins.

DEMAND MANAGEMENT

- Increasing water use efficiency
- Introducing advanced methods of irrigation, especially well irrigated areas.
- Increasing the productivity of unit quantity of water (more crop per drop)
- Introducing changes in cropping pattern
- Managing ground water– stabilize the water level for sustainability
- Improving irrigation management

27

25

FEW MAJOR SCHEMES UNDER IMPLEMENTATION

Sl. N0	Scheme / Project	Total Outlay (Rs. In Crores)
1	Kudimaramath (Participatory Irrigation Management)	829
2	New Reservoir in Thervakandigai to store Krishna Water	380
3	Athikadavu Avinashi Pumping Project	1768
4	Construction of New Regulator across Kollidam in Mukkombu, Trichy	388
5	Construction of a Barrage across the Kollidam River at Adhanur and Kumaramangalam Villages in Cuddalore and Nagapattinam Districts.	495
6	Flood Mitigation works	100
7	Creation of additional storage Structures	254
8	ADB assisted Climate Change Adaptation Program in Cauvery Delta	1,560

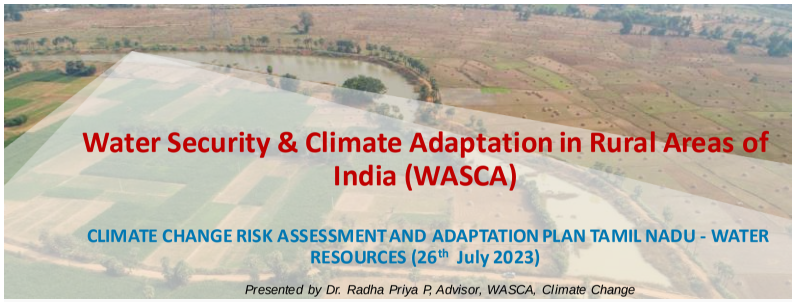
26

FEW MAJOR SCHEMES UNDER IMPLEMENTATION ...contd..

Sl. N0	Scheme / Project	Total Outlay (Rs. In Crores)
9	World Bank Assisted Dam Rehabilitation and Improvement Project (DRIP)	803
10	Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP)	2,962
11	Coastal Protection Works	55
12	NABARD assisted Schemes	260
13	Check Dams & CM announcement schemes	466
14	Repair, Renovation and Restoration (RRR) of water bodies	163
15	NADP/ Rashtriya Krishi Vikas Yojana	21
16	Intra-linking of rivers	872
17	Construction of 160 check dams for GW recharge	1,000
18	National Hydrology Project	28
	TOTAL	12,404

27

28



Water Security & Climate Adaptation in Rural Areas of India (WASCA)

CLIMATE CHANGE RISK ASSESSMENT AND ADAPTATION PLAN TAMIL NADU - WATER RESOURCES (26th July 2023)

Presented by Dr. Radha Priya P, Advisor, WASCA, Climate Change

http://tnwasca-mgnrega.org/

In cooperation with

german cooperation DEUTSCHE ZUSAMMENARBEIT

Implemented by giz

Ministry of Rural Development Government of India

Ministry of Jal Shakti Government of India

MSSRF

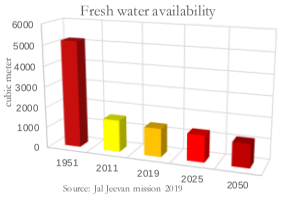
1

Water security is LiFE

Indian CC scenario

- 0.7 °C increase during 1901–2018
- Summer monsoon RF declined 6%
- More frequent dry spells 27% higher during 1981- 2011 relative to 1951- 1980
- Area affected by drought increased 1.3% during 1951- 2016
- Increasing frequency of localized heavy RF - 150mm/day increased by 75% during 1950- 2015 (Source : MoES Report 2021)

Water stress is more



Severe water stress by 2050 (OECD 2014)

Climate extremities & its risks likely to exacerbates the pressure on water security

Challenges

- Demographic
- Socio economic
- Land use changes
- Industrial
- Sectoral demands

2

Project Snapshot

Objective: Converges with the Government programs/schemes and missions for Rural Development, especially with *Mahatma Gandhi NREGA*, *Catch the Rain* programmes etc., contributing to water security while taking climate change into account.

Outputs

- **Enhancing livelihood and climate impacts through the GIS-based planning approach:** Consolidation of *Mahatma Gandhi NREGA* GP GIS-based Plans at district level by harmonising land, water, vegetation interactions
- **Strengthening implementation mechanisms and impact monitoring of NRM interventions:** Preparation & implementation of Issues specific action plan/DPR
- **Up-scaling and institutionalization of innovative solutions**: Demonstration location to state and national level

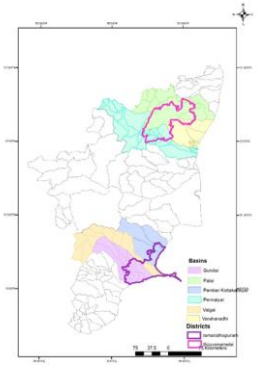
- *At least one state has selected from each Agroclimatic Zones (15)*
- *At least two districts for demonstration in each state*
- *46 districts in 17 states (38 New and 8 from WASCA Phase I)*

3

Overview : Water Security and Climate Adaptation in Rural India (2019-22)

Three Outputs of WASCA:

1. Improving existing **Planning and Financing** mechanisms
2. Strengthening **cooperation** with private sector
3. Demonstrating **Climate Resilient water management Measures (CRM)**



4

Vulnerability	Integrated CWRM Scientific Planning	Vulnerability Ranking at GP level	Resilience Plans	Key water actions	Monitoring
IPCC Vulnerability Assessment	CWRM localization at GP	IPCC Vulnerability Assessment	Resilience works identification in MGNREGA & others	Public & common land: Water conservation, Land production, Afforestation	Mapping actions planned to SDG & NDC
Climate, Water & Agriculture, Socio-Economic Indicators	Non Spatial data	Analysis of Planning mapped with VA indicators	Key Water Actions • Public and common lands • Agriculture and allied areas • Rural Infrastructure • Climate Resilience measures	Agriculture: Fallow land development *insitu* water conservative efforts. Agro forestry & horticulture. Changing cropping patterns	Mapping Impacts as per approved plan
District Vulnerability	Spatial layers	Vulnerability Ranking of GP	Approval of GP Implementation within framework of MoRD and State RD with convergence	Rural infrastructure: Grey water management Rainwater harvesting	Planning Automated Tool
	Hydrology pattern (macro watershed-catchment/ river subbasin			Climate Resilience Measures	Climate Resilience Sustainability Tool
	water budgeting & water stress estimation				
	Community aspirations inclusion with participatory bottom up approach (GP to State)				
	Integration in to Vulnerability Assessment				

Integrated Resilience Framework

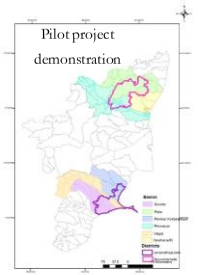
Key Demonstration – 1281 GPs/ 29 blocks in 2 districts (Tiruvannamalai and Ramanathapuram) of Tamil Nadu State during 2019 -2022

* CWRM - Composite Water Resource Management

5

District level vulnerability assessment

CWRM Theme	Indicators of rural water security vulnerability
Climate	Changes in max temperature (°C)
	Changes in min temperature (°C)
	Changes in rainfall (%)
	Excess rainfall years
	Deficient rainfall years
Water	Ground water extraction (%)
	Ground water Recharge (m^3)
	Surface water availability (mm)
	Water gap (mcm)
	% of contamination
Agriculture	Rainfed area (%)
	Cropping intensity (%)
	Soil moisture (Kg/m^3)
	Evapo-transpiration (Kg/m^3)
Socio-economic	Rural proportion (%)
	Multidimensional poverty index
	Source of drinking water within premises in rural (%)
	Marginal farmers land holdings (%)



TN WAASCA: Scoping study report (2020)

District name	CVI
Ramanathapuram	0.70
Dharmapuri	0.64
Perambalur	0.62
Thiruvannamalai	0.61
Krishnagiri	0.60
Thoothukkudi	0.59
Virudhunagar	0.58
Ariyalur	0.58
Thanjavur	0.58
Karur	0.56
Theni	0.56
Viluppuram	0.56
Dindigul	0.56
Sivagangai	0.55
Namakkal	0.54
Thirunelveli	0.54
Pudukottai	0.54
Vellore	0.54
Nagapattinam	0.53
Salem	0.52
Tiruchirapalli	0.52
Madurai	0.51
Tiruppur	0.50
The Nilgiris	0.50
Erode	0.48
Thiruvarur	0.47
Cuddalore	0.47
Thiruvallur	0.46
Kancheepuram	0.46
Kanyakumari	0.44
Coimbatore	0.37

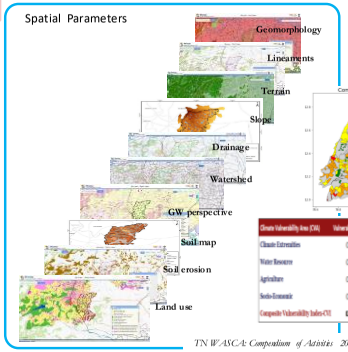
6

CWRM framework through climate lens at GP level

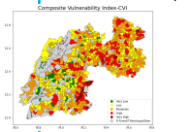
Non spatial Parameters

- traditional waterbodies
- canal networks
- irrigation facilities
- catchments area wise available runoff
- ground water and surface water utilization
- ground water status
- ground water availability
- evapo-transpiration losses
- and water demand for drinking, agriculture and livestock
- land resources
- catchment area/ watershed
- means of water extraction
- irrigation methods
- crop details
- status of soil resources including macro and micronutrients
- soil physical condition, soil moisture, and livestock details
- Area, population
- gender
- vulnerable population and household, details of MGNREGA job seekers
- drinking water sources and
- grey water generation

Spatial Parameters



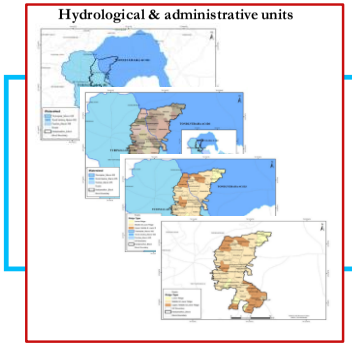
- Vulnerability assessment in 1281 Gram panchayats
- Vulnerable GP's/Block
- Contributing indicators to the total vulnerability

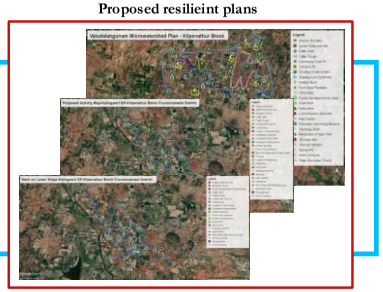


TN WAASCA: Compendium of Activities 2021Block level CWRM reports 2022;

7

Resilience plans through CWRM & MGNERGA convergence





TN WAASCA: Compendium of Activities 2021; Block level CWRM reports 2022

8

Key Water Actions & Climate Resilient Measures under converge

Public & common land

	RMD	TVM
Water Bodies Restored	7561	5264
Afforestation (Ha)	40704	29.8%
Drainage line treated(Km)	1476	8488
Linear plantation(Km)	2555	2641
Silvipasture (Ha)	191	2907

Rural infrastructure

	RMD	TVM
Soak pits community	3,895	16547
Soak pits (Ind)	38,985	49169
Tanka's	2	-
Nutri garden	390750	472845
RRWH	858	1640

Agriculture & Allied Activities

	RMD	TVM
Farm Ponds	10,084	9,482
Mulchiing (Ha)	16,149	52,989
Fallow land Restored (Ha)	84,537	141370
Land development (Ha)	12,668	22,483
Fodder Production Units	19,170	27091
Farm Bunds	32,926	14,099
Azolla Production	2,329	33,669
AGRO-FORESTRY(Ha)	116332	24,892
Vermi Compost	2329	37889
Micro irrigation (Ha)	7,700	20143

23 CRM Models – Drought, heatwave, flood, SLR

Proposed Treatment Area
- ✓ RMD: 19 %
- ✓ TVM : 29 %

Runoff conservation (MCM)
- ✓ RMD:219
- ✓ TVM :407

Families employed
- ✓ RMD: 40,704
- ✓ TVM: 45,477

TN WASCA: Compendium of Activities 2021

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Case Study - CWRM Plan, WASCA TN

Kilapakam Gram Panchyat

Vandavasi Block,

Tiruvannamalai District :

DRDA- Tiruvannamalai

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Climate Table	Minimum (°C)	Maximum (°C)	Diff D/N Temp	ET expressed in mm	ET Loss in HaM	Volumetric Soil Moisture (%)	Normal Rainfall (mm)	% of Normal Rainfall (mm)	Normal Rainy days (No.)	% Normal Rainy days (No.)
1	2	3	4	5	6	7	8	9	10	11
June-19	26.4	35	8.6	110	34.41	31	465.8	45%	89	52%
July-19	27.5	36	8.5	112	34.41	42				
August-19	27.3	34.5	7.2	100	31.29	30				
September-19	26.7	33.7	7	95	31.29	25				
October-19	26.1	32.8	6.7	84	25.03	34	439.8	42%	72	42%
November-19	25.7	32.8	6.7	60	18.77	20				
December-19	24.5	30.9	7.1	54	15.64	16				
January-20	23	28.6	5.6	57	18.77	16	45.8	4%	0	0%
February-20	22	27.6	5.6	45	15.64	4				
March-20	21.1	28.5	7.4	13	3.13	14				
April-20	22.2	30.3	8.1	17	6.26	15	95.2	9%	11	6%
May-20	23.8	33.1	9.3	57	18.77	32				
Average / Total			7.32	67.00	253.41	23.25	1046.60		172	

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Vulnerability Analysis

Vulnerable HHs for Future Livelihoods (source: Census 2011 & SECC data)	
Deprived HH	121
Included HH	1
Total	122
Most Vulnerable HH	
Female Headed HH	28
SC/ST HH	44
HH with disable member	1
No Adult member 16-59	38
Most Vulnerable HH	111
HHs For Livelihoods Target Priority	
Year 1 Priority 1	45
Year 1 Priority 2	4
Year 2 Priority 1	45
Year 2 Priority 2	4
Year 3 Priority 1	22
Year 3 Priority 2	2

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Potential Works Under WASCA : CWRMP Land Classification Analysis

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Land Classification	Area in Ha	PC Area	Logic for Treatment	Proposed Treatment Available Area in Ha	Proposed Area For Plantation activity in Ha	Block Plantation (Comm)/ (Ind v)	No of Linear Community Plantations	No of Total Plantations	Estimated HHs Benefiting	SMC Work No of Trenches	Drainage Line Treatment Works in RMT	Estimated No of farm Ponds (Comm and Indv)	Estimated No of Farm bund with boundary trench	Estimated No of Land Development Area	Estimated No of Composting Farmers
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Forest Area	0	0%	40% of Area	0	0	0	0	0	0	0	0	0	0	0	0
Area under Non-Agricultural Uses	94.06	29%	Additional Area above 20% of TA	6.29	6.29	5,034	1,426	6,460	32	1259	3210	1	1	0	1
Barren & Un-cultivable Land Area	0	0%	75% of the total Area	0.00	0.00	-	-	-	0	0	0	0	0	0	0
Permanent Pastures and Other Grazing Land	1.98	1%	75% of the total Area	1.49	1.49	1,188	-	1,188	6	297	0	0	0	1.485	0
Land Under Miscellaneous Tree Crops etc	3.48	1%	75% of the Total Area	2.59	2.59	2,070	-	2,070	10	518	0	1	0	0	0
Culturable Waste Land Area	0.25	0%	75% of the Total Area	0.19	0.19	150	-	150	1	38	0	0	0	0.1875	0
Fallows Land other than Current Fallows	33.52	10%	25% of the Total Area	8.38	4.19	3,352	1,006	4,358	2	0	0	1.676	1.676	8.38	1.676
Current Fallows	92.38	28%	25% of the Total Area, out of this, 50% area is for Horticulture / Agro Forestry	23.10	11.55	9,238	1,848	11,086	5	0	0	9.238	9.238	0	4.619
Unirrigated Land	29.16	9%	Horticulture / Agro Forestry	7.29	3.65	2,916	583	3,499	1	0	0	2.916	2.916	0	2.916
Irrigated	70.44	22%	100% bore well farmers and 50% target for Horticulture	60.08	30.04	24,032	-	24,032	24	24	0	0		0	0
Total	325.24			109.40	59.98	47,980	4,862	52,842	81	2135	3210	15.83	14.83	10.0525	10.211

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Killapakam: WASCA-CWRMP - Micro Watershed Spread - Priority Analysis

Macro No.	Area (Ha.)	Micro W/s No.	Area (Ha)	Extent WS area in GP	% Area of WS to Total GP Area	% of WS in GP	WS Location	No of Drainage lines in the WS	Order of Drainage lines	No of Tank /Ooran	Extent of Tank in WS	Build up Area in Ha	Barren Land	Waste Land	Erosion land	Salt affected area	Run Off Area	Priority
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
4C2A1	54885.5	4C2A1d10c	420	19	6%	5%	Ridge Upper area	0	0	0	0	0	0	2	9	0	Good	1
		4C2A1d10a	638	6	2%	1%	Ridge Upper area	0	0	0	0	0	0	0	0	0		
									0	0	0	0	0	0	0	0		
4C2A1	54885.5	4C2A1e02c	498	194	60%	39%	Ridge Upper area	1	mid order	1	Ful Area	7.5	0	0	48	0	Good, Bad	1
		4C2A1e02b	519	106	33%	20%	Ridge Upper area	0	0	1	Ful Area	6.5	0	0	10	0	Good, Bad	2
Total				325								14						
Extent			2075	16%														

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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Catchment Classification	Area in Ha	% of Runoff	Run off HaM	% Run Off HaM	Proposed Targeted for Treatment	% of Treatment area to Total Catchment	Increased Area for infiltration due to Soakpits	Avenue Plantation in Ha	Natural Drinage lines treated in ha	Canal Net work in Ha	Tanks Area storage in Ha	Expected Storage & Recharge HaM	Expected RO treated in HaM
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Good Catchment	94.06	37.5	35.27	30.43%	10.34	10%	3.5	0.23	0.15	0.17	2.87	13.83	5.2
Average Catchment	5.68	28.1	1.60	1.38%	4.26	126%	0	0	0	0	0	4.46	1.3
Bad Catchment	225.5	18.7	42.2	68.19%	98.85	44%	0	0	0	0	0	103.49	19.4
Total	325.24		79.0		115.77	36%	3.5	0.23	0.15	0.17	2.87		25.8
												RO Treated	22%

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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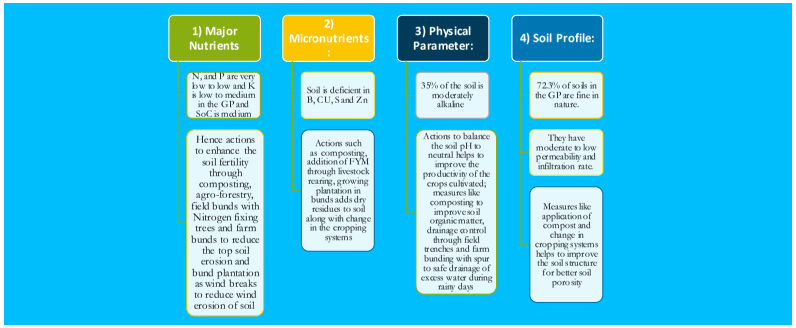
Soil Resources Analysis



CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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1) Tank Systems				
S.N.	Name of Structure	Existing Structures		
		No.	Area (Ha)	Storage Capacity (Ha.M)
1	Pond / Tank	2	1.89	0.65
2	Oorani	1	0.98	0.25
	Total	**3**	**2.87**	**0.90**
2) Natural Drainage Lines length in Mts				
	Natural Drainage Lines length	Length in Village Area (m)	Type of Use	
1	Kilpakkam Chitheri 2 Channel	1500	Irrigation	
3) Canal Network (Mts) and Minor Irrigaton				
1	Main Canal	950	Irrigation	
2	Minor			
3	Distributaries			
4	Water Courses (Field Channels) (MI Tank)	760	Irrigation	
	Total	**1710**		

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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85 % of the total water requirement for agriculture is met through Ground water and only 15% is met via Surface water. Hence equal importance is necessary to augment both ground water and harvest and store surface water

Status of Irrigation Facilities-Surface Water (Source: Census 2011)				
S No	Source	Type	Area Irrigated (Ha)	% of Type
1	Surface Water	Canals Area	0	0.0%
2	Surface Water	Tanks/Lakes Area	10.36	14.7%
3	Surface Water	Waterfall Area	0	0.0%
4	Ground Water	Wells/Tube Wells Area	60.08	85.3%
5	Other Source	Other Source	0	0.0%

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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Killapakam: WASCA CWRMP: Agriculture Water Requirement				
Sl No.	Crop	Irrigated Area (Ha)	Rainfed area (Ha)	Total volume in (Ha M)
1	Paddy	25.30	0	38.0
2	Ragi	1.00	0	0.5
3	Other pulses	10.88	3.53	5.6
4	Sugar cane	5.20	0	10.4
5	Mango	0.00	0.55	0.3
6	Banana	0.39	0	0.9
7	Brinjal	0.20	0	0.1
8	Green chillies	0.80	0	0.5
9	Water melon	1.00	0	0.3
	Total	**44.76**	**4.08**	**56.5**

8% area under rainfed and 92% under irrigation. Of the irrigated area, 57% area under Paddy - a high water requiring crop; being an OE block and 85% of water requirement is through Ground water - change in the cropping system with low water requiring crops like millets, pulses as well as increase the water use efficiency through technologies like SRI and Alternate wetting and drying is necessary

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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Type of Animal	Numbers	Water Req. (HaM)	Percentage	Water Met from Ground Water	Water Met from Surface Water	No of Shelters	Fodder Plots Ha	Cattle Trough
1	2	3	4	5	6	7	8	9
Cattle (Indigenous)	797	2.91	67%	67%	0%	20	10.0	10.0
Cattle (Cross breed)	0	0.00	0%	0%	0%	0	0.0	0.0
Buffaloes	3	0.02	0%	0%	0%	0	0.0	0.0
Sheep	139	0.05	12%	0%	12%	2	0.0	0.0
Goat	222	0.08	19%	0%	19%	6	0	0.0
Horses and Camels	0	0.00	0%	0%	0%		0.0	0.0
Pigs	2	0.00	0%	0%	0%	0	0.0	0.0
Poultry	0	0.00	0%	0%	0%	0	0.0	0.0
Dogs	11	0.00	1%	0%	1%	0	0.0	0.0
Rabits	17	0.00	1%	0%	1%	0	0.0	0.0
Total	1191	3.06		67%	33%	0	0.0	0.0

Of the total water requirement, 67% is met through ground water and remaining 33% is through surface water

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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Availability of Drinking water

92% is depending on ground water and only 8% of total drinking water requirement is met through surface water

Type	Surface Water	Ground Water	% SW	% GW
Tap Supply (FHTC)	0	18	-	-
Tap Supply: Public	0	9	-	-
Handpump	0	6	0%	50%
Open well	0	3	0%	25%
Borewell	0	2	0%	17%
Tank/ Pond/ Oorani	1	0	8%	0%
	1	11	8%	92%

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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S.N	Waste water generation Source	Per day/unit wastewater generation in L	Daily volume of Grey water in L	Annual Grey water in CuM
1	Bathing	15	18675	6816.38
2	Washing	10	12450	4544.25
3	Toilet	10	12450	4544.25
4	Cleaning	5	6225	2272.13
5	Cooking and cleaning Utensils	5	6225	2272.13
6	Others	5	6225	2272.13
	Total	**50**	**62250**	**22721.25**
	Annual Grey water generated in HaM			**2.27**

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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Water Quality Profile

1

Chemical Contaminants (Nos. of Sources with Single Chemical Contaminants): Nil

2

Bacterial and Other Contaminants (Nos. of Sources with Bacteriological Contaminants): Nil

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

23

Water Demand

Water Demand Estimation					
Water Users	Total Annual Requirement (HaM)	Requirement met by Gr. Water (HaM)	Requirement met by S.Water (HaM)	% Gw	% SW
Human	3.41	3.12	0.28	92%	8%
Animals	3.06	2.06	1.00	67%	49%
Agriculture	56.48	48.17	8.31	85%	15%
Industry	0.00	0.00	0.00	0%	0%
Other (specify)	0.00	0.00	0.00	0%	0%
Total	62.95	53.35	9.60	85%	15%

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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Water Budget in HaM

Parameter	Water Budget (Ha.M)
Water for Human	3.41
Water for Agriculture	56.48
Water for Animal	3.06
Water for Industry	0.00
Water for Other Purposes	0.00
Village wise water required	62.95
Available run-off from rain water	79.04
Harvested Runoff from Water Harvesting Activities	0.90
Potential Harvesting from proposed Interventions	25.79
Total Water harvested	26.69
Water deficiency/Surplus	-36.26

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

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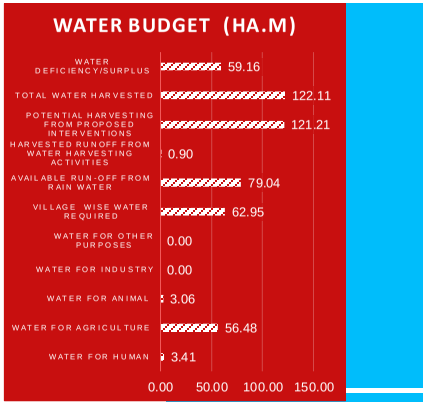
Killapakam GP Water Budget Estimate: CWRMP-WASCA

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai



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Vulnerable Population	13.33% of the population belong to SC community. SECC data 134 HH are vulnerable and out of them 122 are most vulnerable. These families to be provided with sustainable asset creation with water security and future livelihoods with climate resilient models.
Mahatma Gandhi NREGA	91.59% of job card holders participate in MGNREGS works.
Climatic profile	The average difference between D/N temperature is 7.3 degree Celsius. The max change in D/N temperature is noticed during the months of April - July.
Rainfall	89 rainy days during June-Sep with onset in first week of June and ending by first week of October; 72 Rainy days during October to December
Evapo Transpiration	Overall all due 804 mm ET is recorded as per WRIS data. The area influenced by ET is 56.76%. Influence area of ET is 31.285 Ha. It results in a total of 251.53 HaM water losses annually in the GP. The maximum losses of ET are observed during June-July months.
Soil Moisture	Most of the soils are fine and fine loamy with 18-22 % of soil moisture. The volumetric soil moisture data for the shows that during Jan-May 2020 are below this range. Hence during these months, protection measures on lands to be planned. Mulching, fodder development (dry / green); horticulture and if any plantations are taken up watering provision to be made mandatory during these period, with more watering during March-May months.

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Key Water Challenges: 1

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Key Water Challenges: 2

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Land Classification	No forest area
Micro Water Sheds	Out of four watershed boundaries passing through the GP, two watersheds are main, 4C2A1e02c,2b. The extent of these two watersheds in the GP are 39% and 20% respectively, These two watersheds constitute 60% and 33% of the total GP area. But the watershed 4C2A1d10c is very small portion(19Ha), but sheet erosion is noticed in this area. Hence these three watershed areas the WASCA project should focus and priority 1 are 10c,2C and priority 2 is 2b.
Soil Resources	N, and P are very low to low and K is low to medium in the GP and SOM is medium. soil fertility improvement measures such as composting, bund plantation of green manure trees which fix Nitrogen, farm bunding to reduce top soil erosion have to be taken up
Soil Profile	72.3% of soils in the GP are fine in nature. They have moderate to low permeability. Hence efforts to be made to encourage farmers to take up farm bunding with boundary trench, to enable enough soil moisture
Forest Resources	No Forest Land in the GP
Amount of Run-off	Agriculture lands (fallow, dry and irrigated areas) resulting in 68.19% of total Run off. From various proposed work it is estimated to treat 44% of bad catchment area, 75% of average catchment area and 13 % of good catchment area. Overall treatment proposed is 36.24% of catchment area. (excluded linear areas under DLT, Roads)

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Existing Water Harvesting Structures	Two tanks need renovation, One oorani needs renovation
Description of Natural Drainage Lines	One drainage line flowing through the GP, is falling under the major watershed area, connecting the tank. Hence deepening, widening the channel, slit trap and grass trough development or plantations will help to protect and improve the channels. If needed, the channels connecting to tanks, near to that area, lining can be provided to reduce the water losses.
Canal Network	Total of 1710 mt of canal water system if noticed. Of this 44% are field channels. The field channels if de-silted, widened, sides strengthened with vegetation and start point of the courses can be provided with lining up to 10-50 mts.
Availability of Drinking water	A total of 38 drinking water sources are noticed in the GP, Of the 38 sources, 47% are FHTC and 24% are Public taps, constitute majority of the sources. Data on dependent families are not available in secondary sources. As and when primary source data is collected, data will be entered in this section.
Status of Irrigation Facilities-Surface Water	85.3% of agriculture is depending on ground water sources.
Means of Water Extraction	38 Sources of water are noticed in the GP, providing services for irrigation, drinking water. 68% of sources is used for irrigation purpose ad 32% are used for domestic requirements.
Water Application practices for Irrigation	Mostly flooding is followed under tube well farming and tanks system-controlled flooding.

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Key Water Challenges: 3

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Key Water Challenges: 4

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Chemical Contaminants	No chemical contamination is reported
Bacterial and Other Contaminants	No bacterial contamination is reported.
Assessment of Grey Water Generation	2.27 CuM of grey water is generated. Through soak pits (Indv and community) the grey water can be managed.
Details of Domestic Grey Water Drains	Details of existing grey water drains will be collected during ground truthing and data will be filled for action.
Water Demand Estimation (Primary Information)	85% dependency on all water requirement in the GP is on ground water.
Village Wise Water Budgeting	The GP is Over Exploited. The Water budget is deficit. The total water harvested is very low. The available run-off to be harvested is 79HaM.

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Activity	Numbers	Activity	Numbers
Treatment measures of upper slopes		Treatment measures for farmlands and Rural Village	
Afforestation	32474	Composting	15
Contour Continous Bunds (CCB)	2135	Farm Bunding cum trenches	10
Drainage Line Treatment (DLT)	3210	Construction of farm ponds	15
Treatment measures of middle slopes		Silt application	10
Loose Stone Check Dam (LSCD)	1	Land development	4
Water Absorption Trench (WAT)	2111	dryland horticulture	15506
Linear Plantation	4862	Drinking water measures	
Avenue plantation	2314	Rooftop Rainwater Harvesting	2
Block Plantation	8440	Grey water management	
Treatment measures of gentle slopes		soak pits - Vulnerable HH	134
Deepening of waterbodies	1	Livelihood activities	
Desiltation of waterbodies	2	Cattle shed	20
Waterbody Bund strengthening	2	Ffodder plot	10
Inlet development with silt trap of Waterbodies	1	Goat shed	6
Surplus/waste weir	1	Sheep shed	2
Recharge shaft/dug wells	24	Cattle trough	10
Treatment measures for canal network		Azolla unit	20
Canal Bed levelling	1710	Vermi compost	20
CanalBund Plantation	760	Nutrigarden	134
Canal side plantation	200		

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Proposed Activities

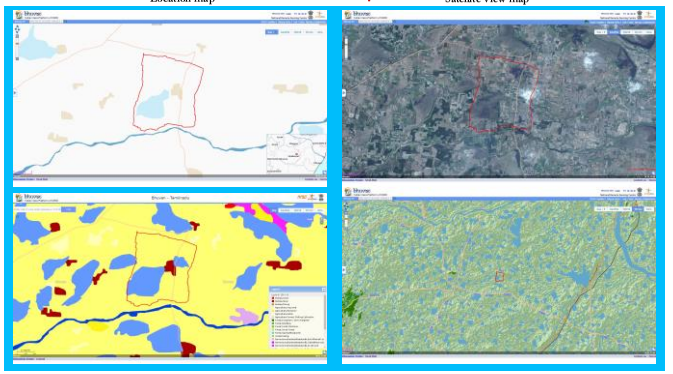
CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Thematic maps

Location map

Satellite view map



Land use land cover map

Terrain map

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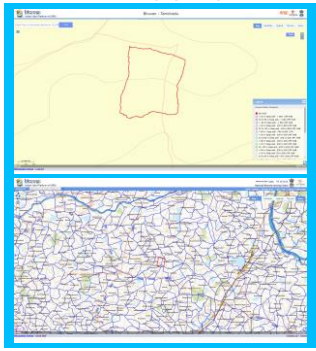
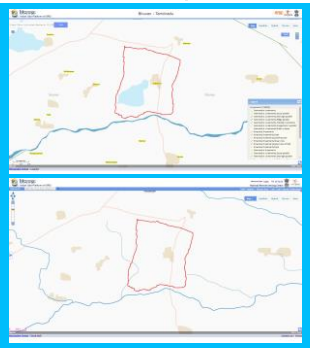
CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Thematic maps

Ground water prospects map



Lineament map



Watershed map

Drainage and surface water bodies map

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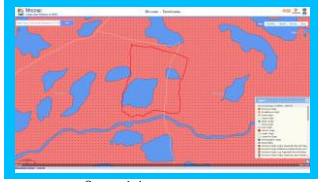
CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

Thematic maps

Salt affected area map

Erosion map

Geomorphology map



Wasteland map

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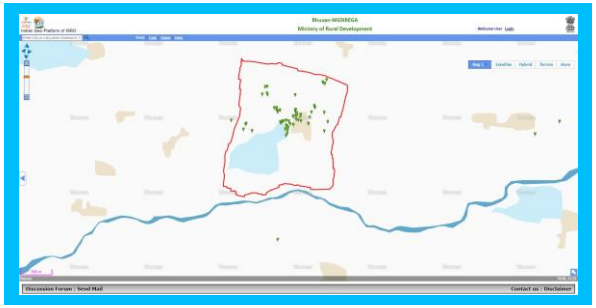
CWRM Plan, Kilpakkam GP, Vandavasi block, Thiruvannamalai

MGNREGA Asset MAP



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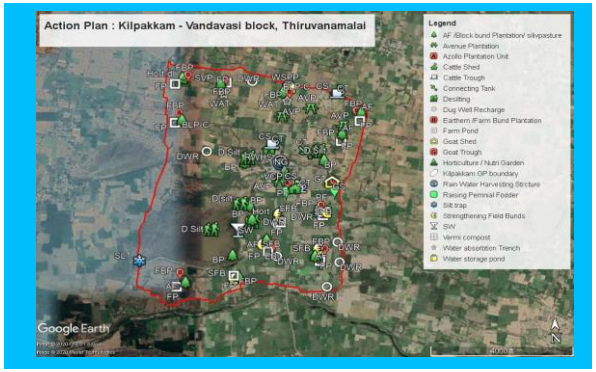
Killpakam CWRMP GP Plan: WASCA-TN



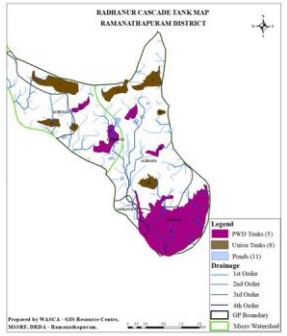
36

Climate Resilience Measures

37

CRM - Ramanathapuram District – Tank Cascade

Tank Cascade	▪ Planned to implement tank cascade with 13 tanks and 11 ponds in Radhanur GP, RS Mangalam block.



38

CRM - Ramanathapuram District - Tanka

Tanka	▪ Tanka is a traditional rainwater storage practice being replicated from Rajasthan to Ramanathapuram in the place of Ooranis, a traditional small pond to ensure safe drinking water. ▪ A gender sensitive and climate responsive solution to tackle water insecurity among vulnerable communities.

39

CRM - Ramanathapuram District – Riverbank stabilization through Plantation

Riverbank stabilization	● Prosopis Juliflora removed from the riverbank and ~1,00,000 tree saplings have been planted on each side of the bank ● Mini-and mega forest has now turned into a sanctuary of 133 endangered tree species. ● Stabilization of riverbank and establishment of mini and mega forests is thus proved as climate resilient measure. ● Urapuli GP, Ramanathapuram is a concrete example of nature positive solution mediated through riverbank stabilization.

40

CRM - Ramanathapuram District – Mini forest

Mini forest

- Mini forest: Planted 5 lakh native trees adopting "Miyawaki" technique.
- It is one of the afforestation methods that has been promoted with 33 locally adapted tree species planted under ultra-high-density plantation with multi-layer system.
- Proven as a best model for the degraded land development, helps to reduce soil erosion, improve the soil moisture and soil health by building organic matter and fixing soil organic carbon, build micro climate and promote biodiversity.
- Planned to promote 50-60 types of enterprises covering one Livelihood activity in each GP (in 429 GPs).

41

CRM - Ramanathapuram District - Mega forest

Mega forest

- A horizontal up scaling strategy of the Mini forest plantation to restore the degraded public and common dry land, thus reduce the soil erosion, improve the infiltration of water and ecosystem service of the land for farming and natural resources conservation

42

CRM - Ramanathapuram District – Livelihood clusters

Livelihood clusters

- Livelihood thematic parks focusing on women: Demonstrated as a method to restore the degraded public land adopting locally relevant themes like Integrated Farming System, trees suitable for dry land horticulture, Agroforestry, silvi pasture, bamboo plantation and food crops with a focus to millets and grain legumes.
- An innovative approach the revive the locally adapted trees and crops by efficiently harvesting and conserving surface runoff water, soil moisture and reduce land degradation.
- 11 thematic parks in 11 blocks with focus to integrated farming, silvi-pasture development, dry land horticulture, dry land annual crops with SHG women

43

CRM - Tiruvannamalai District - Greening of Hillocks

- 68.5 Ha of hillocks were treated with 4000 continuous contour trenches, planted 29972 trees, six gabion structures, seven rockfill dams, 6 check dams, 8 percolation tanks, and 35 farm ponds with more than 100 ha under agroforestry plantations were carried out.
- Increased vegetation cover reducing soil erosion and siltation in water bodies and increasing the groundwater recharge in the downstream
- It supports ten village communities in the down hillocks and promotes agriculture in a 2500ha area covering 2000 farmers and other communitie

Degraded hills – Before treatment in 2019

Hills after treatment in 2022

44

CRM - Tiruvannamalai District – Fallow land development

Fallow Land Development	▪ Identification of farmers are in progress for this year and last year 314 Ha covered for Rs.34.6 lakhs invested by Dept of Agriculture in West Arni, Arni and Polur blocks ▪ 314 ha of fallow individual land has been restored for cultivation which improve land productivity by enhancing in-situ water harvesting and storage within the field and reducing soil degradation and erosion

45

CRM - Tiruvannamalai District – Nursery development with locally adapted species

Nursery Development	▪ 31 block nurseries are planned ▪ 5 district nurseries are planned ▪ Target to raise 27 lakhs plants ▪ 18 block level nurseries at block level, produced 2 lakh quality tree seedlings of 14 native tree species. ▪ The common degraded land has been restored and a scientific nursery management skill is promoted among Mahatma GandhiNREGS job card holders.

46

Tiruvannamalai District – Farm ponds

Farm ponds	▪ Suitable location identified for farm ponds using MGNREGA GP GIS plans & Tools. ▪ 1121 farm ponds in 541 GPs of 18 blocks are created at a unit cost of Rs. 1.78 lakhs with the total project cost amounting to Rs. 19.96

47

CRM - Tiruvannamalai District -Honey Park

Honey Park	▪ Area of the park - 6 Ha ▪ 1200 plants are planted for Honey Park

48

CRM - Tiruvannamalai District -Silvi Pasture Development

Silvi-Pasture Development	▪ 27 Sites are implemented covering 17 Blocks. ▪ 18330 Plants are planted in 46 Ha.

49

Livelihood Thematic Parks (Bamboo Park)

Livelihood Thematic Parks (Horticulture Park)

50

CRM - Ramanathapuram District – Mangrove Plantation

Mangrove Plantation	▪ 9000 plants are planted in the Kavanoor GP, RS Mangalam block ▪ 3.64 ha of Area is taken for mangrove plantation.

51

CRM - Ramanathapuram District – Palm Seed Plantation

Palm Seed Plantation	▪ 17 lakh seeds were planted with 1.45 lakh of person days in 900 location.

52

Snapshots Resilient Activities

53

Acknowledgements

- GIZ India
- RDPR, Govt. of Tamil Nadu – State & District officials
  - District Rural Development Authority – RMD & TVM
  - DRD Government of Tamil Nadu
- Centre for Climate Change and Disaster Management, Anna University
- M S Swaminathan Research foundation
- Sugandhi Devadasan Marine Ressources Institute
- Prime Meridian
- Key experts (Mr. Lakshmikantham, Dr. Manivannan, Mr. Raja & others)
- MGNERGA work force

REFERENCE

http://tnwasca-mgnrega.org/

54

CLIMATE CHANGE IMPACTS ON WATER RESOURCES

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CCCDM, ANNA UNIVERSITY

1

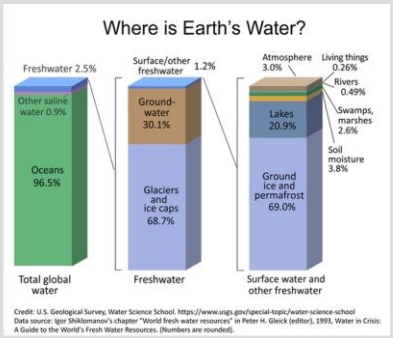
CONTENT

- WATER RESOURCES STATUS – Global & Regional Scale
- CLIMATE CHANGE IMPACT ON WATER RESOURCES - Global & Regional Scale
- CLIMATE CHANGE ASSESSMENT – AR6 Scenarios
- OPERATIONALIZATION OF CLIMATE STUDIO – Water Resources
- FLOOD & DROUGHT RISK – Tamil Nadu (AR6 Scenario)

2

2

WATER RESOURCES – GLOBAL SCALE



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3

WATER STRESSES - INDIA

- Decreasing per capita availability of water
- Extremely low efficiencies of water use, especially in irrigated agriculture
- Indiscriminate use of groundwater
- Rapid urbanization with little scope for increasing infrastructure; limited water availability for urban sustenance in many cities
- Increasing Flood and Drought
- Climate change most likely to aggravate the situation

4

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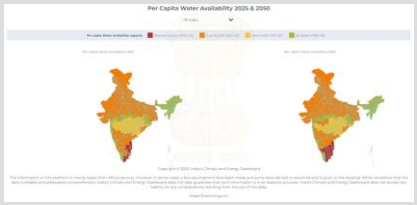
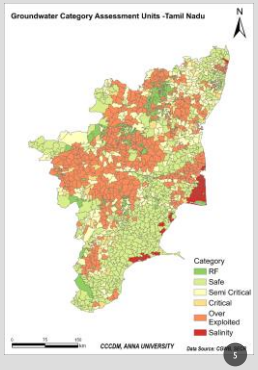
WATER AVAILABILITY 2025 & 2050





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WATER RESOURCES STATUS – TAMIL NADU

Surface Water Potential

Sl. No	River Basin	Surface Water Potential (MCM)
1	Agniyar	637
2	Cauvery	5358
3	Chennai	1062
4	Gundar	549
5	Kallar	128
6	Kodaiyar	916
7	Nambiyar	203
8	Palar	1393
9	Pambar Kottakaraiyar	648
10	PAP	675
11	Paravanar	176
12	Pennaiyar	1319
13	Thamirabarani	883
14	Vaigai	842
15	Vaippar	715
16	Varahanadhi	589
17	Vellar	981
	TOTAL	**17074**

Contribution from Neighbouring State

SW release expected from Andhra Pradesh	218.03 MCM
SW release expected from Kerala	1670.7 MCM
SW release expected from Karnataka	5720 MCM

6

Data Source: Institute of Water Studies, WRD, Tamil Nadu (2018)

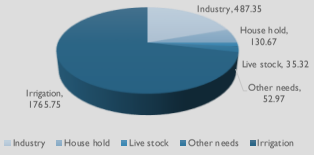
6

WATER RESOURCES STATUS – TAMIL NADU

Groundwater Potential

Annual Extractable GW Resources	19090.09 MCM (674.16 TMC)
Net Annual Ground Water Availability for Future Use	6420 MCM (226.72 TMC)

Water Demand (TMC)



Total Potential of the State

Surface Water (SW)	17074 (MCM)
Groundwater (GW)	19089.8 (MCM)
Contribution from Neighboring State (AP + Kerala + Karnataka)	7608.7 (MCM)
Total	**43772 (MCM); 1545.8 (TMC)**

Supply – Demand Gap

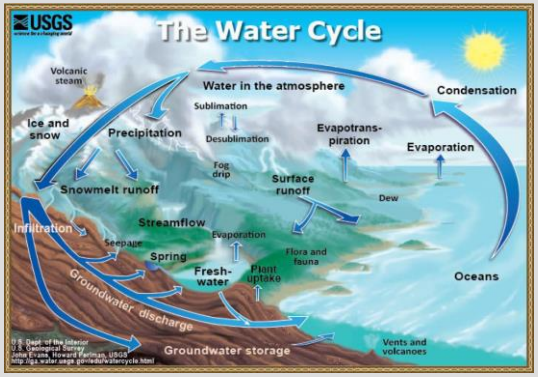
Water Availability	1545.8 (TMC)
Total Demand	2472.05 (TMC)
Gap	**1014 (TMC)**

7

Data Source: Institute of Water Studies, WRD, Tamil Nadu (2018)

7

HYDROLOGICAL CYCLE



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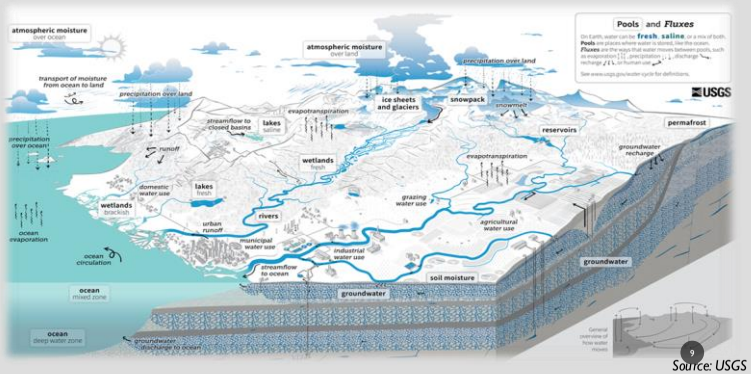
Source: USGS

8

HYDROLOGICAL CYCLE



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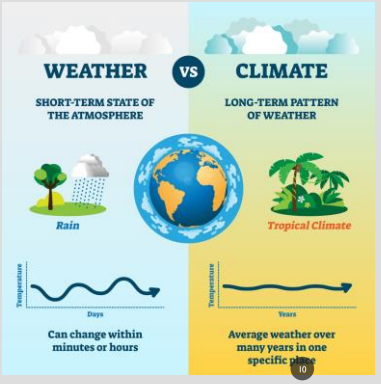
CLIMATE & WEATHER

WEATHER

- Weather is what conditions of the atmosphere are over a short period of time
- Weather can change from minute to minute, hour-to-hour, day to day, and season to season.

CLIMATE

- Climate is how the atmosphere "behaves" over relatively long periods of time.
- Climate, however, is the average of weather over time and space



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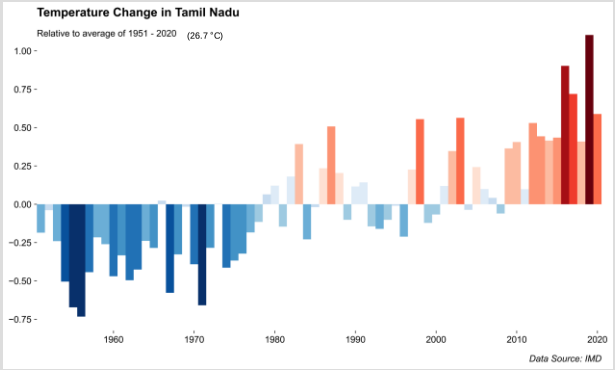
CLIMATE CHANGE - TAMILNADU



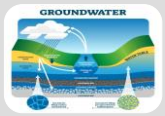
12

Effect of Climate Change on Water Resources

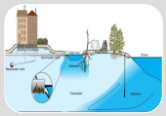
Altering Hydrological Cycle

Increase in Drought Events

Increase in Flood Events



Influence on Groundwater Recharge



Increase in Coastal Salinity

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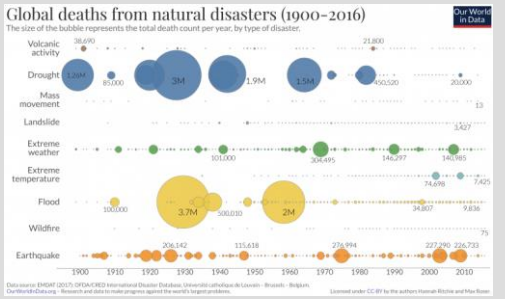
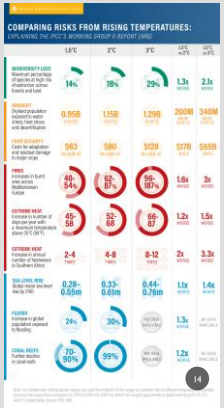
NATURAL DISASTERS





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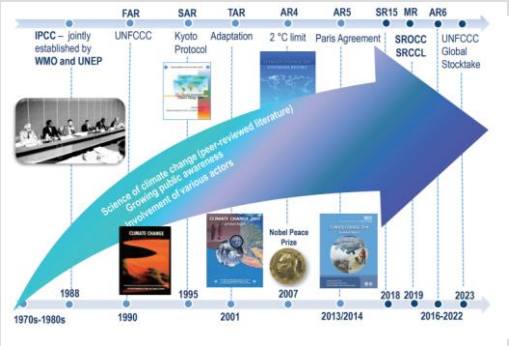
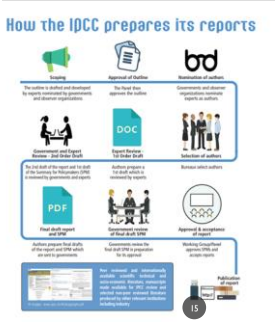
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)





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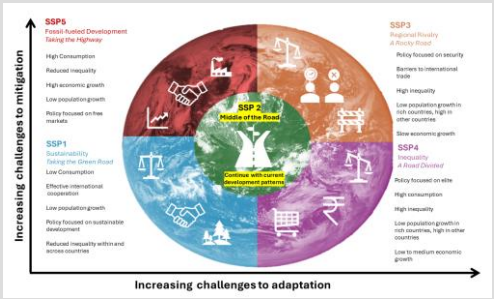
SSP SCENARIOS



The recently released Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) incorporates the SSPs to explore different socio-economic development pathways and their associated climate change consequences

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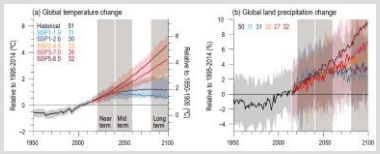
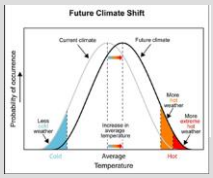
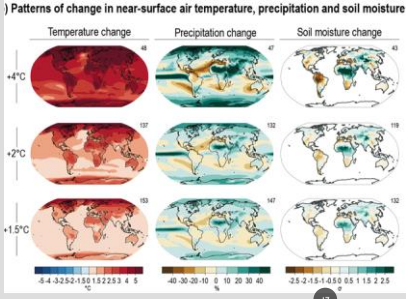
CLIMATE CHANGE PROJECTIONS – SSP SCENARIOS







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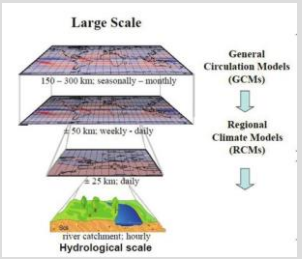
NECESSITY FOR DOWNSCALING

	Better simulated	Less-well simulated	Not well simulated
Spatial scales Mismatch	Global (500x 500 km)	Regional (50 x 50 km)	Local (0 -50 km)
Temporal scales Mismatch	Mean annual and Seasonal	Mean Monthly	Mean daily
Vertical scale Mismatch	500 hPa	800 hPa	Earth surface
Working variables Mismatch	Wind, Temperature, Air pressure	Cloudiness, Precipitation, Humidity	Evapotranspiration, Runoff, Soil moisture

GCM Ability Declines

Hydrological Importance Increase



Source: Xu Chong-Yu, (1999)

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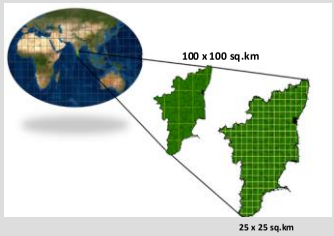
DOWNSCALING OF GLOBAL CLIMATE MODELS

Two main approaches for downscaling climate model outputs are



Statistical Downscaling

Dynamical Downscaling

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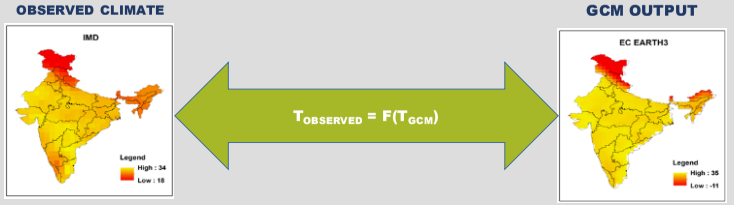
STATISTICAL DOWNSCALING

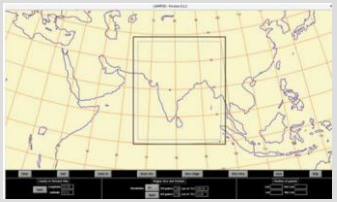


- Statistical downscaling methods use the empirical relationship between large-scale circulation based predictor variables and regional climate variables
- It is based on the assumption that the statistical relationship between large-scale GCM outputs and observational data established for the present-day climate remain unchanged in future climate

20

DYNAMICAL DOWNSCALING

- A Regional Climate Model (RCM) is used with GCM outputs to create higher spatial resolution data via dynamical downscaling.
- RCMs can simulate the past or predict/project the future regional climate
- They require spatially detailed topography and land-use datasets as input data, as well as initial and boundary conditions(which are generally created from GCM outputs)



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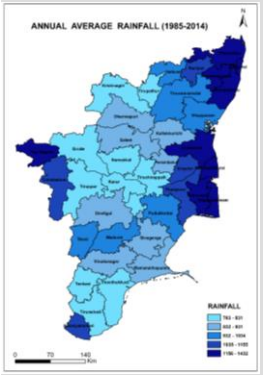
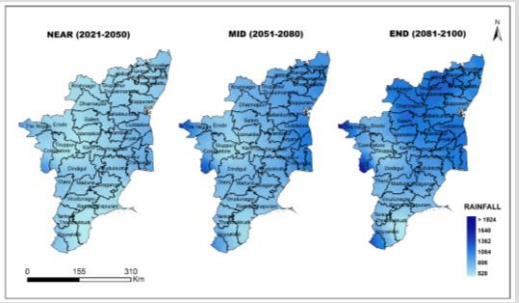
OBSERVED AND PROJECTED RAINFALL (SSP2-4.5) – TAMIL NADU





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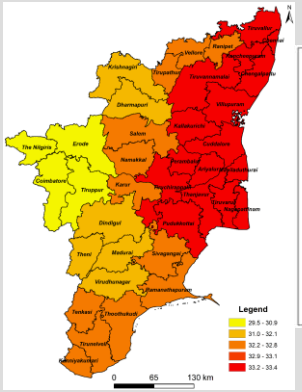
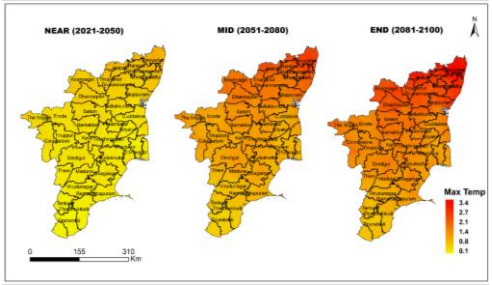
OBSERVED AND PROJECTED TEMPERATURE (SSP2-4.5) – TAMIL NADU





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CLIMATE CHANGE IMPACT ASSESSMENT

Precipitation, Temperature, Radiation, Humidity

Topography, Landuse, Soil and Other Catchment data

Future Water balance analysis at Basin or sub-basin scale (Water Availability, Demand, ET, Soil Moisture, Groundwater recharge)

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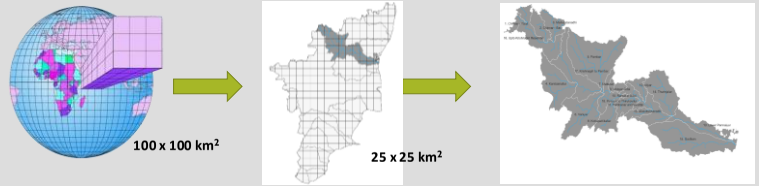
HYDROLOGICAL MODELLING - REGIONAL CLIMATE MODEL



Hydrological Variables

a) Rainfall
b) Minimum Temperature
c) Maximum Temperature
d) Relative Humidity
e) Wind Speed Velocity
f) Solar Radiation

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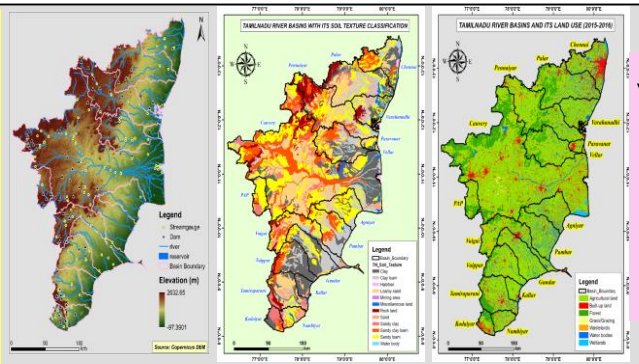
HYDROLOGICAL MODELLING – INPUT LAYERS

SWAT INPUT LAYERS



DEM Map | Soil Map | Land use Map

WATERSHED DELINEATION & HRU (Hydrologic Response Unit) ANALYSIS

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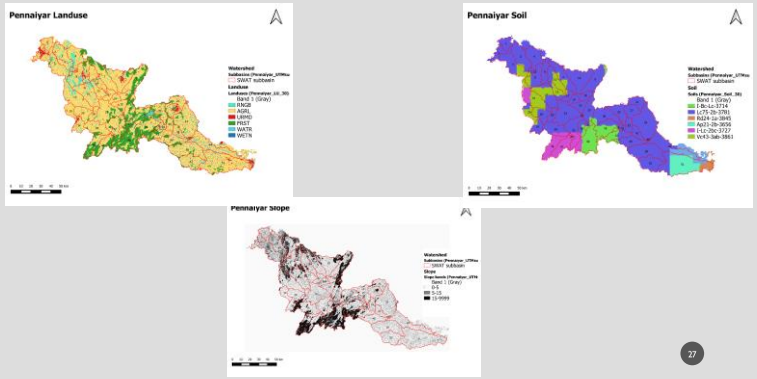
26

HYDROLOGICAL VARIABLES SIMULATION – PENNAIYAR BASIN SSP SCENARIOS



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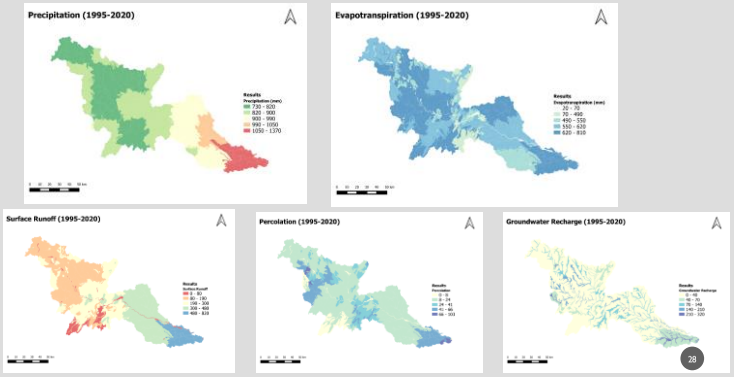
HYDROLOGICAL VARIABLES SIMULATION – PENNAIYAR BASIN SSP SCENARIOS



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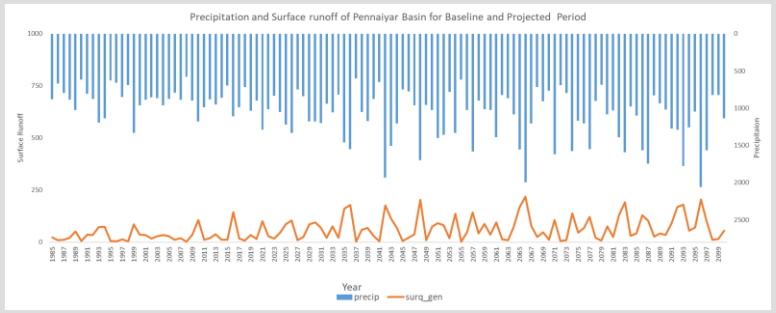
HYDROLOGICAL VARIABLES SIMULATION – PENNAIYAR BASIN SSP SCENARIOS



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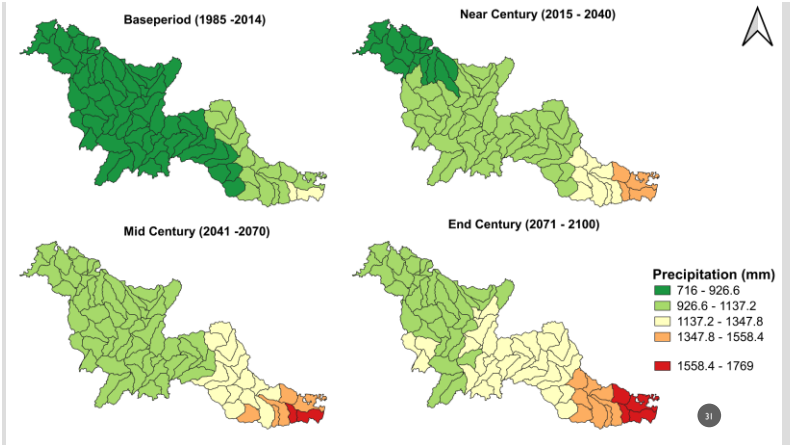

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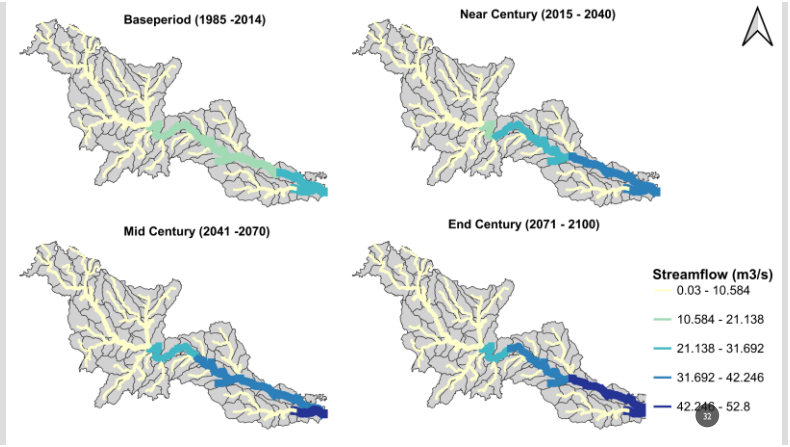

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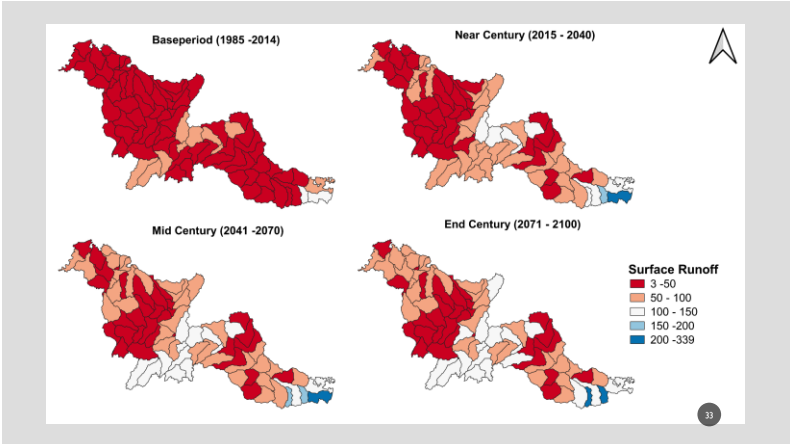

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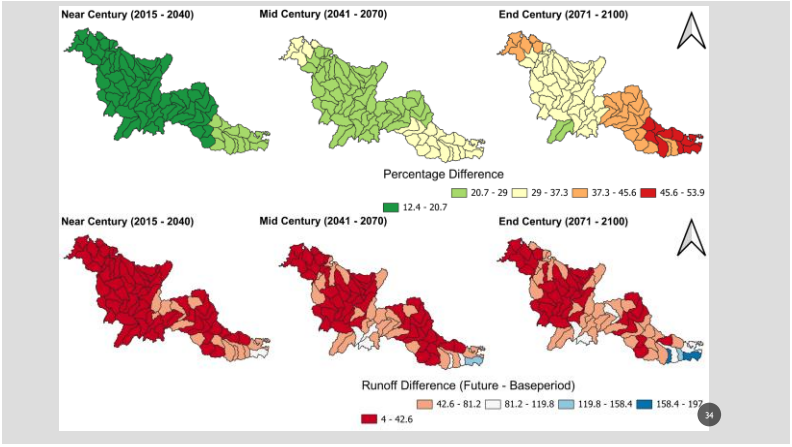

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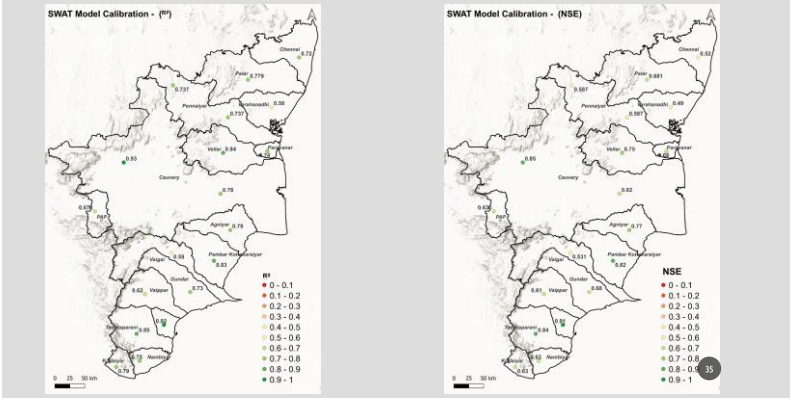
Hydrological Model Calibration



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OPERATIONALIZATION OF CLIMATE STUDIO – WATER RESOURCES

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CLIMATE RISK

Hazard

The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Exposure

The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.

Vulnerability

The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

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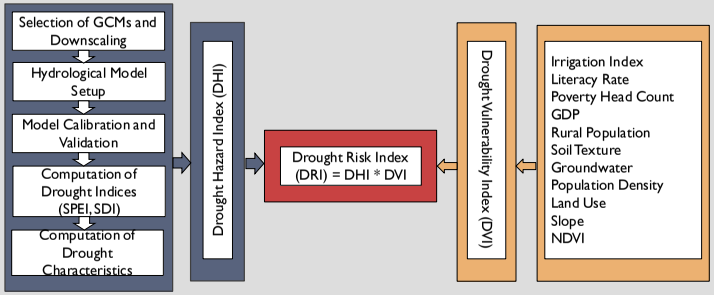
DROUGHT RISK ASSESSMENT - METHODOLOGY



(Maccioni et al., 2015), (Carrao et al., 2016), (Sahana and Mondal, 2023), (IPCC AR6 – WG II)

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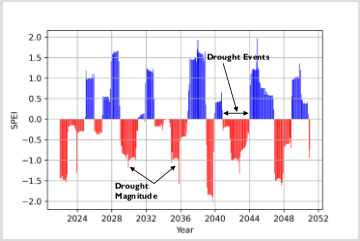
DROUGHT HAZARD ASSESSMENT



Index value	Drought class
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
0.99 to −0.99	Near normal
−1.0 to −1.49	Moderately dry
−1.5 to −1.99	Severely dry
−2.0 and less	Extremely dry

$$DHI_{SPEI} = \omega_1[score(DM)] + +\omega_2[score(FRQ)]]$$

ω_1 , ω_2 are the weights; Drought Magnitude and Frequency

$$DHI_{final} = DHI_{SPEI} + DHI_{SDI}$$

(Maccioni et al., 2015), (Carrao et al., 2016), Singh et al., 2019,(Sahana and Mondal, 2023), (IPCC AR6 – WG II)

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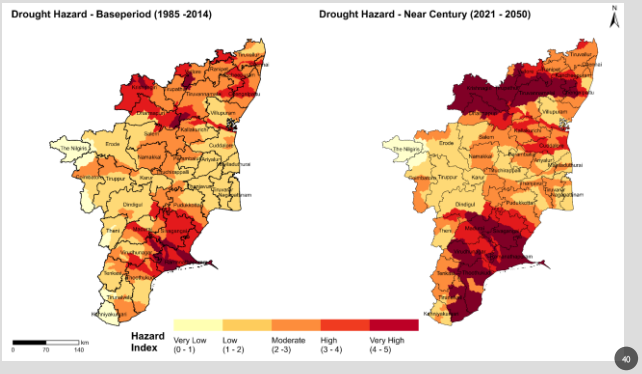
DROUGHT HAZARD INDEX– TAMIL NADU



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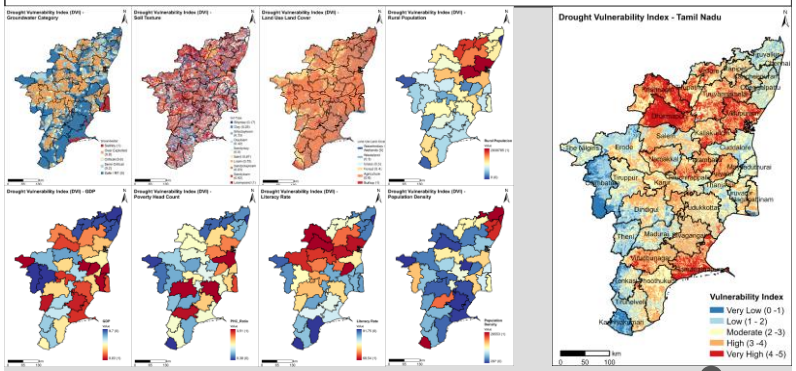
DROUGHT VULNERABILITY INDEX – TAMIL NADU



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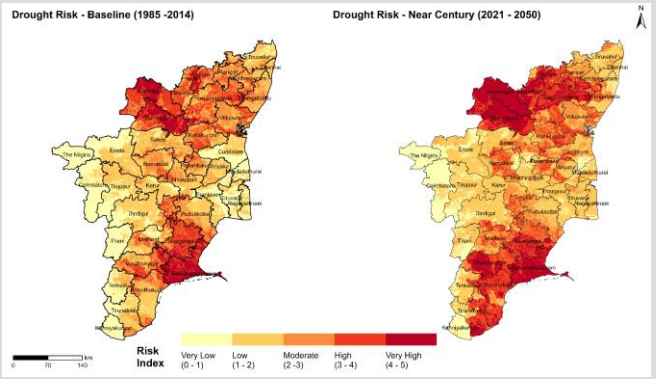
DROUGHT RISK INDEX– TAMIL NADU



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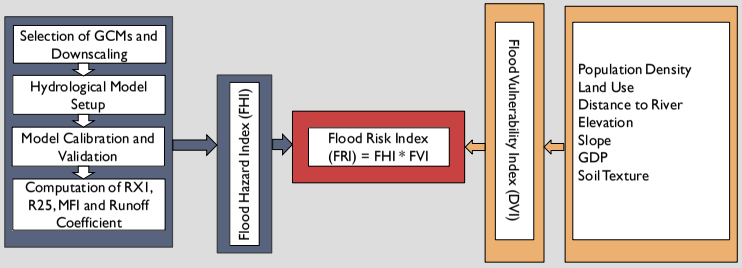
FLOOD RISK ASSESSMENT - METHODOLOGY



(ShadmehriToosi et al., 2020), (Tanoue et al., 2016), (IPCC AR6 – WG II)

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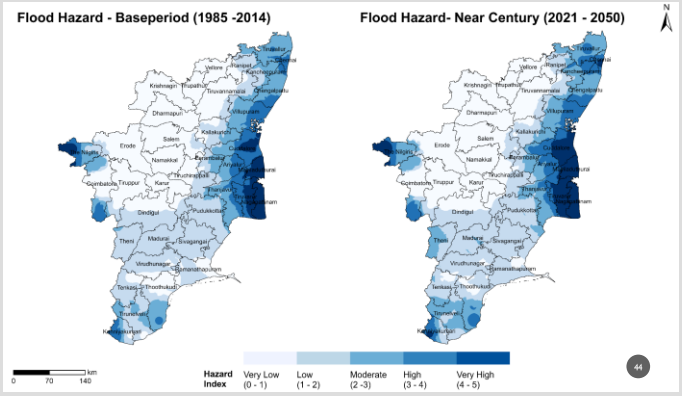
FLOOD HAZARD INDEX– TAMIL NADU



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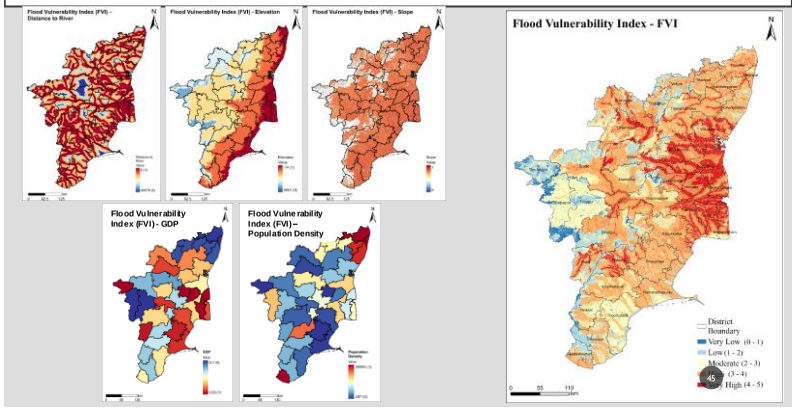
FLOOD VULNERABILITY INDEX – TAMIL NADU



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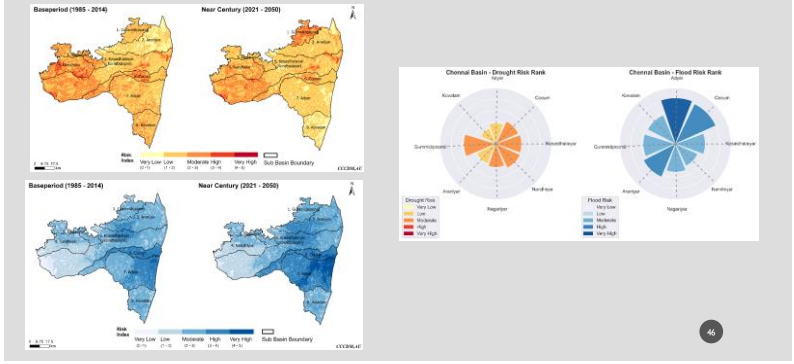
CLIMATE RISK IMPACT ON CHENNAI RIVER BASIN



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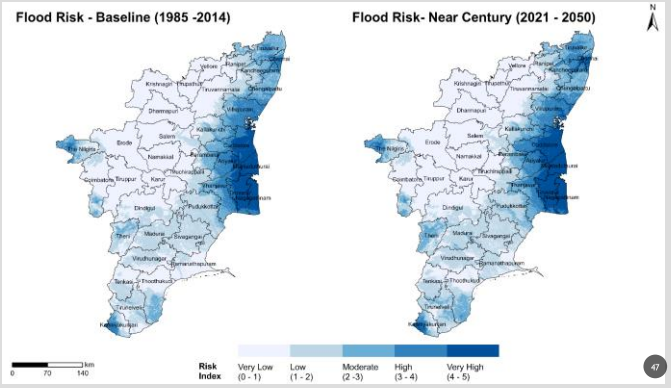
FLOOD RISK INDEX– TAMIL NADU



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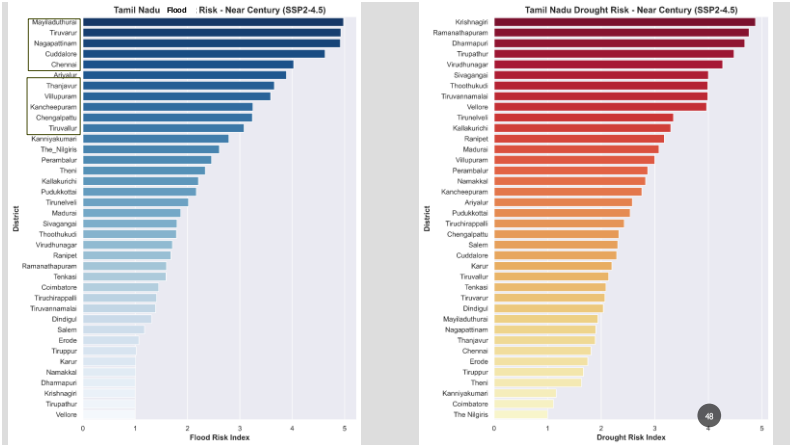

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Centre for Climate Change and Disaster Management
Department of Civil Engineering, Anna University, Chennai - 600 025

VISION

The CCCDM to be the Centre for Excellence to address challenges of Climate Change and Disaster Management

MISSION

- Disseminating Knowledge of regional climate risks and cadastral level climate resilient actions to cope up with changing climate
- Promoting climate science and disaster risk reduction research
- Strengthening the capacity for climate change adaptation, mitigation and disaster risk reduction

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