REPORT ON

REDUCING EMISSION THROUGH INCREASING GREEN COVER AND CARBON SINK IN TAMIL NADU: A WAY FORWARD

Organised by
Centre for Climate Change and Disaster Management (CCCDM)
Anna University, Chennai – 600025

Funded by
State Planning Commission (SPC),
Government of Tamil Nadu

PREAMBLE

The State Planning Commission, Government of Tamil Nadu had sanctioned an amount of Rs. 2,01,250/- (Rupees Two Lakh One thousand two hundred and fifty only) to the Centre for Climate Change and Disaster Management for conducting two-days Seminar on "Reducing Emission through increasing green cover and carbon sink in Tamil Nadu: A way forward" vide Proc .Roc. No: 976/SPC/LUD/2020 dated 23.03.2020. Due to COVID-19 restrictions, the seminar was conducted in the year 2021-2022.

The **objective** of the programme was to address the goals of the Green India Mission (GIM) to respond to climate change by a combination of adaptation and mitigation measures, which will help to enhance carbon sequestration and sinks and adaptation of vulnerable species/ecosystems to the changing climate and adaptation of forest-dependent communities.

Two events were conducted under this programme:

- A webinar on the theme, "Reducing Emission through increasing Green Cover and Carbon Sink in Tamil Nadu: A way forward" on 21st January 2022 in Microsoft Team Platform.
- Training programme on "Estimation of Carbon sequestration and Carbon sink" was held on 11th and 12th February, 2022 for Forest Range Officers and Foresters at Guindy National Park Auditorium.

The following topics were covered during the Webinar on "Reducing Emission through increasing Green Cover and Carbon Sink in Tamil Nadu: A way forward":

- **Climate Change - India's NDC and Tamil Nadu State Action Plan on Climate Change** by Dr. Jayanthi Murali IFS**,** Special Secretary to Government, Environment & Climate Change, Department of Environment, Climate Change & Forests, Govt. of Tamil Nadu
- **Climate Action – Global Outlook** by Dr. Kurian Joseph, Director, CCCDM, Anna University, Chennai
- **Regional Climate Scenario and Cadastral Level Modelling** by Dr. K. Palanivelu, Professor, CES, Anna University, Chennai

- **Status of Forests and Green Cover in Tamil Nadu** by Thiru. Anurag Mishra IFS, Additional Principal Chief conservator of forests, Department of Forests, Govt. of Tamil Nadu
- **Biodiversity of Tamil Nadu** by Dr. S. Jayakumar, Professor and Head, Department of Ecology and Environmental Sciences, Pondicherry University,
- **Carbon Sequestration and Carbon Sink Estimation**: Dr. A. Ramachandran, DSc, Emeritus Professor, CCCDM, Anna University, Chennai

More than 100 participants from various academic and research institutes, industry and government participated in the Webinar and gave positive feedback for the programme.

Two days Training programme on "Estimation of Carbon Sequestration and Carbon Sink" on February 11th, 2022 to Forest Range Officers and February 12th, 2022 to Foresters at Guindy National Park Auditorium were conducted. The main aim of the programme is to impart knowledge and provide the scientific methodology to estimate carbon sequestration and ways to enhance the carbon sink specifically in the forest areas.

Key deliverables from the Programme

- Wide awareness created on the important policies related to carbon and climate change viz. the Kyoto Protocol, National Action Plan for Climate Change (NAPCC), Intergovernmental Panel on Climate Change (IPCC), India's NDCs on reducing emissions intensity of its GDP by 33 to 35% by 2030 from 2005 levels, national missions focussing on climate change and need for enrichment of soil carbon in forest.
- Hands on Practical training on carbon stock estimation provided to Forest Range Officers (14 nos.) and Foresters (14 nos.).

Recommendations

It is recommended to take up carbon stock estimation for different forests in Tamil Nadu and carry out activities needed for enrichment of carbon sink including soil carbon.

TABLE OF CONTENTS

PROCEEDINGS

I. Webinar on Reducing Emission through increasing Green Cover and Carbon Sink in Tamil Nadu: a Way Forward: January 21st, 2022

The Centre for Climate Change and Disaster Management, Anna University with financial support by the State Planning Commission (SPC), Government of Tamil Nadu has conducted a one-day webinar on "**Reducing Emission through Increasing Green Cover and Carbon Sink in Tamil Nadu: a way forward"** on 21st January, 2022 through MS team platform.

Climate change, caused due to increased anthropogenic activities and resultant emissions of greenhouse gases, is now widely recognized as major environmental problem. India's Nationally Determined Contributions (NDC) towards Climate Justice guarantees low carbon growth through reducing emissions intensity and enhancing forests Carbon Sink through additional forest and tree cover. The Green India Mission (GIM) is one of the eight missions under National Action Plan for Climate Change (NAPCC), Government of India aims to increase the forest cover, improve its quality and ecosystem services including biodiversity. Moreover, GIM aims to enhance carbon sequestration of about 100 million tons carbon dioxide equivalent annually. In this context, numerous challenges that are to be addressed includes urbanization, industrialization which require sector wise and region wise inventory of GHG emissions and carbon sinks. Based on this background, the aim of this webinar is to address the goals of GIM to respond to climate change by a combination of adaptation and mitigation measures, which help to enhance carbon sequestration and sinks, adaptation of vulnerable species/ecosystems to the changing climate and adaptation of forest-dependent communities.

The following topics were elaborated during the webinar to achieve the objective:

- Climate Change - India's NDC and Tamil Nadu State Action Plan on Climate Change
- Climate Action – Global Outlook
- Regional Climate Scenario and Cadastral Level Modelling
- Status of Forests and Green Cover in Tamil Nadu
- Biodiversity of Tamil Nadu
- Carbon Sequestration and Carbon Sink Estimation

1. Webinar Proceedings:

Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster Management, Anna University, Chennai welcomed the delegates, participants and provided the panoramic view of the present scenario in which the webinar is conducted. Dr. A. Ramachandran, DSc, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University, Chennai gave a brief about the webinar and enlightened the participants with the basics of carbon capture and storage, Kyoto Protocol and need for enrichment of soil carbon in forest. Prof. Dr. R. Velraj, Vice-Chancellor, Anna University inaugurated the webinar and delivered the Inaugural address briefing about the National Action Plan for Climate Change (NAPCC) and motivating for the significance of tree plantation. Thiru. A. Udhayan IFS, Chairman, Tamil Nadu Pollution Control Board, Government of Tamil Nadu delivered the Presidential address highlighting about the carbon dioxide sequestration, green growth and common but differentiated responsibility.

Dr. Jayanthi Murali IFS, Special Secretary to Government, Environment and Climate Change, Department of Environment, Climate Change and Forests, Government of Tamil Nadu has delivered the Keynote address on Climate Change and India's Nationally Determined Contributions (NDCs) and Tamil Nadu State Action Plan on Climate Change (TNSAPCC). She expounded about the key features of the Intergovernmental Panel on Climate Change (IPCC), salient features of India's NDCs on reducing emissions intensity of its GDP by 33 to 35% by 2030 from 2005 levels, national missions focussing on climate change and showcased the fund flow for climate change research. Dr. S. Kanmani, Director, Centre for Environmental Studies delivered the felicitation address and emphasized on the need for inter-linkages of the various environmental sectors with the climate change for better solutions.

The one-day webinar had 5 technical sessions of 45 minutes duration each with lectures delivered by eminent speakers who are experts in the field, academicians, forest officials and Tamil Nadu government representatives.

Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster Management, Anna University, Chennai delivered the technical session I talk on "Climate Action-Global Outlook". Professor elaborated about the Green India Mission (GIM), which is the main theme of the webinar. He also gave insights about the mind-sets for sustainability, sustainable development,

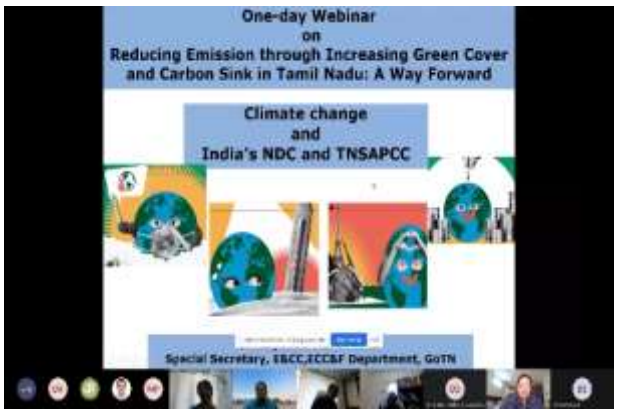
sustainable development goals (SDGs), especially on climate action SDG 13 and its inter-linkages with other sectors, carbon sink, climate change adaptation, carbon management ways, climate actions for green cover and carbon sink enhancement. Followed by the technical session II talk on "Regional Climate Scenario and Cadastral level modelling" delivered by Dr. K. Palanivelu, Professor, Centre for Environmental Studies and Adjunct faculty of Centre for Climate Change and Disaster Management, Anna University, Chennai. Professor, illustrated about the regional climate models, Representative Concentration Pathways (RCPs), climate change projections and climate models. He showed real-time case studies of climate change studies on the various sectors of Tamil Nadu with spatio-temporal maps and climate projections.

Thiru. Anurag Mishra IFS, Additional Principal Chief conservator of forests, Department of Forests, Government of Tamil Nadu delivered the technical session III talk on "Status of Forests and Green cover in Tamil Nadu". He highlighted about the India's State of Forest Report, forest cover mapping and assessment of forest and tree cover. Dr. S. Jayakumar, Professor and Head, Department of Ecology and Environmental Sciences, Pondicherry University, Puducherry delivered the technical session IV talk on Biodiversity of Tamil Nadu. He elaborated about the ecosystem services, bio-climatic conditions over forests, inter-linkages of biodiversity and climate change and forest fires. He showed the virtual tour of the Eastern-Ghats. Last technical session V on "Carbon sequestration and carbon sink estimation" was delivered by Dr. A. Ramachandran DSc, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University, Chennai. Professor detailed about the organic carbon and dovetailed with soil for enhancing plant growth. He also highlighted about the core concepts of carbon sequestration to the participants.

Dr. A. Merline Sheela, Assistant Professor (SG), Centre for Environmental Studies, Anna University, Chennai proposed the vote of thanks. Dr. S. Sri Shalini, DST-Women Scientist and Dr. Divya Subash Kumar, Project Associate, Centre for Climate Change and Disaster Management, Anna University facilitated as the Master of Ceremony for the webinar. The webinar was attended by more than 100 participants from around various universities, colleges, government departments, non-governmental organisations and industries.

2. SPC Webinar Programme Photographs:

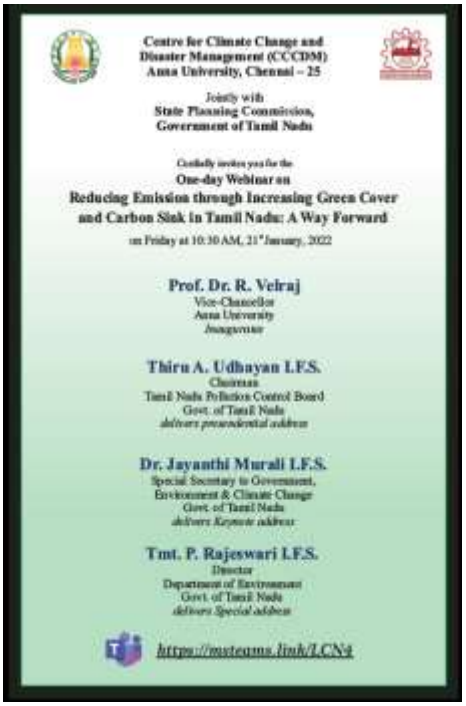
Inaugural Session



Technical Sessions

Valedictory Session

3. Webinar Invitation:



Centre for Climate Change and Disaster Management (CCCDM)
Anna University, Chennai – 25

Jointly with
State Planning Commission,
Government of Tamil Nadu

Cordially invites you for the
One-day Webinar on

Reducing Emission through Increasing Green Cover and Carbon Sink in Tamil Nadu: A Way Forward

on Friday at 10.30 AM, 21st January, 2022

Prof. Dr. R. Velraj
Vice-Chancellor
Anna University
Inaugurates

Thiru A. Udhayan I.F.S.
Chairman
Tamil Nadu Pollution Control Board
Govt. of Tamil Nadu
delivers presendential address

Dr. Jayanthi Murali I.F.S.
Special Secretary to Government,
Environment & Climate Change
Govt. of Tamil Nadu
delivers Keynote address

Tmt. P. Rajeswari I.F.S.
Director
Department of Environment
Govt. of Tamil Nadu
delivers Special address

https://msteams.link/LCN4

PROGRAMME

INAUGURAL SESSION

Welcome Address	10:30-10:35 AM	**Dr. Kurian Joseph** Director, Centre for Climate Change and Disaster Management (CCCDM), Anna University
About the programme	10:35-10:40 AM	**Dr. A. Ramachandran D.Sc.** Emeritus Professor, CCCDM, Anna University
Inaugural Address	10:40-10:55 AM	**Prof. Dr. R. Velraj** Vice-Chancellor, Anna University
Presidential Address	10:55-11:10 AM	**Thiru. A. Udhayan, I.F.S.,** **Chairman** Tamil Nadu Pollution Control Board Govt. of Tamil Nadu
Keynote Address	11:10-11:25 AM	**Dr. Jayanthi Murali I.F.S.,** Special Secretary to Government, Climate Change, Environment and Forest Govt. of Tamil Nadu
Special Address	11:25-11:35 AM	**Tmt. P. Rajeswari I.F.S.,** Director Department of Environment Govt. of Tamil Nadu
Felicitation Address	11:35-11:40 AM	**Tmt. S Sudha I.F.S.,** Head of Division (Land Use) State Planning Commission, Govt. of Tamil Nadu
Felicitation Address	11:40-11:45 AM	**Dr. S. Kannani** **Professor & Director** Centre for Environmental Studies, Anna University

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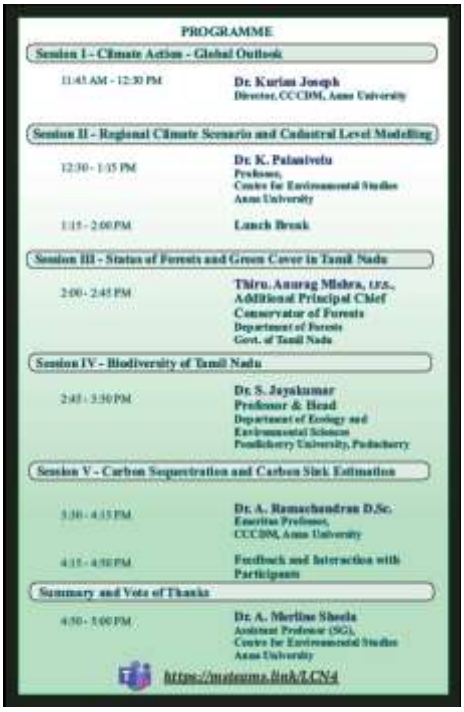

PROGRAMME

Session I - Climate Action - Global Outlook

11.45 AM - 12.30 PM	**Dr. Kurian Joseph** Director, CCCDM, Anna University

Session II - Regional Climate Scenario and Cadastral Level Modelling

12.30 - 1.15 PM	**Dr. K. Palanivelu** Professor, Centre for Environmental Studies Anna University
1.15 - 2.00 PM	**Lunch Break**

Session III - Status of Forests and Green Cover in Tamil Nadu

2.00 - 2.45 PM	**Thiru. Anurag Mishra, I.F.S.,** **Additional Principal Chief Conservator of Forests** Department of Forests Govt. of Tamil Nadu

Session IV - Biodiversity of Tamil Nadu

2.45 - 3.30 PM	**Dr. S. Jayakumar** **Professor & Head** Department of Ecology and Environmental Sciences Pondicherry University, Puducherry

Session V - Carbon Sequestration and Carbon Sink Estimation

3.30 - 4.15 PM	**Dr. A. Ramachandran D.Sc.** Emeritus Professor, CCCDM, Anna University
4.15 - 4.50 PM	**Feedback and Interaction with Participants**

Summary and Vote of Thanks

4.50 - 5.00 PM	**Dr. A. Merline Sheela** Assistant Professor (SG), Centre for Environmental Studies Anna University

https://msteams.link/LCN4

4. Webinar Brochure:

Target Audience

Climate Change researchers, stakeholders from Government of Tamil Nadu, Postgraduates from environmental and life sciences department from various colleges and NGOs. About 200 participants will be registered for the programme.

REGISTRATION

Kindly, fill the google form link for the registration.

https://forms.gle/UwmUfmBoC1V3qXbs9

NO REGISTRATION FEE

The Webinar will be conducted online mode on 21st January 2022 in Microsoft Team Platform.

https://msteams.link/LCN8

For further details, contact:

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Chennai - 600025
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Website: www.annauniv.edu/cccdm

Chief Patrons

Prof. Dr. R. Velraj
Vice Chancellor, Anna University
Dr. J. Jeyaranjan
Vice Chairman
State Planning Commission, Chennai-5

Patrons

Dr. G. Ravikumar
Registrar
Anna University
Thiru. T. S. Rajsekar, IAS
Member Secretary
State Planning Commission, Chennai-5
Tmt. Sudha.S., IFS
Head of Division (Land Use)
State Planning Commission, Chennai – 5

Organizing Committee

Dr. Kurian Joseph
Professor & Director
CCCDM, Anna University
Dr. A. Ramachandran
Emeritus Professor
CCCDM, Anna University
Dr. K.P. Jaya
Professor & Head of the Department,
Civil Engg., Anna University
Dr. S. Kanmani
Professor & Director,
Centre for Environmental Studies
Anna University
Dr. K. Palanivelu
Professor
Centre for Environmental Studies
Anna University
Dr. A. Merline Sheela
Assistant Professor (SG)
Centre for Environmental Studies
Anna University
Dr. S. Sri Shalini
(Seminar Coordinator)
DST-Women Scientist
CCCDM, Anna University, Chennai

ONE-DAY WEBINAR ON

REDUCING EMISSION THROUGH INCREASING GREEN COVER AND CARBON SINK IN TAMIL NADU: A WAY FORWARD

21st January 2022

Organized by

Centre for Climate Change and Disaster Management (CCCDM)
Department of Civil Engineering
Anna University, CEG Campus
Chennai-600025

Jointly with

State Planning Commission
Government of Tamil Nadu

Virtual Mode: Microsoft Team Platform

About Anna University

The Anna University, Chennai, established on 4th September 1978, is a prestigious technological university in India. The University has been pioneering in engineering education, technology development and allied sciences to remain abreast in many frontier areas. Besides promoting research and disseminating knowledge gained there from, it fosters cooperation between the academic and industrial communities. The Anna University shall strive towards a World Class Institution by producing professionals with high technical knowledge, professional skills and ethical values. The University shall be a preferred partner to the industry and community for contribution towards their economic and social development by providing high quality manpower through excellence in teaching, research and consultancy.

About CCCDM

The Centre for Climate Change and Disaster Management (CCCDM) is the first Centre in Tamil Nadu functioning exclusively to address the climate issues through research activities. The Government of Tamil Nadu has recognized CCCDM, Anna University as the nodal agency for Tamil Nadu State Action Plan on Climate Change's (TNSAPCC) Knowledge Management Sector. Research works in CCCDM includes developing regional climate scenario, sectoral impact and vulnerability assessments in agriculture, coastal, forest, health, and urban sector and framing adaptation strategies. This is a pioneering Centre in the country to look into the climate adaptation research in various natural resources.

About SPC-TNSLURB

The State Planning Commission (SPC) was constituted in Tamil Nadu on 25th May 1971 under the Chairmanship of the Hon'ble Chief Minister as an Advisory Body to make recommendations to the Government on various matters pertaining to the development of the State. Major functions of SPC includes: Evaluating major plan schemes through Department of Evaluation and Applied Research, undertaking special studies as required by the State for formulation and implementation of plan projects and programs, etc. The State Government has constituted 'Tamil Nadu State Land Use Research Board (TNSLURB)' as a permanent body in the State Planning Commission to hold Seminars/ Workshops and to commission studies.

About the Seminar

Climate change, caused due to increased anthropogenic activities and resultant emissions of greenhouse gases, is now widely recognized as major environmental problem. India's Nationally Determined Contributions (NDC) towards Climate Justice guarantees low carbon growth through reducing emissions intensity and enhancing forests Carbon Sink through additional forest and tree cover. The Green India Mission (GIM) is one of the eight missions under National Action Plan for Climate Change (NAPCC). Government of India aims to increase the forest cover, improve its quality and ecosystem services including biodiversity. Moreover, GIM aims to enhance carbon sequestration of about 100 million tons carbon dioxide equivalent annually.

In this context, numerous challenges that are to be addressed includes urbanization, industrialization which require sector wise and region wise inventory of GHG emissions and carbon sinks.

This seminar addresses the goals of GIM to respond to climate change by a combination of adaptation and mitigation measures, which help to enhance carbon sequestration and sinks, adaptation of vulnerable species/ecosystems to the changing climate and adaptation of forest-dependant communities.

Topics to be covered during seminar:

- Climate Change and India's NDC
- Climate Change impacts at regional scale: Insights from cadastral level
- Status of Green cover in Tamil Nadu
- Biodiversity of Tamil Nadu
- Carbon Sequestration and Carbon sink
- Practical training on estimation of carbon sequestration and sink
- Poster Presentation

Experts from Tamil Nadu Forest department, Tamil Nadu Pollution Control Board, Department of Environment, Government of Tamil Nadu, State Development Policy Council, Pondicherry University and Anna University will deliver the lectures to enrich the knowledge of the participants on these topics.

5. Webinar Agenda:

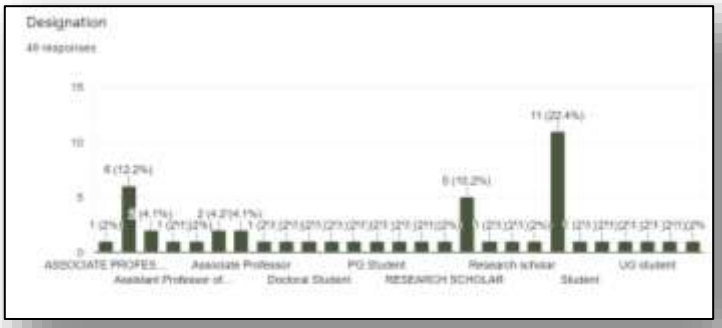
One-day Webinar on

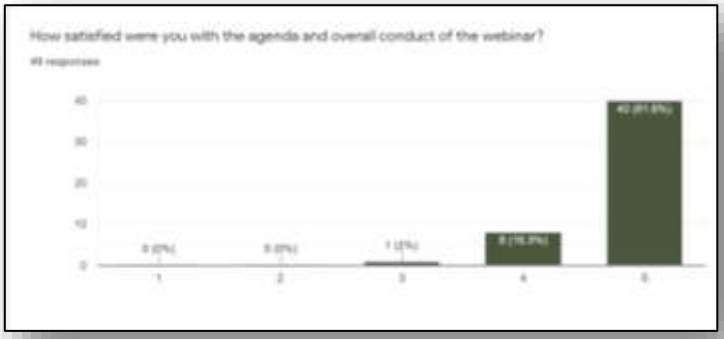
REDUCING EMISSION THROUGH INCREASING GREEN COVER AND CARBON SINK IN TAMIL NADU: A WAY FORWARD

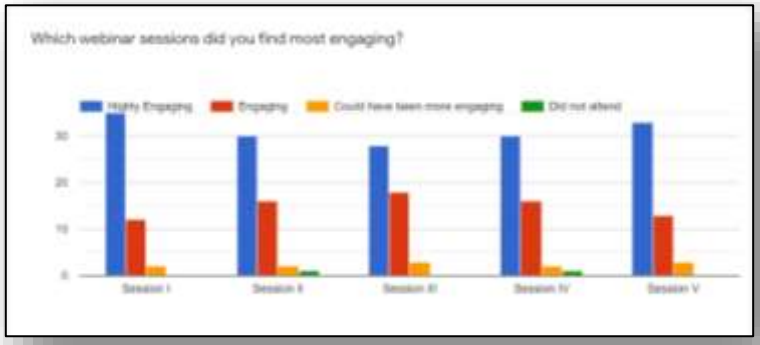
Agenda

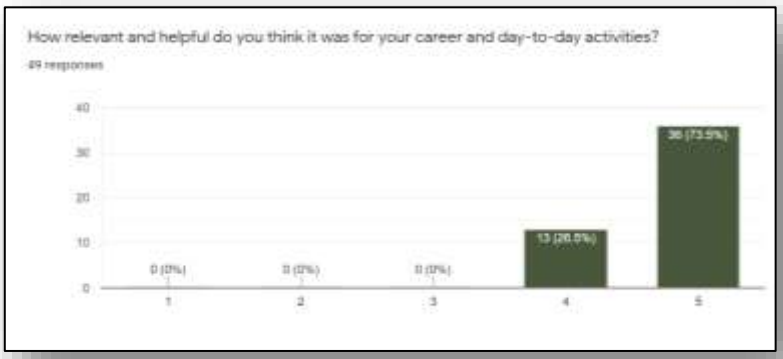
January 21st, 2022	
INAUGURAL SESSION: 10.30 A.M to 11.40 A.M	
10:30 - 10:35 A.M	**Welcome Address** Dr. Kurian Joseph Director, Centre for Climate Change and Disaster Management (CCCDM), Anna University, Chennai
10:35 - 10:40 A.M	**About the Seminar** Dr. A. Ramachandran D.Sc. Emeritus Professor, CCCDM, Anna University, Chennai
10:40 – 10:55 A.M	**Inaugural Address** Prof. Dr. R.Velraj Vice- Chancellor, Anna University, Chennai
10:55 – 11:10 A.M	**Presidential Address** Thiru. A. Udhayan IFS Chairman, Tamil Nadu Pollution Control Board
11:10 – 11:25 A.M	**Keynote Address : Climate Change and India's NDC and TNSAPCC** Dr. Jayanthi Murali IFS Special Secretary to Government, Environment & Climate Change, Environment, Climate Change and Forests Department, Government of Tamil Nadu
11:25 – 11:35 A.M	**Special Address** Tmt. P. Rajeswari IFS Director, Department of Environment Government of Tamil Nadu
11:35 – 11:40 A.M	**Felicitation Address** Tmt. S. Sudha IFS Head of Division (Land Use) State Development Policy Council, Chennai
11:40 – 11:45 A.M	**Felicitation Address** Dr. S. Kanmani Professor & Director Centre for Environmental Studies, Anna University, Chennai
SESSION – I: Climate Action – Global Outlook	
11:45 - 12:30 P.M	Dr. Kurian Joseph Director, CCCDM, Anna University, Chennai
SESSION – II: Regional Climate Scenario and Cadastral Level Modelling	
12:30 - 1:15 P.M	Dr. K. Palanivelu Professor, Centre for Environmental Studies Anna University, Chennai
1:15 - 2:00 P.M	**LUNCH**
SESSION – III : Status of Forests and Green Cover in Tamil Nadu	
2:00 – 2:45 P.M	Thiru Anurag Mishra IFS Additional Principal Chief Conservator of Forests Department of Forests, Government of Tamil Nadu
SESSION – IV: Biodiversity of Tamil Nadu	
2:45 – 3:30 P.M	Dr. S. Jayakumar Professor and Head Department of Ecology and Environmental Sciences Pondicherry University, Puducherry
SESSION – V : Carbon Sequestration and Carbon Sink Estimation	
3:30 - 4:15 P.M	Dr. A. Ramachandran D.Sc. Emeritus Professor CCCDM, Anna University, Chennai
4:15 – 4:50 P.M	**Feedback and Interaction with Participants**
4:50 – 5:00 P.M	**Summary and Vote of Thanks** Dr. A. Merline Sheela Assistant Professor (SG) Centre for Environmental Studies, Anna University, Chennai

6. Feedback from the participants

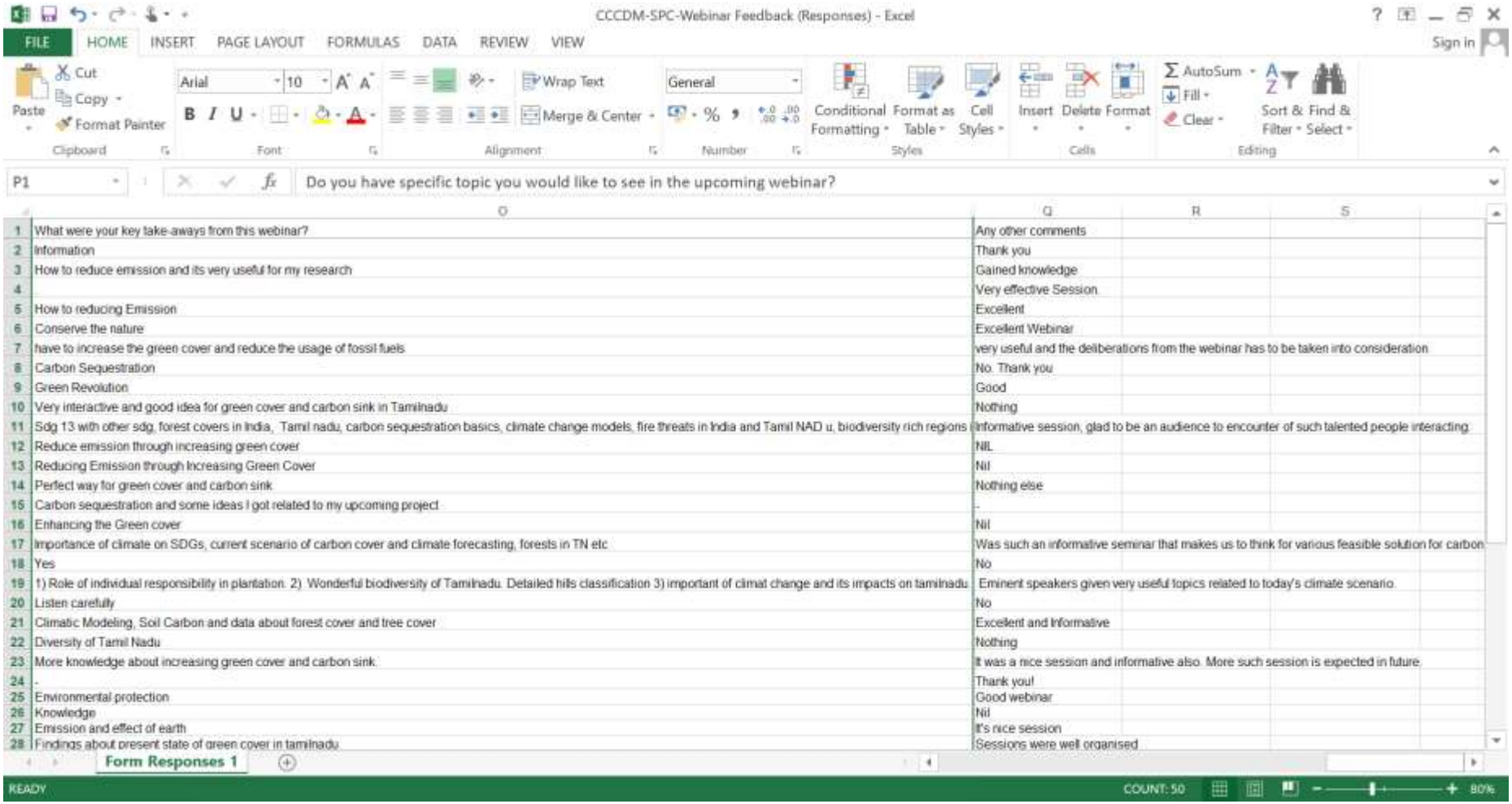








7. Key take-aways from the webinar and other comments



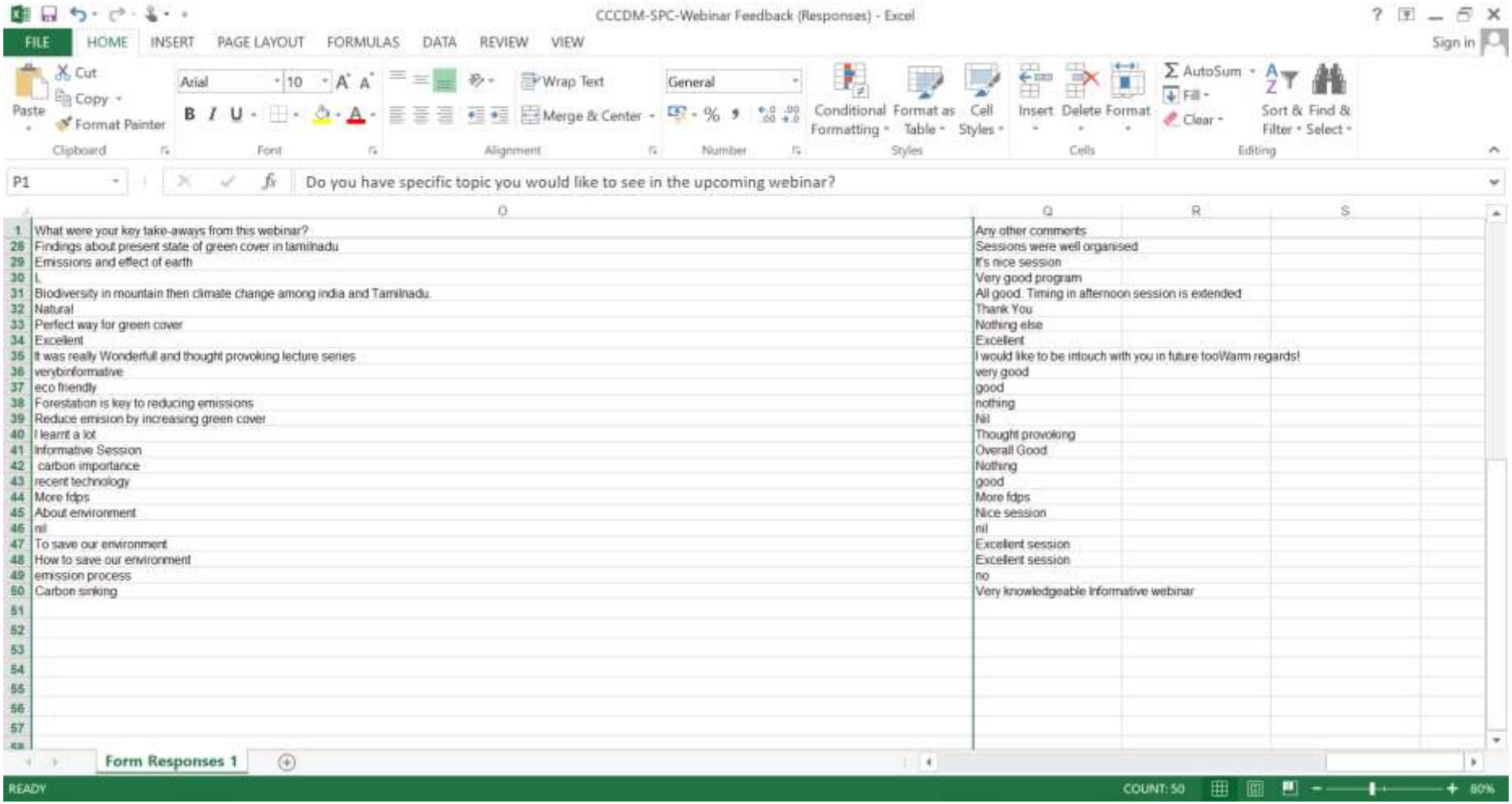
CCCDM-SPC-Webinar Feedback (Responses) - Excel

P1: Do you have specific topic you would like to see in the upcoming webinar?

	O	Q
1	What were your key take-aways from this webinar?	Any other comments
2	Information	Thank you
3	How to reduce emission and its very useful for my research	Gained knowledge
4		Very effective Session
5	How to reducing Emission	Excellent
6	Conserve the nature	Excellent Webinar
7	have to increase the green cover and reduce the usage of fossil fuels	very useful and the deliberations from the webinar has to be taken into consideration
8	Carbon Sequestration	No. Thank you
9	Green Revolution	Good
10	Very interactive and good idea for green cover and carbon sink in Tamilnadu	Nothing
11	Sdg 13 with other sdg, forest covers in India, Tamil nadu, carbon sequestration basics, climate change models, fire threats in India and Tamil NAD u, biodiversity rich regions	Informative session, glad to be an audience to encounter of such talented people interacting
12	Reduce emission through increasing green cover	NIL
13	Reducing Emission through Increasing Green Cover	Nil
14	Perfect way for green cover and carbon sink	Nothing else
15	Carbon sequestration and some ideas I got related to my upcoming project	-
16	Enhancing the Green cover	Nil
17	Importance of climate on SDGs, current scenario of carbon cover and climate forecasting, forests in TN etc	Was such an informative seminar that makes us to think for various feasible solution for carbon
18	Yes	No
19	1) Role of individual responsibility in plantation. 2) Wonderful biodiversity of Tamilnadu. Detailed hills classification 3) important of climat change and its impacts on tamilnadu	Eminent speakers given very useful topics related to today's climate scenario.
20	Listen carefully	No
21	Climatic Modeling, Soil Carbon and data about forest cover and tree cover	Excellent and Informative
22	Diversity of Tamil Nadu	Nothing
23	More knowledge about increasing green cover and carbon sink.	It was a nice session and informative also. More such session is expected in future.
24	-	Thank you!
25	Environmental protection	Good webinar
26	Knowledge	Nil
27	Emission and effect of earth	It's nice session
28	Findings about present state of green cover in tamilnadu	Sessions were well organised

Form Responses 1

READY COUNT: 50 80%



	O	Q	R	S
1	What were your key take-aways from this webinar?	Any other comments		
28	Findings about present state of green cover in tamilnadu	Sessions were well organised		
29	Emissions and effect of earth	It's nice session		
30	L	Very good program		
31	Biodiversity in mountain then climate change among india and Tamilnadu.	All good. Timing in afternoon session is extended		
32	Natural	Thank You		
33	Perfect way for green cover	Nothing else		
34	Excellent	Excellent		
35	It was really Wonderfull and thought provoking lecture series	I would like to be intouch with you in future tooWarm regards!		
36	verybinformative	very good		
37	eco friendly	good		
38	Forestation is key to reducing emissions	nothing		
39	Reduce emision by increasing green cover	Nil		
40	I learnt a lot	Thought provoking		
41	Informative Session	Overall Good		
42	carbon importance	Nothing		
43	recent technology	good		
44	More fdps	More fdps		
45	About environment	Nice session		
46	nil	nil		
47	To save our environment	Excellent session		
48	How to save our environment	Excellent session		
49	emission process	no		
50	Carbon sinking	Very knowledgeable Informative webinar		
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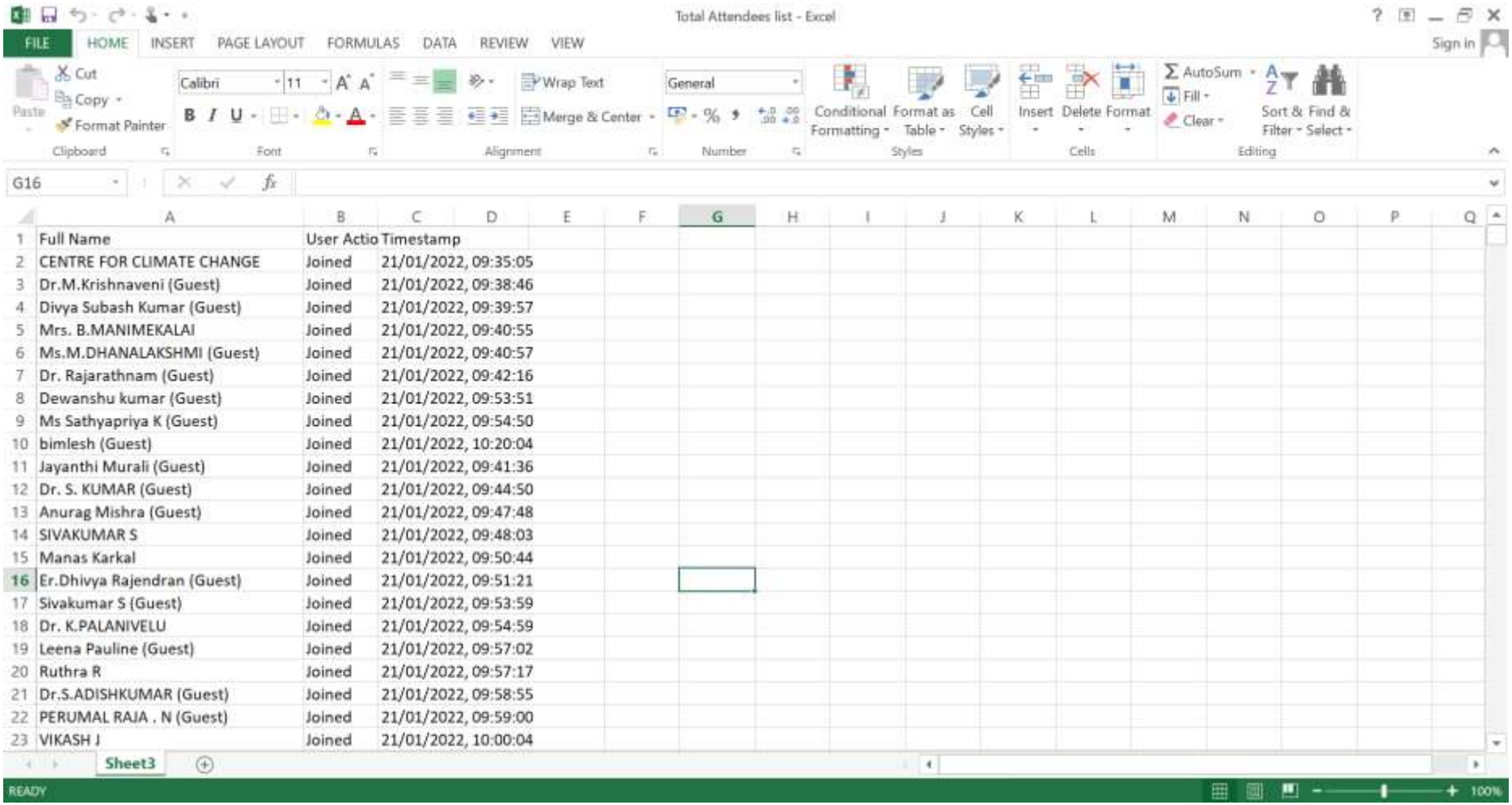
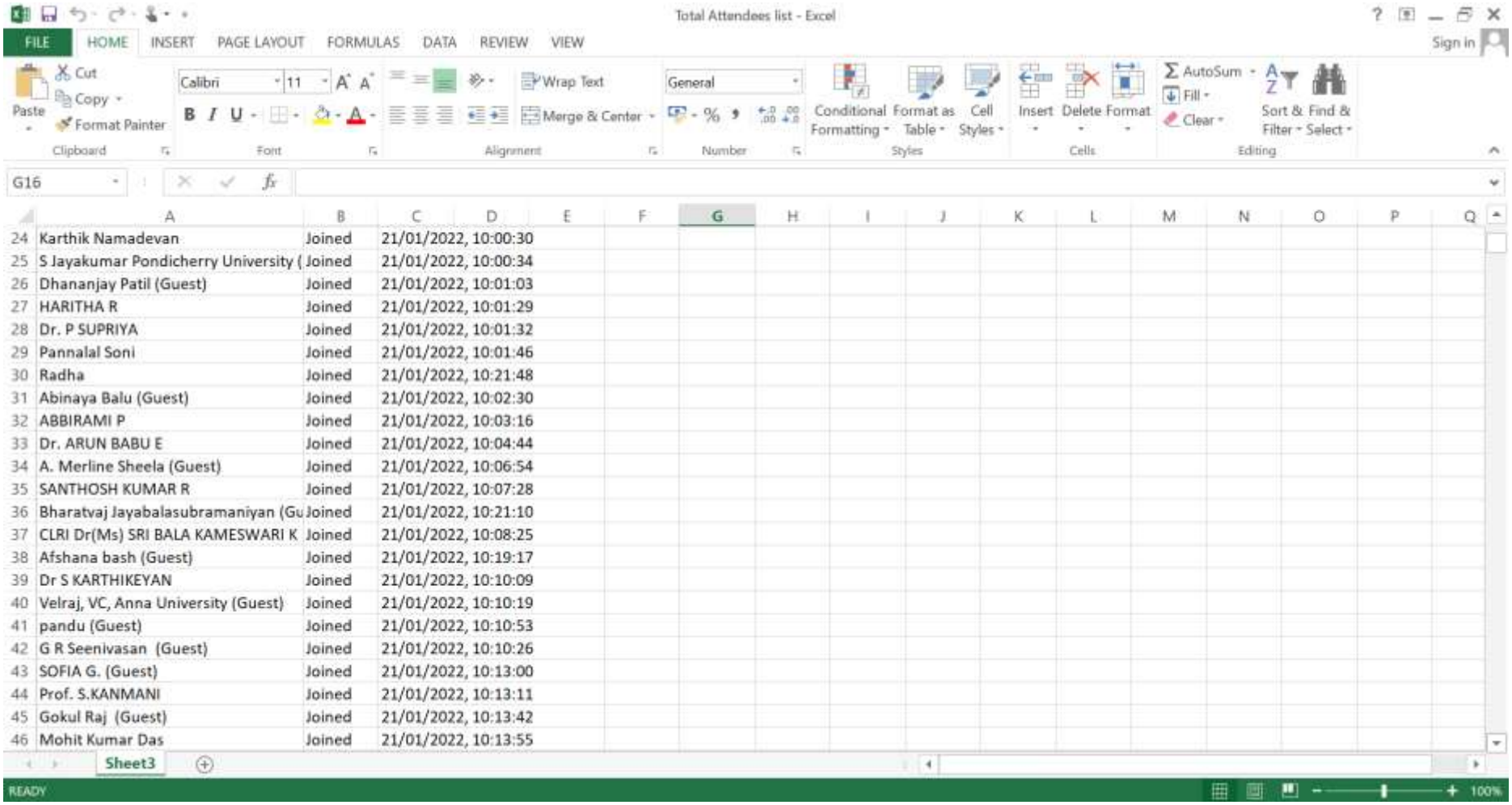
8. List of Participants



Total Attendees list - Excel

	A	B	C
1	Full Name	User Actio	Timestamp
2	CENTRE FOR CLIMATE CHANGE	Joined	21/01/2022, 09:35:05
3	Dr.M.Krishnaveni (Guest)	Joined	21/01/2022, 09:38:46
4	Divya Subash Kumar (Guest)	Joined	21/01/2022, 09:39:57
5	Mrs. B.MANIMEKALAI	Joined	21/01/2022, 09:40:55
6	Ms.M.DHANALAKSHMI (Guest)	Joined	21/01/2022, 09:40:57
7	Dr. Rajarathnam (Guest)	Joined	21/01/2022, 09:42:16
8	Dewanshu kumar (Guest)	Joined	21/01/2022, 09:53:51
9	Ms Sathyapriya K (Guest)	Joined	21/01/2022, 09:54:50
10	bimlesh (Guest)	Joined	21/01/2022, 10:20:04
11	Jayanthi Murali (Guest)	Joined	21/01/2022, 09:41:36
12	Dr. S. KUMAR (Guest)	Joined	21/01/2022, 09:44:50
13	Anurag Mishra (Guest)	Joined	21/01/2022, 09:47:48
14	SIVAKUMAR S	Joined	21/01/2022, 09:48:03
15	Manas Karkal	Joined	21/01/2022, 09:50:44
16	Er.Dhivya Rajendran (Guest)	Joined	21/01/2022, 09:51:21
17	Sivakumar S (Guest)	Joined	21/01/2022, 09:53:59
18	Dr. K.PALANIVELU	Joined	21/01/2022, 09:54:59
19	Leena Pauline (Guest)	Joined	21/01/2022, 09:57:02
20	Ruthra R	Joined	21/01/2022, 09:57:17
21	Dr.S.ADISHKUMAR (Guest)	Joined	21/01/2022, 09:58:55
22	PERUMAL RAJA . N (Guest)	Joined	21/01/2022, 09:59:00
23	VIKASH J	Joined	21/01/2022, 10:00:04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24 Karthik Namadevan Joined 21/01/2022, 10:00:30
25 S Jayakumar Pondicherry University (Joined 21/01/2022, 10:00:34
26 Dhananjay Patil (Guest) Joined 21/01/2022, 10:01:03
27 HARITHA R Joined 21/01/2022, 10:01:29
28 Dr. P SUPRIYA Joined 21/01/2022, 10:01:32
29 Pannalal Soni Joined 21/01/2022, 10:01:46
30 Radha Joined 21/01/2022, 10:21:48
31 Abinaya Balu (Guest) Joined 21/01/2022, 10:02:30
32 ABBIRAMI P Joined 21/01/2022, 10:03:16
33 Dr. ARUN BABU E Joined 21/01/2022, 10:04:44
34 A. Merline Sheela (Guest) Joined 21/01/2022, 10:06:54
35 SANTHOSH KUMAR R Joined 21/01/2022, 10:07:28
36 Bharatvaj Jayabalasubramaniyan (Gu Joined 21/01/2022, 10:21:10
37 CLRI Dr(Ms) SRI BALA KAMESWARI K Joined 21/01/2022, 10:08:25
38 Afshana bash (Guest) Joined 21/01/2022, 10:19:17
39 Dr S KARTHIKEYAN Joined 21/01/2022, 10:10:09
40 Velraj, VC, Anna University (Guest) Joined 21/01/2022, 10:10:19
41 pandu (Guest) Joined 21/01/2022, 10:10:53
42 G R Seenivasan (Guest) Joined 21/01/2022, 10:10:26
43 SOFIA G. (Guest) Joined 21/01/2022, 10:13:00
44 Prof. S.KANMANI Joined 21/01/2022, 10:13:11
45 Gokul Raj (Guest) Joined 21/01/2022, 10:13:42
46 Mohit Kumar Das Joined 21/01/2022, 10:13:55
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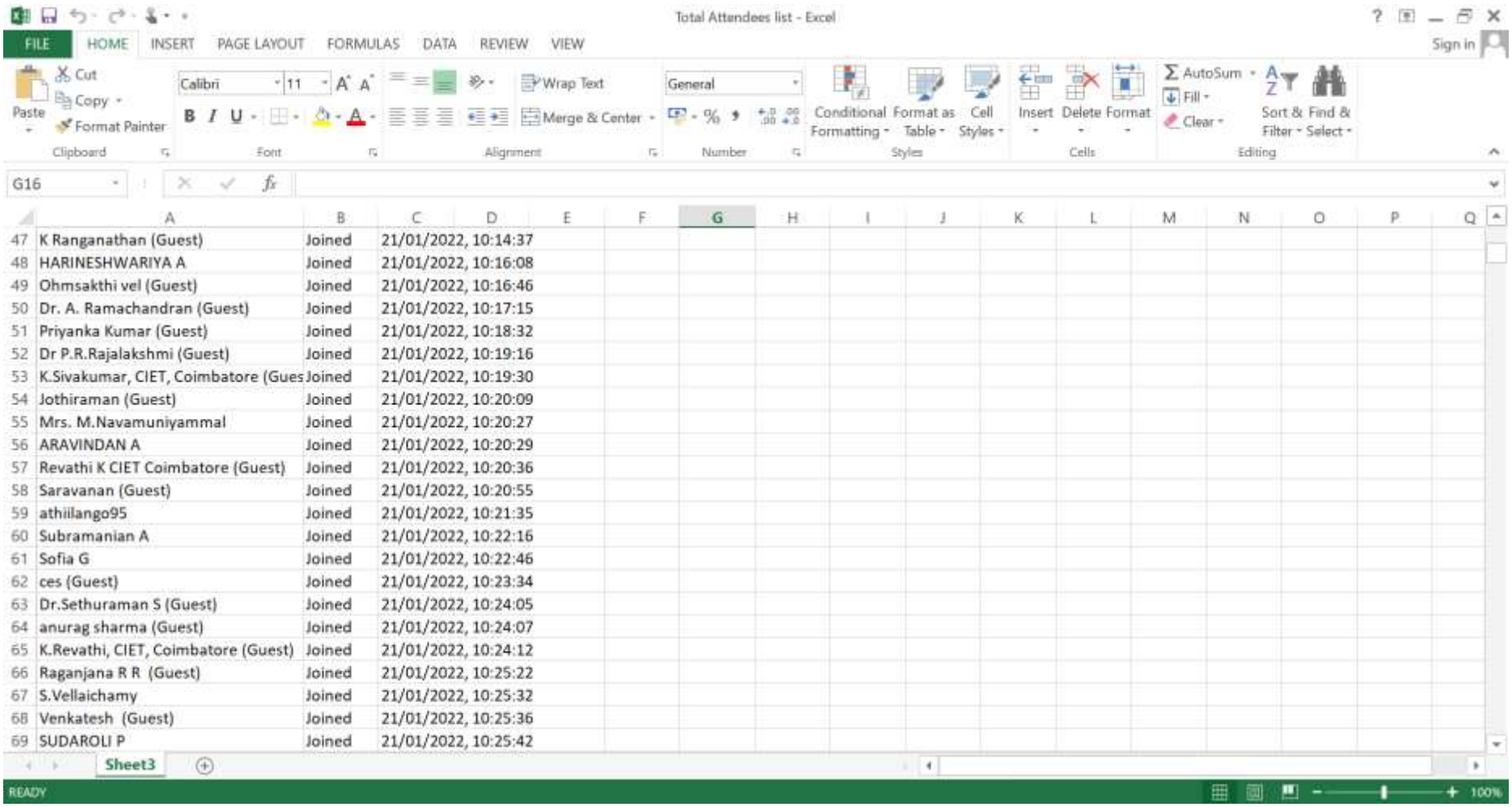

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49	Ohmsakthi vel (Guest)	Joined	21/01/2022, 10:16:46	
50	Dr. A. Ramachandran (Guest)	Joined	21/01/2022, 10:17:15	
51	Priyanka Kumar (Guest)	Joined	21/01/2022, 10:18:32	
52	Dr P.R.Rajalakshmi (Guest)	Joined	21/01/2022, 10:19:16	
53	K.Sivakumar, CIET, Coimbatore (Gues	Joined	21/01/2022, 10:19:30	
54	Jothiraman (Guest)	Joined	21/01/2022, 10:20:09	
55	Mrs. M.Navamuniyammal	Joined	21/01/2022, 10:20:27	
56	ARAVINDAN A	Joined	21/01/2022, 10:20:29	
57	Revathi K CIET Coimbatore (Guest)	Joined	21/01/2022, 10:20:36	
58	Saravanan (Guest)	Joined	21/01/2022, 10:20:55	
59	athiilango95	Joined	21/01/2022, 10:21:35	
60	Subramanian A	Joined	21/01/2022, 10:22:16	
61	Sofia G	Joined	21/01/2022, 10:22:46	
62	ces (Guest)	Joined	21/01/2022, 10:23:34	
63	Dr.Sethuraman S (Guest)	Joined	21/01/2022, 10:24:05	
64	anurag sharma (Guest)	Joined	21/01/2022, 10:24:07	
65	K.Revathi, CIET, Coimbatore (Guest)	Joined	21/01/2022, 10:24:12	
66	Raganjana R R (Guest)	Joined	21/01/2022, 10:25:22	
67	S.Vellaichamy	Joined	21/01/2022, 10:25:32	
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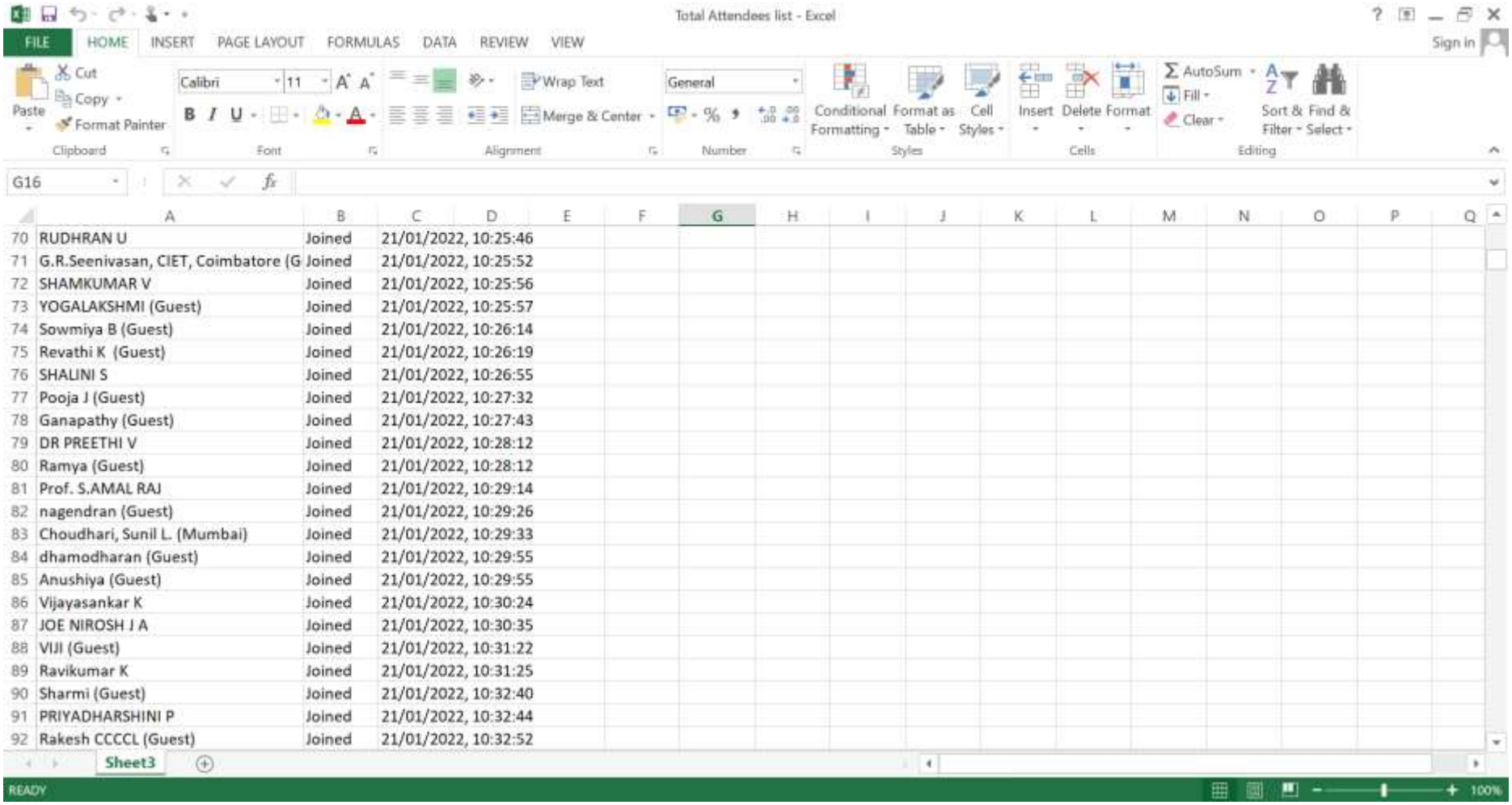

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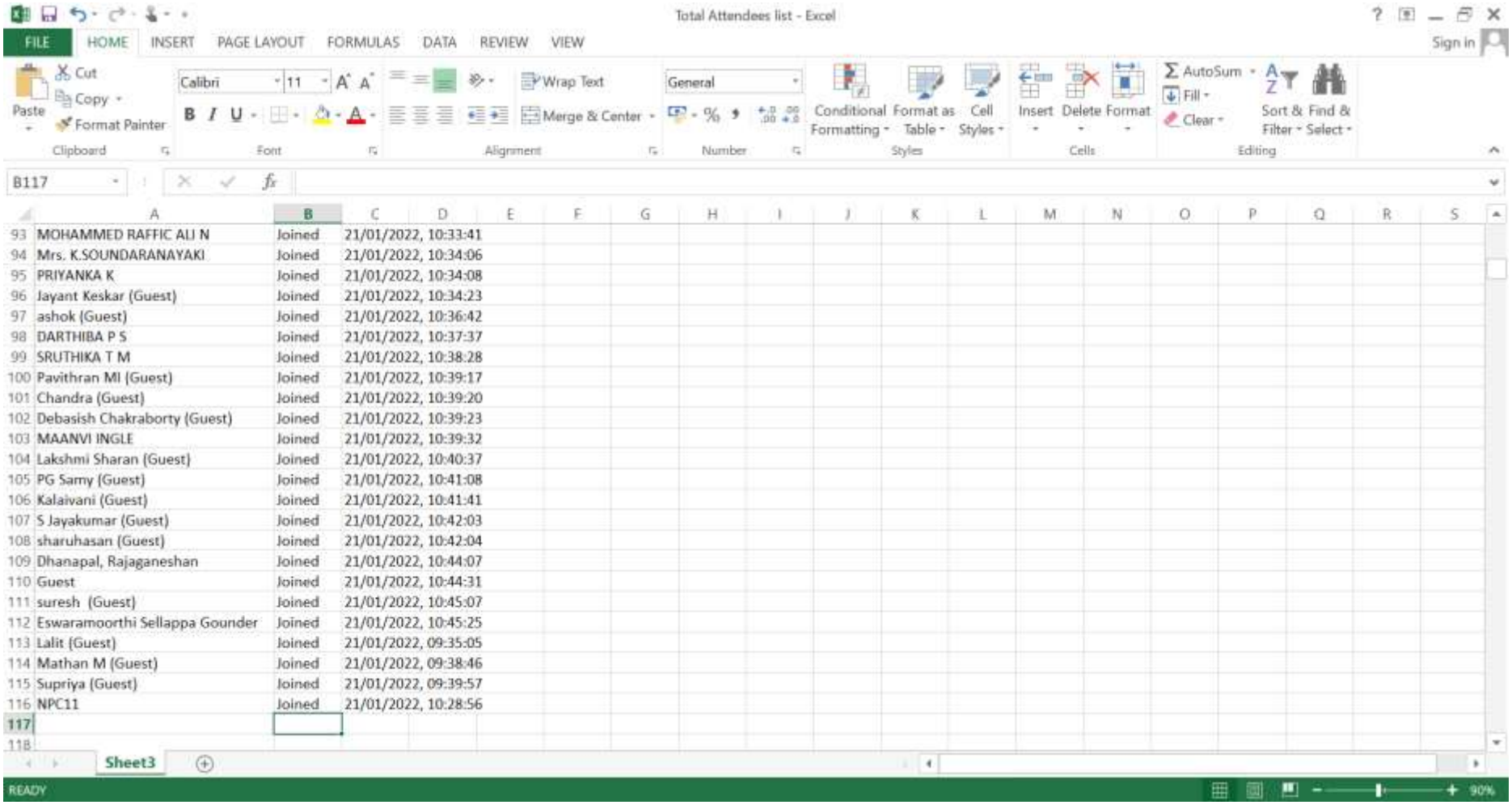
72	SHAMKUMAR V	Joined	21/01/2022, 10:25:56
73	YOGALAKSHMI (Guest)	Joined	21/01/2022, 10:25:57
74	Sowmiya B (Guest)	Joined	21/01/2022, 10:26:14
75	Revathi K (Guest)	Joined	21/01/2022, 10:26:19
76	SHALINI S	Joined	21/01/2022, 10:26:55
77	Pooja J (Guest)	Joined	21/01/2022, 10:27:32
78	Ganapathy (Guest)	Joined	21/01/2022, 10:27:43
79	DR PREETHI V	Joined	21/01/2022, 10:28:12
80	Ramya (Guest)	Joined	21/01/2022, 10:28:12
81	Prof. S.AMAL RAJ	Joined	21/01/2022, 10:29:14
82	nagendran (Guest)	Joined	21/01/2022, 10:29:26
83	Choudhari, Sunil L. (Mumbai)	Joined	21/01/2022, 10:29:33
84	dhamodharan (Guest)	Joined	21/01/2022, 10:29:55
85	Anushiya (Guest)	Joined	21/01/2022, 10:29:55
86	Vijayasankar K	Joined	21/01/2022, 10:30:24
87	JOE NIROSH J A	Joined	21/01/2022, 10:30:35
88	VIJI (Guest)	Joined	21/01/2022, 10:31:22
89	Ravikumar K	Joined	21/01/2022, 10:31:25
90	Sharmi (Guest)	Joined	21/01/2022, 10:32:40
91	PRIYADHARSHINI P	Joined	21/01/2022, 10:32:44
92	Rakesh CCCCL (Guest)	Joined	21/01/2022, 10:32:52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AutoSum
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93 MOHAMMED RAFFIC ALI N Joined 21/01/2022, 10:33:41
94 Mrs. K.SOUNDARANAYAKI Joined 21/01/2022, 10:34:06
95 PRIYANKA K Joined 21/01/2022, 10:34:08
96 Jayant Keskar (Guest) Joined 21/01/2022, 10:34:23
97 ashok (Guest) Joined 21/01/2022, 10:36:42
98 DARTHIBA P S Joined 21/01/2022, 10:37:37
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102 Debasish Chakraborty (Guest) Joined 21/01/2022, 10:39:23
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104 Lakshmi Sharan (Guest) Joined 21/01/2022, 10:40:37
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110 Guest Joined 21/01/2022, 10:44:31
111 suresh (Guest) Joined 21/01/2022, 10:45:07
112 Eswaramoorthi Sellappa Gounder Joined 21/01/2022, 10:45:25
113 Lalit (Guest) Joined 21/01/2022, 09:35:05
114 Mathan M (Guest) Joined 21/01/2022, 09:38:46
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II. Training on - Estimation of Carbon sequestration and Carbon sink - February 11th and 12th, 2022

The Centre for Climate Change and Disaster Management, Anna University with financial support by the State Planning Commission (SPC), Government of Tamil Nadu has conducted two days Training programme on "Estimation of Carbon Sequestration and Carbon Sink" on February 11th, 2022 to Forest Range Officers and February 12th, 2022 to Foresters at Guindy National Park Auditorium.

The training programme address the goals of GIM to respond to climate change by a combination of adaptation and mitigation measures, with a specific focus on understanding the ways of carbon sequestration in forestry sector. The main aim of the programme is to impart knowledge and provide the scientific methodology to estimate carbon sequestration and ways to enhance the carbon sink specifically in the forest areas. The Forest range officers (14 nos.) and Foresters (14 nos.) of Tamil Nadu Forest Departments are the participants of the training programme.

1. Training Programme Proceedings:

The inaugural function of the training programme on "Estimation of Carbon Sequestration and Carbon Sink" was on February 11th, 2022. Thiru. Syed Muzammil Abbas, Principal Chief Conservator of Forests & Chairman, Arasu Rubber Corporation, Department of Forests, Government of Tamil Nadu inaugurated the training programme and highlighted the importance of carbon sequestration in forestry and in oceans. Dr. Kurian Joseph, Director, Centre for Climate Change and Disaster Management, Anna University, Chennai welcomed the dignitaries and briefed about the training programme by edging through sustainable mind-set for effective action at field. Dr. A. Ramachandran, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University ensured that the programme will instigate the real time methodology to estimate carbon sink in Forests and how to enhance the soil carbon.

Thiru. Ashok Upreti IFS, Principal Chief Conservator of Forests and Head of Forest Department, Department of Forests, Government of Tamil Nadu, presided over the programme and emphasized the role of forest department, in taking action towards enhancing the forest

cover which will improve the carbon sequestration. He briefed about the Tamil Nadu Green Mission, the Wetland Mission and the Climate Missions, which are to be operational through the special mode of Green Climate Company. Thiru. Anurag Mishra, Additional Principal Chief Conservator of Forest, Department of Forests, Government of Tamil Nadu, motivated the forest officers to consider the hands-on session as Training of Trainers, and take forward the message of enhancing carbon sink in soil upto regional level and upscale to district level for a holistic execution.

Tmt. K. Geethanjali IFS, Conservator of Forests, Chennai Circle, Department of Forests, Government of Tamil Nadu, delivered the felicitation address and signified this training programme as a benchmark action to connect the climate change science and the Forest Department to facilitate ground level scientific implementation. Tmt. S. Sudha IFS, Head of Division (Land Use), State Planning Commission, Chennai felicitated the Forest department and the CCCDM, Anna University for organising the training programme jointly with the SPC for addressing the significant role of carbon sink to tackle climate change. Thiru. E. Prasanth IFS, Wild Life Warden, Chennai, Department of Forests, Government of Tamil Nadu, thanked the members on the dais, the organisers, the SPC and the participants and wished the programme great success.

The two-days training programme had three technical sessions of 45 minutes duration each with lectures delivered by eminent speakers who are experts in the field, academicians and forest officials. Followed by a practical training of more than two hours at the field in Guindy National park.

Thiru. A. Udhayan IFS, Chairman, Tamil Nadu Pollution Control Board, Government of Tamil Nadu delivered the technical session I talk on “Estimation of Soil Carbon stock in Natural Forest”. He elaborated about the components of the terrestrial carbon stocks and comprehensively deliberated about the extent of carbon in the forests. He detailed the carbon sequestration and forest soils, and explained the different methods available for the estimation of soil carbon. He also presented the real-time study results of carbon estimation conducted at Javadi hills and showed the profile of soil organic carbon distribution in the Javadi hills. He emphasized about the need for mapping of soil organic carbon in forests for effective afforestation and carbon sequestration.

Followed by the technical session II talk on "Estimation of Above Ground Biomass Carbon stock in Forestry" delivered by Thiru. Anurag Mishra IFS, Additional Principal Chief conservator of forests, Department of Forests, Government of Tamil Nadu. He illustrated about the carbon pools in the forest ecosystem. He briefed about the various methods for the above ground biomass carbon estimation. The different sampling techniques available were explained in-detail. He elucidated about the circumference at breast height (CBH) measurement for the estimation of above ground biomass carbon. Based on this CBH technique the practical training at field was conducted.

Dr. A. Ramachandran DSc, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University, Chennai delivered the technical session III talk on "Carbon Sink: A Way Forward". He explicated about the forestry in 21st century. The mechanisms of carbon sequestration and carbon sink was demonstrated to the participants. The soil organic profile in various forest ecosystems was exhibited. He highlighted about the soil organic carbon in the forests. He also accentuated on the accurate assessment of forest degradation, need for appropriate soil amendments and soil and water conservation.

2. Practical Training at Guindy National Park Field

Based on the technical sessions, the hands-on training was provided to the participants on the estimation of carbon stock at forests. Dr. A. Ramachandran DSc, Emeritus Professor, Centre for Climate Change and Disaster Management, Anna University, Chennai trained the participants for the estimation of the forest carbon sequestration and carbon sink at the field. The soil sampling technique along with slicing of the soil layers for carbon sample analysis was demonstrated by Thiru. A. Udhayan IFS, Chairman, Tamil Nadu Pollution Control Board, Government of Tamil Nadu. Thiru. Anurag Mishra IFS, Additional Principal Chief conservator of forests, Department of Forests, Government of Tamil Nadu conducted practical exercise to measure and calculate the above ground biomass carbon at Guindy National Park forest by CBH measurement method. The training worksheet for the above ground biomass carbon estimation was shared among the participants for hands-on experience on carbon estimation.

Dr. S. Sri Shalini, DST-Women Scientist and Dr. Divya Subash Kumar, Project Associate, Centre for Climate Change and Disaster Management, Anna University facilitated as the Master of Ceremony for the training programme.

3. SPC Training Programme Photographs:

Inaugural Session








Technical Sessions

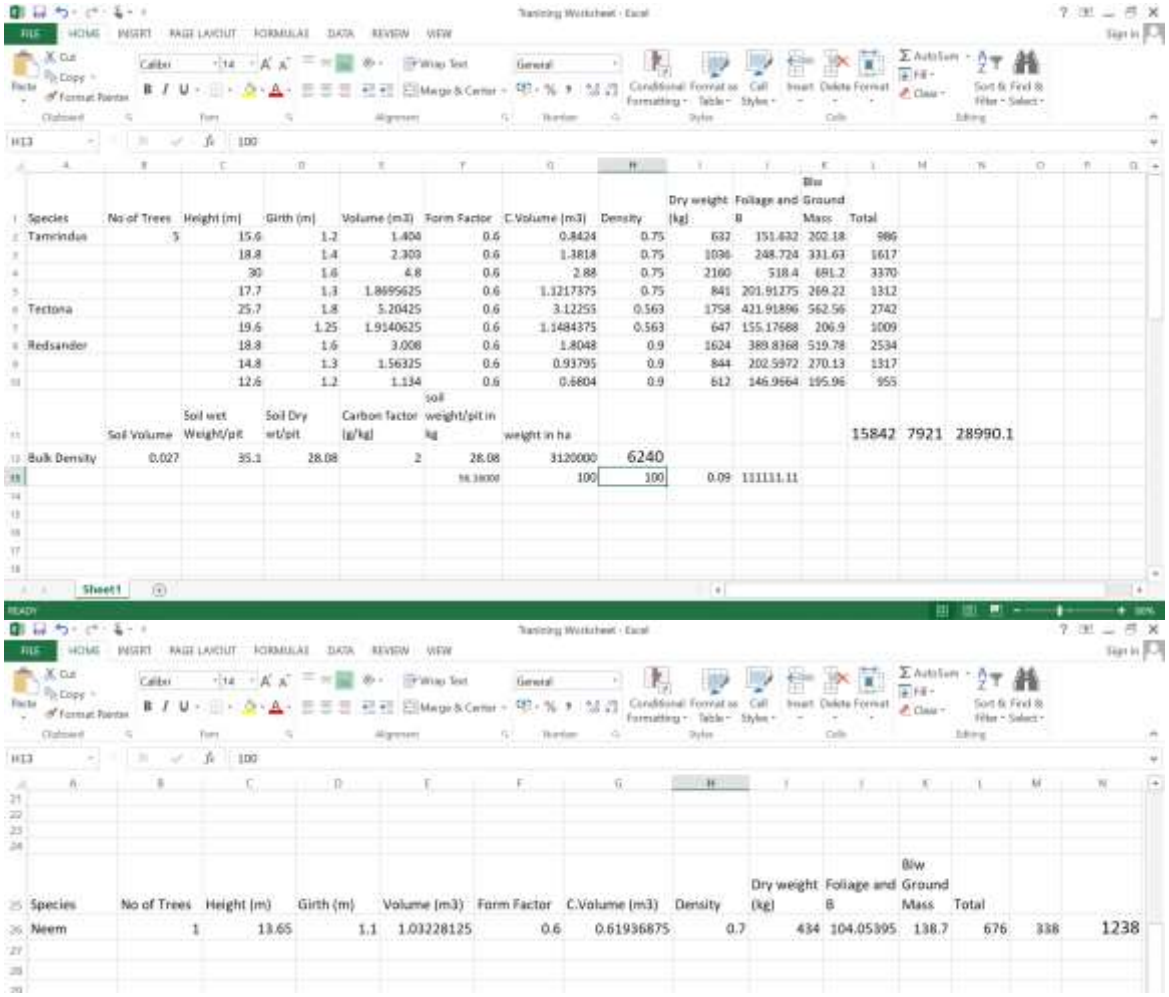
Practical Training for Forest Range Officers at Guindy National Park Field

Training programme for Foresters on February 12th, 2022

Technical sessions

Practical training for Foresters at Guindy National Park Field

4. Training Worksheet



Species	No of Trees	Height (m)	Girth (m)	Volume (m3)	Form Factor	C.Volume (m3)	Density	Dry weight (kg)	Foliage and B	Blw Ground Mass	Total
Tamrindus	5	15.6	1.2	1.404	0.6	0.8424	0.75	632	151.632	202.18	986
		18.8	1.4	2.309	0.6	1.3818	0.75	1036	248.724	331.63	1617
		30	1.6	4.8	0.6	2.88	0.75	2160	518.4	691.2	3370
		17.7	1.3	1.8695625	0.6	1.1217375	0.75	841	201.91275	269.22	1312
Tectona		25.7	1.8	5.20425	0.6	3.12255	0.563	1758	421.91896	562.56	2742
		19.6	1.25	1.9140625	0.6	1.1484375	0.563	647	155.17688	206.9	1009
Redsander		18.8	1.6	3.008	0.6	1.8048	0.9	1624	389.8368	519.78	2534
		14.8	1.3	1.56325	0.6	0.93795	0.9	844	202.5972	270.13	1317
		12.6	1.2	1.134	0.6	0.6804	0.9	612	146.9664	195.96	955
	Soil Volume	Soil wet Weight/pit	Soil Dry wt/pit	Carbon factor (g/kg)	soil weight/pit in kg	weight in ha					
										15842	7921	28990.1
Bulk Density	0.027	35.1	28.08	2	28.08	3120000	6240				
						100	100	0.09	111111.11		

Species	No of Trees	Height (m)	Girth (m)	Volume (m3)	Form Factor	C.Volume (m3)	Density	Dry weight (kg)	Foliage and B	Blw Ground Mass	Total		
Neem	1	13.65	1.1	1.03228125	0.6	0.61936875	0.7	434	104.05395	138.7	676	338	1238

5. Training Programme Agenda on February 11th, 2022

REDUCING EMISSION THROUGH INCREASING GREEN COVER AND CARBON SINK IN TAMIL NADU: A WAY FORWARD

Organised by Centre for Climate Change and Disaster Management (CCCDM), Anna University and funded by State Planning Commission (SPC), Government of Tamil Nadu

HANDS-ON TRAINING PROGRAMME TO FOREST RANGE OFFICERS ON ESTIMATION OF CARBON SEQUESTRATION AND CARBON SINK

Agenda

February 11th, 2022	
INAUGURAL SESSION: 10.00 A.M to 11.30 A.M	
10:00 - 10:05 A.M	**Welcome Address** **Dr. Kurian Joseph** Director, Centre for Climate Change and Disaster Management (CCCDM), Anna University, Chennai
10:05 - 10:15 A.M	**About the Training Programme** **Dr. A. Ramachandran D.Sc.** Emeritus Professor, CCCDM, Anna University, Chennai
10:15 – 10:30 A.M	**Inaugural Address** **Thiru. Syed Muzammil Abbas IFS** Principal Chief Conservator of Forests & Chairman, Arasu Rubber Corporation Department of Forests, Government of Tamil Nadu
10:30 – 10:50 A.M	**Presidential Address** **Thiru.Ashok Upreti IFS** Principal Chief Conservator of Forests and Head of Forest Force Department of Forests, Government of Tamil Nadu
10:50 – 11:10 A.M	**Special Address** **Thiru Anurag Mishra** Additional Principal Chief Conservator of Forests Department of Forests, Government of Tamil Nadu
11:10 – 11:20 A.M	**Felicitation Address** **Tmt. K. Geethanjali IFS** Conservator of Forests, Chennai Circle Department of Forests, Government of Tamil Nadu
11:20 – 11:25 A.M	**Felicitation Address** **Tmt. S. Sudha IFS** Head of Division (Land Use) State Planning Commission, Chennai
11:25 – 11:30 A.M	**Vote of Thanks** **Thiru. E. Prasanth IFS** Wild Life Warden, Chennai Department of Forests, Government of Tamil Nadu

TECHNICAL SESSIONS ON CARBON SEQUESTRATION	
SESSION – I: Estimation of Soil Carbon stock in Natural Forest	
11:30 – 12:15 P.M	**Thiru. A. Udhayan IFS** Additional Principal Chief Conservator of Forests & Chairman, Tamil Nadu Pollution Control Board
SESSION – II: Estimation of Above Ground Biomass Carbon stock in Forestry	
12:15 – 1:00 P.M	**Thiru. Anurag Mishra, IFS** Additional Principal Chief Conservator of Forests Department of Forests, Government of Tamil Nadu
SESSION – III: Carbon Sink: A Way Forward	
1:00 - 1:45 P.M	**Dr. A. Ramachandran D.Sc.** Emeritus Professor CCCDM, Anna University, Chennai
1:45 – 2.30 P.M	**LUNCH BREAK**
SESSION – V: Practical Training at Field	
2:30 – 4.30 P.M	**Dr. A. Ramachandran D.Sc.** Emeritus Professor CCCDM, Anna University, Chennai
	Thiru. Udhayan IFS Additional Principal Chief Conservator of Forests & Chairman, Tamil Nadu Pollution Control Board
	Thiru. Anurag Mishra, IFS Additional Principal Chief Conservator of Forests Department of Forests, Government of Tamil Nadu
4.30 – 5.00 P.M	**Feedback from Participants**

6. Training Programme Agenda on February 12th, 2022

REDUCING EMISSION THROUGH INCREASING GREEN COVER AND CARBON SINK IN TAMIL NADU: A WAY FORWARD

Organised by Centre for Climate Change and Disaster Management (CCCDM), Anna University and funded by State Planning Commission (SPC), Government of Tamil Nadu

HANDS-ON TRAINING PROGRAMME TO FORESTERS ON ESTIMATION OF CARBON SEQUESTRATION AND CARBON SINK

Agenda

February 12th, 2022	
10:00 - 10:20 A.M	**Welcome Address** **Dr. Kurian Joseph** Director, Centre for Climate Change and Disaster Management (CCCDM), Anna University, Chennai
10:20 - 10:45 A.M	**About the Training Programme** **Dr. A. Ramachandran D.Sc.** Emeritus Professor, CCCDM, Anna University, Chennai
10:45 – 11:00 A.M	**BREAK**
TECHNICAL SESSIONS ON CARBON SEQUESTRATION	
SESSION – I: Estimation of Above Ground Biomass Carbon stock in Forestry	
11:00 – 11:45 A.M	**Thiru. Anurag Mishra, IFS** Additional Principal Chief Conservator of Forests Department of Forests, Government of Tamil Nadu
SESSION – II: Carbon Sink: A Way Forward	
11:45 - 12:30 P.M	**Dr. A. Ramachandran D.Sc.** Emeritus Professor CCCDM, Anna University, Chennai
12:30 – 1.30 P.M	**LUNCH BREAK**
SESSION – III : Practical Training at Field	
1:30 – 4.30 P.M	**Dr. A. Ramachandran D.Sc.** Emeritus Professor CCCDM, Anna University, Chennai **Thiru. Anurag Mishra, IFS** Additional Principal Chief Conservator of Forests Department of Forests, Government of Tamil Nadu
4.30 – 5.00 P.M	**Feedback from Participants**

7. List of Participants

Training Programme

On

Carbon Sequestration & Enhancement of Carbon sink on Forestry

Date: 11th February 2022. **Venue:** Guindy National Park, Chennai.

SL: No	Name	Designation	Address	Contact Details (E-mail Id & Mobile No)	Signature
1	JRAshok kumar	Forest Range Officer	SF Pethanaickenpalayam Range Salem SF Division	JRashokkumar@live.in 9789661652	JRAshok
2.	V. Suresh Babu	Forest Range officer	Gummaraipoondi Range Tiruvallure Division	9843995851	V. Suresh Babu
3.	M. Ananthakumar	Forest Range officer	Morappur Range, Dharmapuri division	7904977632	M. Ananthakumar
4.	S. Jayaseelan	Forest Range officer	Alagarkovil Range Dindigul Division	96883 99969	S. Jayaseelan
5.	P. Duraimurugan	Forest Range officer	Valapady Range Salem Division.	9597999751 krpc050@gmail.com	P. Duraimurugan

Training Programme
On
Carbon Sequestration & Enhancement of Carbon sink on Forestry

Date: 11th February 2022. **Venue:** Guindy National Park, Chennai.

SL: No	Name	Designation	Address	Contact Details (E-mail Id & Mobile No)	Signature
6.	N. Nanda kumar	Forest Range officer	Ooty South Range, Nilgiris Forest Division	9551507909	11/2/22
7.	R. Ravi	Forest Range officer	Hosur Forest Divn. Hosur	raviforester@gmail.com 9489287104	11/2/2022
8.	G.k. Dealipan	Forest Range Officer	Kanniyakumari Forest Division @ Nagercoil	9842035442	11/2/2022
9.	P.K. Stalin	Forest Range officer	Tirunelveli forest Division.	94866 70490 leokstalin@gmail.com	11/2/22
10.	P. NATARAJAN	FOREST RANGE OFFICER	Dharmapuri forest Division, Dharmapuri	7667224593 gpnataraj@gmail.com	11/02/2022

Training Programme

On

Carbon Sequestration & Enhancement of Carbon sink on Forestry

Date: 11th February 2022.

Venue: Guindy National Park, Chennai.

SL: No	Name	Designation	Address	Contact Details (E-mail Id & Mobile No)	Signature
11.	R. ARUN KUMAR	FRO	Coimbatore Range Coimbatore	8248150724	
12.	D. SENTHILKUMAR	FRO	Sirumugai Range Coimbatore Division.	9894579581	
13.	R. Saravanakumar	FRO	Thiruvmangalam SF Range Madurai Division	saravananferi@gmail.com 9488386750	
14.	R. Karthikraja	FRO	Ponnaniyar Dam Range, Karur Division	Karthikrajatnfd@gmail.com 9894964598	
15.					

Training Programme

On

Carbon Sequestration & Enhancement of Carbon sink on Forestry

Date: 12th February 2022.

Venue: Guindy National Park, Chennai.

SL: No	Name	Designation	Address	Contact Details (E-mail Id & Mobile No)	Signature
1.	T. SAKTHIVEL	FORESTER	ATTUR RANGE SALEM SECTION KARUR ENGINEERING DIVISION	levikkas@gmail.com 9445212469	
2.	N. RAGUL	Forester	Shervaroys North Range Salem Forest Division	rahulmech485@gmail.com 8072596121	
3.	A. SRINIVASAN	FORESTER	YALAPADY RANGE SALEM DIVISION	Srinisugan143@gmail.com 6380687322	
4.	K.S. MURALI	FORESTER	Rasipuram IFF 2 Range Namakkal Division	KS.murali@rediffmail.com 9750357819	
5.	G. VINOTH.	Forester	Social Forestry Range, Inside Kallakurichi SF Division.	gvinoth.gv@gmail.com 9677791925	

Training Programme

On

Carbon Sequestration & Enhancement of Carbon sink on Forestry

Date: 12th February 2022.

Venue: Guindy National Park, Chennai.

SL: No	Name	Designation	Address	Contact Details (E-mail Id & Mobile No)	Signature
6.	A. Nagarajan	Forester	Madurai Division Madurai Range.	mraja16021980@gmail 9790302405	
7.	K. Baby	Forester	Arni Range T.V. malai	Kbaby forester@gmail.com 9842360120	
8.	J. BALAVIGNESH	FORESTER	Enforcement Range Kavanaipattai Thiruvallur Division.	8056210800 jbalavignesh@yahoo.com	
9.	S.K. POUL	FORESTER	Social Forestry Range Kallakurichi	94884-70724. spoul.skz@gmail.com	
10.	B. Pradeep	Forester.	Megamalai Division Varusanadu Rang	9952784813 bpradeepmechanical@gmail.com	12/02/22

ANNEXURE

SANCTION FROM THE STATE PLANNING COMMISSION

PROCEEDINGS OF THE MEMBER- SECRETARY, STATE PLANNING COMISSION, CHEPAUK, CHENNAI – 600 005
PRESENT: Thiru Anil Meshram, I.A.S.,

Proc Roc No:976/SPC/LUD/2020 **Dt.23.03.2020**

Sub: SPC -TNSLURB - Work Plan for the year 2019-2020 - Approval of Seminar on "Reducing Emission Through Increasing Green Cover and Carbon Sink in Tamil Nadu: A Way forward" by Centre for Climate Change und Disaster Management, Anna University, Guindy, Chennai- Release of first Installment amount santion order" issued – regarding

Ref:
1. G.O. No. 58, Planning, Development & Special Initiatives (SPC) Department, Dated: 10.02.2011
2. From the Director, Centre for Climate Change and Disaster Management, Anna University, Chennai, E-mail dated: Dec 3rd 2019
3. Minutes of the TNSLURB meeting held on 12.12.2019
4. From the Director, Centre for Climate Change and Disaster Management,Anna University,Chennai, letter dated: 18.03.2020
5. Invoice No. CCCDM/SPC/Seminar/2020 Date: 18.03.2020

ORDER:

The Tamil Nadu State Land Use Research Board (TNSLURB), has decided to conduct a seminar entitled **"Reducing Emission Through Increasing Green Cover and Carbon Sink in Tamil Nadu: A Way forward"** for the year 2019-20. The above seminar has been entrusted to the Director, Centre for Climate Change and Disaster Mangement (CCC&DM), Anna University Guindy, Chennai – 600025 at a cost of **Rs.2,01,250/- (Rupees Two Lakhs One Thousand Two Hundred and Fifty Only)** and the duration of the seminar is **Two Days.**

The payement would be made as follows:

Installment No.	Financial Year	Amount (In Rupees)	Remarks
1.	2019-20	1,61,000.00 (80%)	Initial Payment to tbe released upon signing the TOR.
2.	2020-21	20,125.00 (10%)	On receipt of seminar completion report. This report will be placed for discussion
3.	2020-21	20,125.00 (10% 20,125	On receipt of final Seminar report incorporating the suggestions made by the SPC – 20 copies together with the soft copy in Disc. This amount includes 5% perfromacnce security (details are set out in para11 below)
	Total	**2,01,250.00**	**(Rupees Two Lakh One Thousand Two Hundred and Fifty Only)**

2. The Terms of Reference (TOR) duly signed by the Director, Centre for Climate Change and Disaster Management (CCC&DM), Anna University, Guindy, Chennai, has been received vide reference 4th cited. As per the Terms of Reference, it has been agreed to release a sum of Rs.1,61,000/- (Rupees One Lakh Sixty One Thousand only) to the Director, CCC&DM, Anna University, Guindy, Chennai as initial payment on signing the TOR for the year 2019 -2020, corresponding invoice also received vide reference 5th citied.

3. Hence, in pursuance of the powers issued in G.O. first cited, sanction is hereby accorded for a sum of Rs.1,61,000/- (Rupees One Lakh Sixty One Thousand only) being the first installment amount for conduct a seminar entitled "Reducing Emission Through Increasing Green Cover and Carbon Sink in Tamil Nadu: A Way forward". The Accounts Officier, SPC is hereby authorized to draw and disburse an amount of Rs. 1,44,900/- (Rupees One Lakh Forty four Thousand and Nine Hundred Only) through ECS to the Director, Centre for Technology Development and Transfer (CTDT), Anna University, Chennai to the following Bank Account.

Bank and Name of the Branch	**State Bank of India, Anna University, Chennai A.U. College College Campus, Sardar Patel Road, Guindy, Chennai-600 025**
Bank Account No	**30061247489**
MICR Code	**600002039**
PAN No.	**AAALA1314K**
GST NO.	**33AAALA1314K1ZQ**

4. The Accounts Officier, SPC is authorized to draw and remit an amount of Rs.16,100/- (Rupees Sixteen Thousand and One hundred only) being the 10% of the TDS for Rs. 1,61,000/- in to the Government Account vide U/S 194 J of Income Tax Act.

5. The Director, CCC&DM, Anna University, Guindy, Chennai is requested to send a stamped receipt for Rs.1,61,000/- (Rupees One Lakh Sixty One Thousand only) and Utilization Certificate for the first installment amount. Further it is also requested to send a Seminar Completion Report to Tamil Nadu Land Use Research Board of the State Planning Commission at the earliest.

One-day Webinar
on
Reducing Emission through Increasing Green Cover and Carbon Sink in Tamil Nadu: A Way Forward

Climate change and India's NDC and TNSAPCC

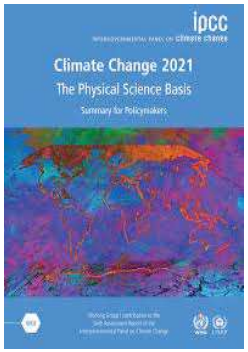
Dr. Jayanthi Murali I.F.S.
Special Secretary, E&CC,ECC&F Department, GoTN

United Nations Framework Convention on Climate Change

- UNFCCC established an international environment treaty to combat "dangerous human interference with the climate system" in part by stabilizing green house gas concentrations in the atmosphere.
- Signed by **154 states** at UN Conference on Environment and Development (UNCED), informally known as the **Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992**.
- Secretariat at **Bonn** from **21 March 1994**.

Intergovernmental Panel on Climate Change (IPCC)

- **Inter governmental body of UN** responsible for advancing knowledge on human-induced CC.
- **Established in 1988 by WMO & UNEP** & endorsed by UN General Assembly.
- **Headquarter in Geneva**, Switzerland, comprised of **195 Member States .**
- **Comprehensive scientific information information on anthropogenic CC** (natural, political & economic impact, risks & response options).
- **Does not conduct original research nor monitor CC**, but rather undertakes a periodic, systematic review of all relevant published literatures**.**



Sixth assessment cycle of IPCC to be completed in 2022.

Nationally Determined Contribution (NDC)

- **19th COP Warsaw (2013): All countries required to prepare INDCs** and present them before COP 21 in Paris.
- **20th COP in Lima (2014):Further clarity on form of INDC**: not mitigation centric and can include other components as per country priorities.
- **21th COP in Paris (2015):** UNFCCC **created a mechanism for Intended NDCs** to be submitted
  - 96 parties agreed to aim to limit global warming to less than 2 °C, and try to limit the increase to 1.5 °C.
  - Paris Agreement into force on **4 November 2016** in those countries that had ratified the Agreement, and other countries had ratified the Agreement since.
  - Countries were given **freedom and flexibility to ensure nationally appropriate climate change mitigation and adaptation plans.**
  - INDCs became **NDC as countries ratified Paris Agreement**.
- **22nd COP in Marrakesh (2016):** focused on **NDCs and their implementation.**

Salient features of India's NDC

- To propagate a **healthy and sustainable way of living** based on traditions , values of conservation and moderation.
- To adopt a **climate-friendly and a cleaner path** at corresponding level of economic development.
- To **reduce emissions** intensity of its GDP by 33 to 35 % by 2030 from 2005 level.
- To achieve **about 40 % cumulative electric power installed capacity from non-fossil fuel based energy resources** by 2030.
- To **create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent** through additional forest and tree cover by 2030.
- To **adapt better to CC by enhancing investments sectors vulnerable to CC**-agriculture, water resources, Himalayan region, coasts, health & disaster management.
- To **mobilize domestic & additional funds** from developed countries to implement mitigation and adaptation actions.
- To **build capacities, create domestic framework and international architecture** for quick diffusion of climate technology in India and for joint collaborative R&D.

How are India's NDC different from other countries?

- India's NDC has strong focus on CC adaptation.
- Of 8 Missions outlined in India's NAFCC, **4 efforts are focused on adaptation efforts –** sustainable agriculture, increasing water use efficiency, sustaining Himalayan ecosystem and creating sustainable habitats.
- India is able to dedicate same level of focus and effort on **adaptation on as large a scale.(NAFCC projects).**
- Financial implications of CC goals are outlined, in addition to outlining its plan for developing and **enabling technology transfers to facilitate India's NDC achievement.**

NATIONAL ACTION PLAN ON CLIMATE CHANGE

EIGHT MISSIONS:

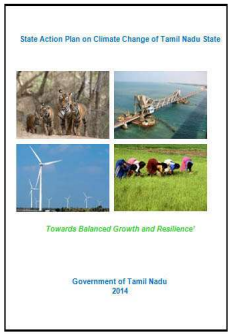
- **National Solar Mission**
- **National Mission for Enhanced Energy Efficiency**
- **National Mission on Sustainable Habitat**
- **National Water Mission**
- **National Mission for Sustaining the Himalayan Ecosystem**
- **National Mission for a Green India**
- **National Mission for Sustainable Agriculture**
- **National Mission on Strategic Knowledge on Climate Change**

TAMIL NADU STATE ACTION PLAN ON CLIMATE CHANGE(TNSAPCC)

- **Year 2015-2020**
- **Endorsed by MOEF&CC,GOI on 31st March 2015**

VULNERABLE SECTORS IDENTIFIED IN TNSAPCC

- **Sustainable Agriculture**
- **Water Resources**
- **Forest and Biodiversity**
- **Coastal Area Management**
- **Energy Efficiency, Renewable energy and Solar Mission**
- **Sustainable Habitat**
- **Knowledge Management**



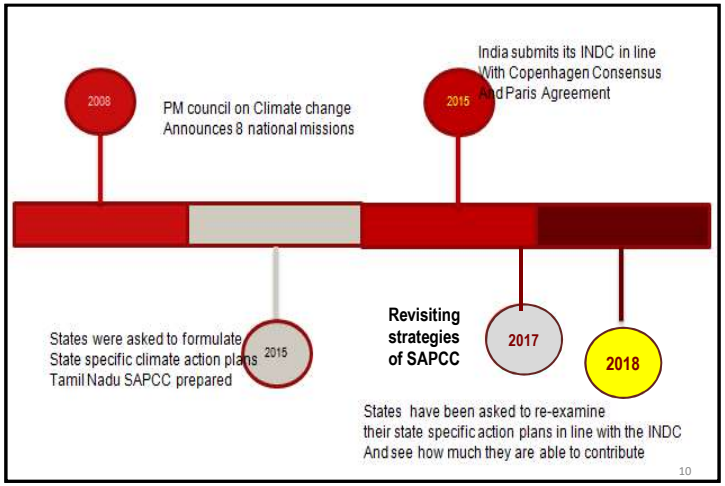
TNSAPCC: COMPOSITION OF THE STEERING COMMITTEE

Chairman: Chief Secretary,Government of Tamil Nadu

Member Secretary: Director of Environment, Government of Tamil Nadu

Members:
1. ACS to Govt., E,CC&F Department
2. ACS to Govt., Finance Department
3. ACS to Govt., Planning, Development & Special Initiatives Department
4. Principal Secretary to Govt., Energy Department
5. ACS to Govt., Industries Department
6. ACS to Govt., Public Works Department/water resources
7. Principal Secretary to Govt., Health & Family Welfare Department
8. Principal Secretary to Govt., RD&PR Department
9. Principal Secretary to Govt., Agriculture & Farmers welfare Department
10. Principal Chief Conservator of Forest(HoD)
11. Chairman & Managing Director, Tamil Nadu Energy Development Agency
12. Member Secretary, State Planning Commission
13. Director, CCCDM, Anna University
14. Director, IRS, Anna University
15. Director, Madras School of Economics
16. CGM/OIC, NABARD, Regional Office

REVISION OF TNSAPCC



METHODOLOGY FOLLOWED

Principle 1

To demonstrate ambition and commitment of the State to **address issue of CC and State's contribution to India's NDC**

Principle 2

To assess and show real progress made by the State in **addressing State specific vulnerability based on priorities set out in SAPCC**

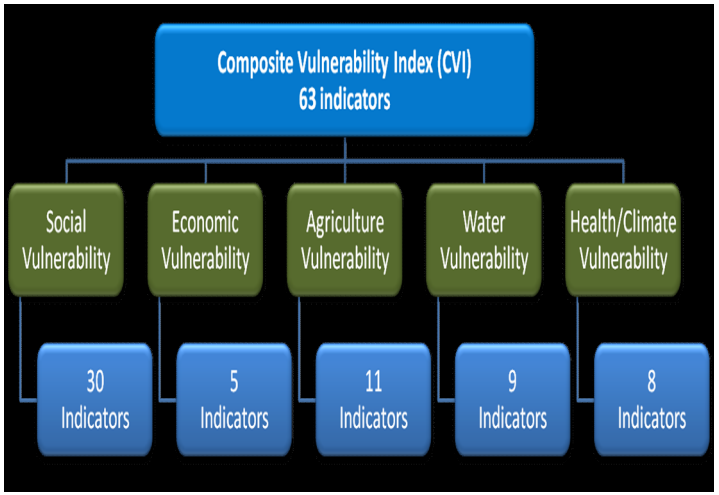
Principle 3

Develop a long term climate action plan (2030) and policy aligned to INDC with **implementation and M&E framework**

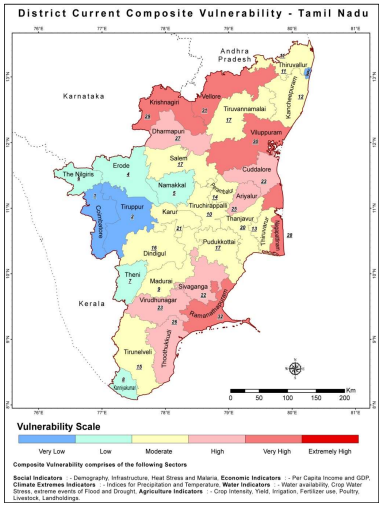
PROCESS FOLLOWED FOR REVISION OF TNSAPCC

1. Consultation with concerned line departments
2. Inception Workshop and finalisation of data collection format
3. Appointment of nodal officers from each department for assisting revision of SAPCC
4. Format for data collection was shared with all concerned Line Departments
5. Line Departments were followed up several times for stock taking data
6. Draft report was prepared from available data on all Sectors relevant in TNSAPCC

COMPOSITE VULNERABILITY INDEX



CURRENT VULNERABILITY INDEX



Current Vulnerability Index

Very High Vulnerable: **Ramanathapuram, Vellore, Villupuram, Krishnagiri and Nagapattinam (5 Districts)**

High Vulnerable: Dharmapuri, Thoothukkudi, Ariyalur, Cuddalore, Virudhunagar and Sivaganga (6 Districts)

DIFFERENCE BETWEEN TNSAPCC AND REVISION OF TNSAPCC

Sectors in SAPCC	Sectors in Revision of SAPCC
Sustainable Agriculture	Sustainable Agriculture
Water Resources	Water Resources
Coastal Area Management	Coastal Area Management
Forestry and Biodiversity	Forestry and Biodiversity
Energy Efficiency, Renewable Energy and Solar Mission	Energy Efficiency, Renewable Energy and Solar Mission
Sustainable Habitat	Sustainable Habitat
Knowledge Management	Knowledge Management
	Vulnerability, Disaster Management & Mitigation
	Health and Gender
	SDG's ; Monitoring & Evaluation

TNSAPCC Framework 2.0 (2021-2030)

State Climate profiles – Understand climate data

- Overview of the State
- State climate profile
- CC Risk & Assessment of vulnerabilities

Adaptation & Mitigation Strategies-

- Delineation of sectoral strategies, linkages with NDC&SDG
- Priority Adaptation Actions to implement strategies(Agriculture, Water resources, Forest & Biodiiversity, Coastal Area Management)
- Priority Mitigation Actions to implement strategies (Enhanced Energy Efficiency & Solar Mission, Sustainable habitat)

Financial Allocation – Address State Priorities

- Sectoral focus , funding structure and scale (stock taking)
- Proposed budget

Monitoring & Evaluation – Effective Institutional Mechanism

- Proposed activities & Implementing agencies
- Specific project proposals and time frame for implementation

PROPOSED ALLOCATION OF BUDGET IN SECTORS IN TNSAPCC 2.0

Sector	Proposed Budget (2021-30) (In Crore)	From State/Central budget available (In Crore)
Sustainable Agriculture	71,731.94	58,426.94
Water Resources	19041.84	16728.00
Forest & Biodiversity	2834.44	2301.44
Coastal Area Management	4776.10	2626.58
Strategic Knowledge for Climate Change	280.87	271.68
Enhanced Energy Efficiency & Solar Mission	98,056.68	42522.31
Sustainable Habitat	127,489.33	98,021.77
Total	**324,211.20**	**220,898.72**

CHALLENGES DURING PREPARATION OF TNSAPCC 2.0

climate information system to aid decision-making

- **Data requirement** from sectoral line departments to assess climate risks
- **Fragmentation of data**
- **Baseline data**

Mainstreaming SDG's & NDC targets into SAPCC sectors

- Revised SAPCC work towards establishing clear linkages with **SDG/NDC goals**.
- Crucial step towards exploring **synergies in sectors and development plans**

Comprehensive budgeting exercise to ensure predictability of finance

- **Climate budgeting-** financial roadmap encapsulating financial availability for each proposed activity along with clear identification of its sources in sectoral line departments

Way forward....

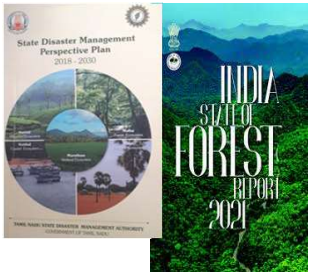
At COP 26, Hon'ble Prime Minister has made following key Announcements (Panchamrit):

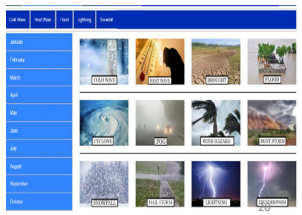
1. India will take its non-fossil fuel capacity to **500GW by 2030**.
2. India will achieve **about 50% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030** by help of transfer tech low cost international finance like GCF.
3. India will reduce the total **projected carbon emissions by one billion tonnes from now to 2030.**
4. Reduce Emission Intensity of GDP **by 45% by 2030 from 2005 level.**
5. By year **2070**, India will achieve the target **Net Zero**.

Hon'ble Prime Minister emphasised on the need for sustainable lifestyles through a mass movement.
Lifestyle for Environment(LIFE)

Way forward....

1. Updating important schemes and programmes in line Departments.
2. Incorporating ISFR 2021 data.
3. Incorporating details from important documents.
4. Placing SAPCC 2.0 in State Level Steering Committee for onward submission to MoEF&CC, GoI

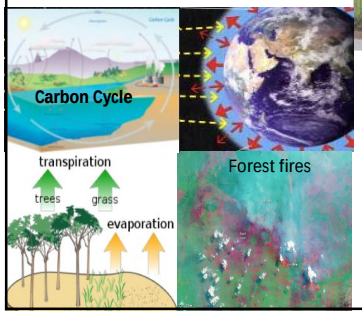




India's First Weather Hazard and Vulnerability Atlas released by Ministry of Earth Sciences

THANK YOU

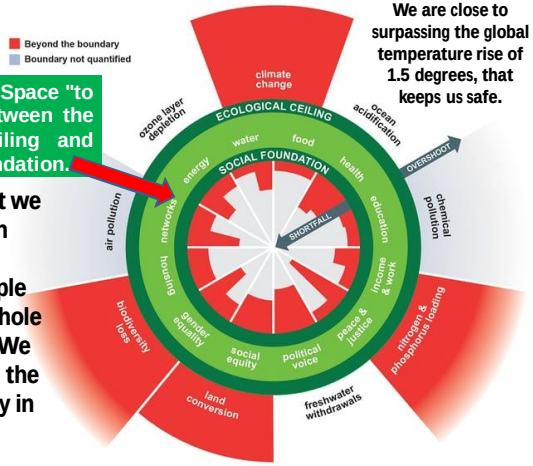
CLIMATE ACTION THE GLOBAL OUTLOOK



Dr. KURIAN JOSEPH
Professor of Environmental Engineering and Director
Centre for Climate Change and Disaster Management (CCCDM)
Department of Civil Engineering
CEG Campus, Anna University
Chennai-600025

FIVE MINDSETS FOR SUSTAINABILITY

- **Earthly mindset**
  - **to define genuine sustainability challenges**
- **Analytic mindset**
  - **to find solutions to sustainability challenges**
- **Careful (Precautionery) Mindset**
  - **Dealing with uncertainty**
- **Collaborative mindset**
  - **interaction with different actors and interests**
- **Action mindset**
  - **translation of understanding into** judgments, decisions, commitments and, eventually, **actions**



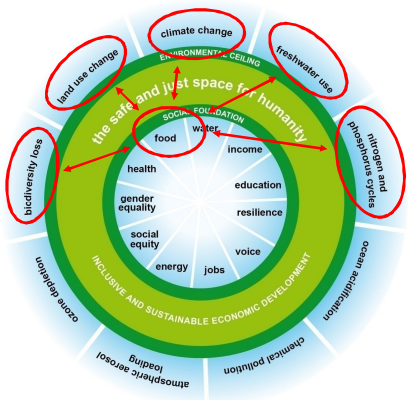
"Safe and Just Space "to live well is between the Ecological Ceiling and the Social Foundation.

At the moment we transgress both lines. While Billions of people still live in the hole in the middle, We have breached the outer boundary in several places.

We are close to surpassing the global temperature rise of 1.5 degrees, that keeps us safe.

Source: **9 dimensions of planetary boundaries** according to Rockström et al. 2009, **12 dimensions of social boundaries** according to Raworth 2017, based on government priorities at Rio+20 and later UN Conferences.

THE BOUNDARIES ARE INTERDEPENDENT



To produce food, people need to convert land, use water and nitrogen and phosphorus.

But doing this to excess results in biodiversity loss, and contributes to climate change.

It can also undermine water availability – all of which undermine the potential to grow food.

Source : Kate Raworth, Oxfam. kraworth@oxfam.org.uk

Doughnut Economics: Seven Ways to Think Like a 21st Century Economist, Kate Raworth. Chelsea Green Publishing, White River Junction (2017), 309 pages, ISBN: 9781603586740

SDGs -A blueprint for a better world by 2030

UNITED NATIONS SUSTAINABLE DEVELOPMENT SUMMIT 2015 25-27 SEPTEMBER

People every where to have a decent life in Peace and Partnership. Prosperity is shared and our Planet is protected.

SDG13 and other SDGs

SDG1-No Poverty

- Climate change will reduce poor people's livelihood assets, for example, health, access to water, homes, and infrastructure.
- Poor people more vulnerable to climate change and disasters
- Adaption to climate change and reducing the risks of disasters and shocks is critical

SDG2-Zero Hunger

- Climate change is projected to alter regional food security
- Sustainable and climate-smart agriculture is a key solution in the fight to limit average temperature increase to below 2°C.

SDG3-Good Health and Well-being

- increases in heat-related mortality and illness associated with heat waves due to increased weather variability, changes in frequency and intensity of extreme weather events (heat-waves, cold spells, heavy rainfall, storms, droughts), and changing patterns in infectious disease distribution.

SDG13 and other SDGs

SDG4 –Quality Education

- Natural disasters and drought reduce children's available time
- BUILD RESILIENCE to ensure children can go to school at all time, including during extreme climate events

SDG5 –Gender Equality

- Women are amongst the most vulnerable to environmental degradation and are particularly affected by climate change impacts

SDG6 –Water and Sanitation

- Climate actions focus on water efficiency and water ecosystem management.

SDG13 and other SDGs

SDG7 –Affordable Clean Energy

- Energy provided by fossil fuels is the main contributor of climate change (60% of GHGs)
- Energy Efficiency and Green Energy are key climate Actions

SDG8 –Decent work and economic growth

- Promote green growth and jobs contributing to restoring and protecting the environment and natural resources

SDG9 –Industry, innovation and infrastructure

- Innovate to make green infrastructure, increase energy efficiency and reduce their adverse environmental impact

SDG13 and other SDGs

SDG10 – Reduced Inequalities	SDG11 –Sustainable cities and communities	SDG12 –Sustainable Consumption and Production
• Climate change and disasters have a dire impact on the poorest and vulnerable groups • Adapt and fight climate change to reduce inequalities, conflicts and forced migration worldwide	• Cities account for up to 80% of energy consumption as well as 75% of global waste and carbon emissions • Promote sound urban planning, sustainable building, low-carbon transports, green spaces and sustainable lifestyles	• Circular economy • Reduce the food wasted by producers, retailers and consumers • Switch to energy efficient lightning

SDG13 and other SDGs

SDG14 – Life below water	SDG15 –Life on Land	SDG16: Peace, justice and strong institutions
• Coral reefs which provides a home to 25% of all marine life are being destroyed at an alarming rate • Fight climate change, stop coral mining and promote sustainable tourism	• Role of ecosystems, forest management and land use in climate change mitigation and adaptation • Combat desertification, and restore degraded land and soil	• Governance and Enforcement of Climate Actions

SDG13 and other SDG17

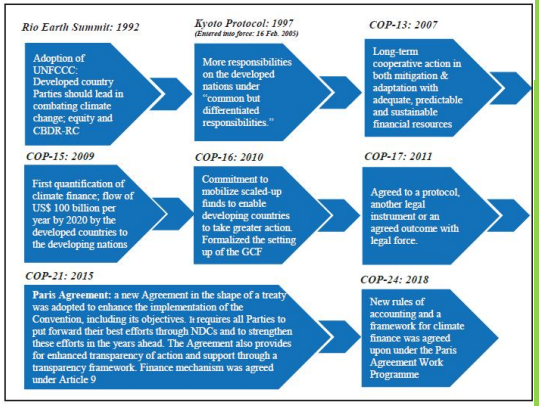
SDG17: Partnerships for goals

- Global climate change is a global issue and response requires global cooperation, especially to help developing countries to adapt to the adverse impacts of climate change.
- Providing financial support, technology transfer, and capacity building for those countries that need it the most - particularly the Least Developed Countries (LDCs) and the Small-Island Developing States (SIDS).

SDG-13-Climate Action- Targets

- **13.1:** Strengthen Resilience and Adaptive Capacity to Climate Related disasters
- **13.2:** Integrate Climate Change Measures into Policies and Planning
- **13.3:** Build Knowledge and Capacity to meet Climate Change
- **13.A:** Implement the UN Framework Convention on Climate Change (UNFCC)
- **13.B:** Promote Mechanisms to raise Capacity for Climate Planning and management

UNFCC : Rio Summit 1992 to the 26th Session of the Conference of Parties (COP 26)-2021

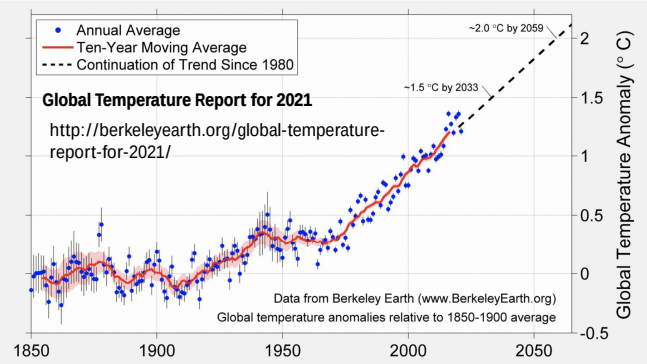


Source: Various COP Decisions. GCF – Green Climate Fund

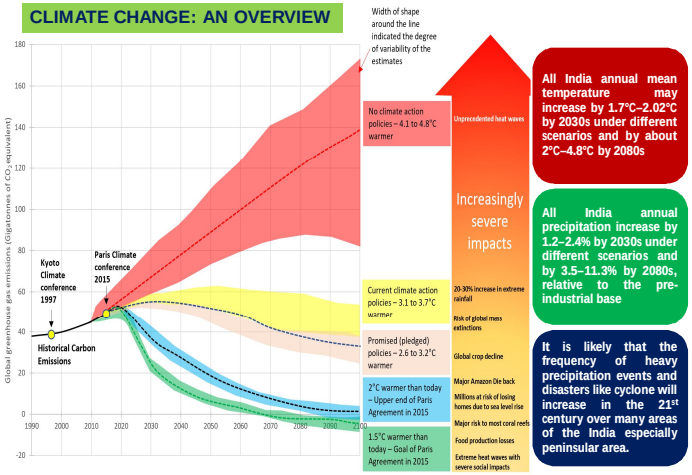
COP 26 :2021 has taken forward the discussions and India Committed to

1. **Increase non-fossil energy capacity to 500 GW (gigawatts) by 2030.**
2. **Meet 50 percent of energy requirements from renewable energy (RE) by 2030.**
3. **Reduce the total projected carbon emissions by 1 billion tonnes (BT) by 2030.**
4. **Reduce the carbon intensity of the economy by less than 45 percent.**
5. **Achieve net zero carbon by 2070**

At 1.2°C of global warming, with current pace, we will hit 1.5°C in 2033 and 2°C by 2060.



CLIMATE CHANGE: AN OVERVIEW



All India annual mean temperature may increase by 1.7°C–2.02°C by 2030s under different scenarios and by about 2°C–4.8°C by 2080s

All India annual precipitation increase by 1.2–2.4% by 2030s under different scenarios and by 3.5–11.3% by 2080s, relative to the pre-industrial base

It is likely that the frequency of heavy precipitation events and disasters like cyclone will increase in the 21st century over many areas of the India especially peninsular area.

Climate Action Universe is Broad

Clean Energy

Power Generation
- Solar
- Wind
- Clean coal (sequestration, infrastructure)
- Other clean power generation (Geothermal, hydro, biomass, wave/tidal, methane capture, nuclear)

Cleantech Infrastructure
- Infrastructure management
- Supply chain management

Power Storage Technology
- Battery technology and fuel cells

Transport & Sustainable Biofuels
- Low carbon transportation
- Bio-diesel, ethanol

Energy & Material Efficiency

Advanced Materials
- Advanced coatings
- Lightweight substitutes
- Solvents and biodegradables

Building Efficiency
- Building management incl. green data centre mgmt
- Heating & cooling systems
- Lighting systems
- Insulation
- Micro generation/micro CHP

Power Grid Efficiency
- Transmission (including smart grids)
- Smart metering
- Storage
- Infrastructure

Environmental Resource Mgmt.

Water
- Desalination/Purification
- Wastewater treatment
- Distribution and management

Agriculture
- Irrigation innovation
- Clean pesticides
- Consumer food purity
- Seeds
- Timberland

Waste Management
- Recycling
- Toxin management
- Energy from waste
- Land remediation

Environmental Services

Environmental Protection
- Land conservation
- Environmental restoration
- Timberland
- Forestry
- Sea defenses
- Carbon

Business Services
- Insurance
- Logistics
- Green focused banking
- Microfinance
- Consultancy/advisory
- Intellectual property
- Weather

Choices
- **Choose fresh, seasonal produce grown locally (reduce the carbon emissions from transportation, preservation and prolonged refrigeration)**
- **Eat less meat and dairy**
- **Cut back on Flying (Video Conferencing)**
- **Walk or cycle or use Public Transport**
- **Reduce energy use and Bills**
- **Respect and protect Green Spaces**
- **Reduce consumption and Waste**

Voice and Votes
- **Make the voice heard by decision makers on Energy, Environment, Green spaces, infrastructure, waste management**

DECISION SUPPORT SYSTEMS AND STAKEHOLDER PARTICIPATION CRITICAL

Eight National Missions, form the core of the National Action Plan on Climate Change

- National Solar Mission
- National Mission on Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Eco-system
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change.

http://pmindia.nic.in/

National Mission for Green India (GIM)

Launched in February, 2014 with the objective to

- safeguard the biological resources of our nation and associated livelihoods against the peril of adverse climate change
- recognise the vital impact of forestry on ecological sustainability, biodiversity conservation and food-, water- and livelihood-security.

Increased forest/tree cover on 5 m ha of forest/non-forest lands and improved quality of forest cover on another 5 m ha (a total of 10 m ha).

Improved ecosystem services including biodiversity, hydrological services and carbon sequestration as a result of treatment of 10 m ha.

Increased forest-based livelihood income of about 3 million households living in and around the forests.

Enhanced annual CO_2 sequestration by 50 to 60 million tonnes in the year 2020

National Mission for Green India (GIM)

Enhancing quality of forest cover and improving ecosystem services

- Eco-restoration of degraded open forest
- Restoration of Grasslands

Ecosystem restoration and increase in forest cover

- Rehabilitation of Shifting Cultivation areas
- Restoring Scrublands
- Restoration of Mangroves
- Restoration of abandoned mining areas

Enhancing tree cover in Urban and Peri-Urban areas

- Open spaces/green spaces like parks/wood lots
- Diffused planting such as on avenues and in households
- Institutional lands, especially lands belonging to or allotted to business/industrial houses and educational institutions

Agro-Forestry and Social Forestry

Restoration of Wetlands

Cross-cutting Interventions

- Improving fuel-use efficiency and promoting alternative energy sources
- Community Livelihood Enhancement
- Community Conserved Areas and Sacred Groves
- Understanding, identifying and protecting areas/catchments of hydrological importance:

Strengthening Institutions for Decentralized Forest Governance

Improving investment climate for farmers

Forests are much more than Timber and Carbon

Ameliorating climate

- Carbon Sink

Food security:

- fruits, flowers, leaves, stems, seeds, roots, tubers, mushrooms, etc.
- Organic matter to maintain the fertility, structure and water-holding capacity of soils

Biodiversity

- Forests are home to 80% of the country's biodiversity (FAO 2010).

Water security:

- Forests are vital for maintaining the hydrological cycle and regulating water flows and sub-soil water regimes, recharging the aquifers, maintaining the flow of water in rivers and rivulets

Livelihood security of local communities

- fuel wood, fodder, small timber, and medicinal plants, and artisan raw material like canes and bamboo, that are crucial to livelihood security of forest-dependant communities

How forest management helps tackle climate change -Mitigation?

Carbon Sequestration through increases in forests and trees and forest carbon stock enhancement

- Afforestation, reforestation and forest restoration
- Increase of tree cover in farming systems (agroforestry), rural landscapes and cities
- Enhancement of carbon stocks and sequestration capacity through management practices

Forest carbon stocks conservation through reduction of deforestation and forest degradation

- Sustainable practices of forest management and use
- Integrated fire management
- Management of forest health and vitality
- Management of forest biodiversity
- Management of protected areas and wildlife

How forest management helps tackle climate change -Adaptation?

Strengthening adaptive capacity of trees and forests especially in fragile forest ecosystems

- Management of forest biodiversity
- Forest health and vitality to reduce vulnerability
- Intensifying fire management systems
- Adaptive management practices

Strenghtening adaptive capacity of forest dependent communities

- Strengthening coping strategies
- Diversifying forest management-related employment opportunities and livelihoods
- Adaptive land use planning and management

Forest Threats and Management

Management measures must be adapted to the specific threats of the site.

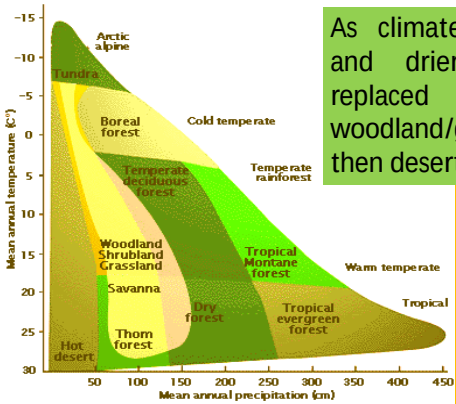
- fires, pests and diseases, poor management and harvesting, overexploitation, grazing and other disturbances.

Forest management activities include:

- sustainable practices of forest management and use
- integrated fire management
- management of forest health and vitality
- management of forest biodiversity
- management and extension of protected areas

For more information:
www.fao.org/forestry/sfm

Temperature and precipitation control where forests are found



As climate gets warmer and drier forests are replaced by woodland/grasslands and then deserts.

Increased temperatures and levels of atmospheric carbon dioxide, and changes in precipitation and in the frequency and severity of extreme weather events are having notable impacts on the condition of the world's forests

FOCUS ON MANAGE FRAGILE FOREST ECOSYSTEMS

Forest ecosystems particularly vulnerable to climate change

mountain forests and watersheds	dryland forests	coastal forests

Management measures are often critical to reduce their vulnerability and facilitate their adaptation to climate change.

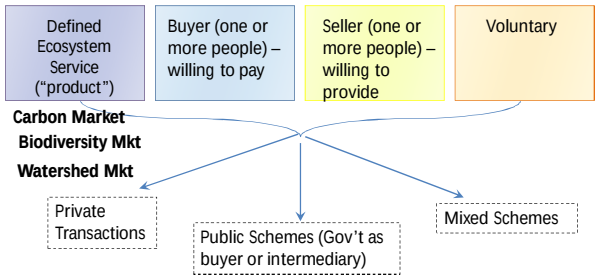
increase slope stability and reduce erosion	integrated coastal area management	build resilience and counteract the increasing vulnerability of people, forest ecosystems and species living in drylands.

FINANCING FORESTS' CONTRIBUTION TO CLIMATE ACTION

- Voluntary Carbon Markets
- Adaptation Fund of the Global Environment Facility
- REDD (reducing emissions from deforestation and forest degradation in developing countries) + Partnership
- Bilateral and NGO funding
- Forest Investment Program (FIP) of Strategic Climate Fund
- Forest Carbon Partnership Facility (FCPF)

Payments for Ecosystem Services?

- Incentives offered to farmers or landowners in exchange for managing their land to provide some sort of ecological service.



URBAN GREEN SPACES AND POLLUTION ABATEMENT

Reduce air pollutants directly when dust and smoke particles are trapped by vegetation.

Reduce the levels of noise depending on their quantity, quality and the distance from the source of noise pollution.

Biodiversity and nature conservation - reproduction of species and conservation of plants

Better storm water management

Green Urban Landscapes require supporting water sources and manure

- **Integrate with Solid Waste Management (use of compost) and Sewage Treatment (utilisation of Treated sewage)**

Ensure that the Tree Root do not Damage sewer and Buildings
Leaf litter Management

To conclude... Climate actions for Green cover and Carbon Sink enhancement must ...

Provide synergies and be balanced with other national and local objectives such as

- Production of goods
- Protection of soil
- Water and other environmental services
- Conservation of biodiversity
- Provision of socio-cultural services
- Livelihood support and Poverty alleviation

Have integrated approach including

- Policy and Governance
- Planning and Practices
- Intersectoral cooperation and coordination
- Community Participation
- Monitoring and assessment

THANKS

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Regional Climate Scenarios and Cadastral Level Modelling

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Centre for Environmental Studies
Anna University, Chennai
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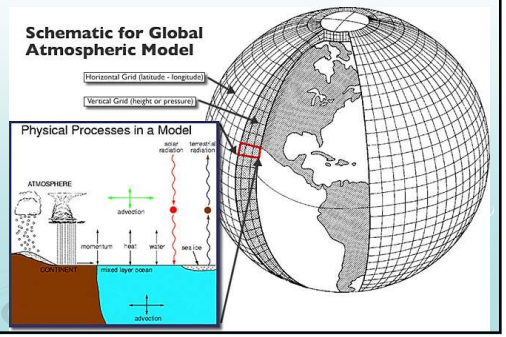
Global Climate Models

Mathematical Representation of the Climate System based on its physical, chemical and biological components in the form of a computer program



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Grid Resolution

Spatial resolution specifies the horizontal size of the grid cells (in degrees of latitude and longitude or in km).

Temporal resolution refers to the size of the time steps used in models; how often (in simulated or "model time") calculations of the climate variables are calculated.

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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

GCM are regionalized by developing RCMs through **Downscaling**-The process by which coarse-resolution GCM outputs are translated into finer resolution climate information, so that they better account for regional climatic influences, such as local topography.

- Dynamically using RCMs (PRECIS, REGCM etc)
- Statistically (SDSM)-statistical relationships developed and simulation done
- Pattern Scaling

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Climate projection/Climate scenario

- A climate projection is the response of the climate system to different greenhouse gas scenarios, often based upon simulations by climate models.
- Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions, that may or may not be realized, and are therefore subject to substantial uncertainty not related to the climate system. A climate change projection is the difference between a climate projection and the current climate. Climate scenario is often used synonymously with climate projection.
- A climate prediction or climate forecast is the result of an attempt to produce a most likely description or estimate of the actual evolution of the climate in the future, e.g. at seasonal, inter-annual or decadal time scales
- While seasonal forecasts are routinely issued in some regions, climate predictions at longer time-scales In the same way as weather forecasts depends on the initial state of the atmosphere, climate predictions depends on an accurate description of the initial state, mainly in the oceans.

Forecast – Subset of prediction, anything you predict for the future is forecast

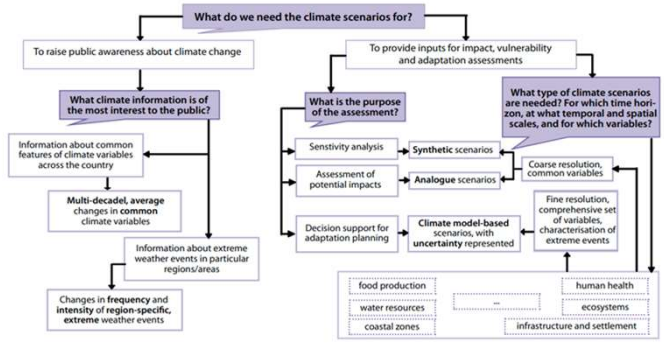
Predictions – Done for past, present and future

Projections – A probabilistic statement that it is possible that something will happen in the future if certain conditions develop. The set of boundary conditions that is used in conjunction with making a projection is often called a scenario, and each scenario is based on assumptions about how the future will develop

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

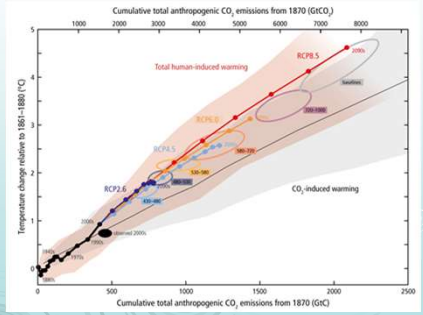
- **AR4 - SRES** (Special Report on Emission Scenarios)
  - Emissions A1F1, A1B, A1T1, A2. B1, B2
- **AR5 - RCP** (Representative Concentration Pathway)
  - Concentration produce radiative forcing values in year 2100 compared to pre-industrial values of +2.6, +4.5, +6.0 & +8.0 W/m^2
  RCP2.6, RCP4.5, RCP6.0, RCP8.5
- AR6-SSP 1 to 5

Importance of Climate Scenarios



Anthropogenic Emission and Temperature Change

- Global mean surface temperature increase as a function of cumulative total global carbon dioxide (CO_2) emissions from various lines of evidence
- Multi-model spread over the four RCP scenarios and fades with the decreasing number of available models in RCP8.5
- Based on the baseline period (1860 to 1880),
  - RCP 2.6 rise up to 2°C,
  - RCP 4.5 rise at 2.5 °C
  - RCP 6 rise at 3°C and
  - RCP 8.5 rise at 4°C



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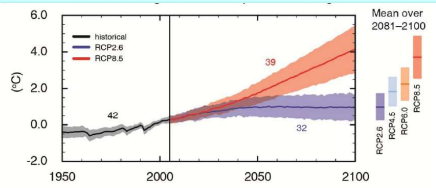
Representative Concentration Pathways (RCPs) approximate total radiative forcing in year 2100 relative to 1750:

RCP2.6 (2.6 W m-2, CO_2 eq conc. 475 ppm
RCP4.5 (4.5 W m-2, CO_2 eq conc. 630 ppm
RCP6.0 (6.0 W m-2, CO_2 eq conc. 800 ppm
RCP8.5 (8.5 W m-2, CO_2 eq conc. 1313 ppm)

Representative Concentration Pathways (RCPs), was used for the AR5 climate model simulations



Global surface temperature change for the end of the 21st century is projected to be likely to exceed 1.5°C relative to 1850 -1900 in all but the lowest scenario considered, and likely to exceed 2°C for the two high scenarios

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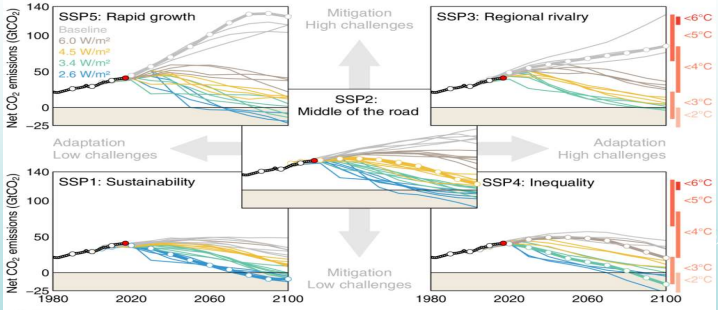
Global CO_2 emissions ($GtCO_2$) for all IAM runs in the SSP database separated out by SSPs



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CO_2 Emission and Temp

- In the relatively sustainability-focused **SSP1**, emissions peak between 2040 and 2060 – even in the absence of specific climate policies, declining to around **22 to 48** giga tonnes of CO_2 ($GtCO_2$) per year by 2100. This results in **3-3.5 C** of warming by 2100.
- In the "middle of the road" SSP2, emissions continue to increase through the end of the century, reaching between **6 5$GtCO_2$ and 85 $GtCO_2$**, with resulting warming of **3.8-4.2 C**.
- Models show a wide range of possible baseline emissions for the "regional rivalry" **SSP3**, with most runs showing increases up to around 76-86 $GtCO_2$ by 2100 with warming of **3.9-4.6 C.**
- Despite its high inequality, emissions are relatively low in **SSP4** due to rapid technological progress on low-carbon energy sources. SSP4 emissions range from **34 $GtCO_2$ to 45 $GtCO_2$** by 2100, with warming of **3.5-3.8 C**.
- Finally, the high-growth energy-intensive **SSP5** shows the most overall emissions of any SSP, ranging from **104 $GtCO_2$ to 126 $GtCO_2$** in 2100, resulting in warming of **4.7-5.7 C**.

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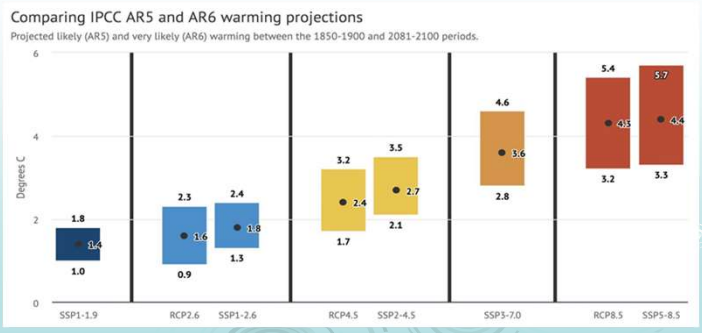
Projected Global Temperature Change under AR5 and AR6 scenarios

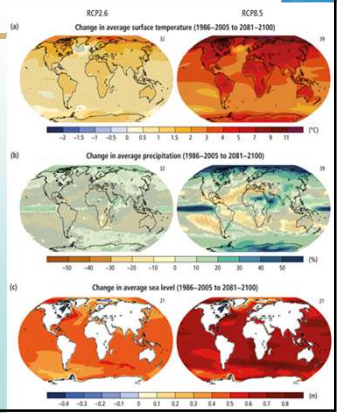


World -Climate projection

Coupled Model Intercomparison Project Phase 5 (CMIP5) multi-model mean projections

(a) change in annual mean surface temperature and
(b) (b) change in annual mean precipitation, in percentages, and
(c) change in average sea level.

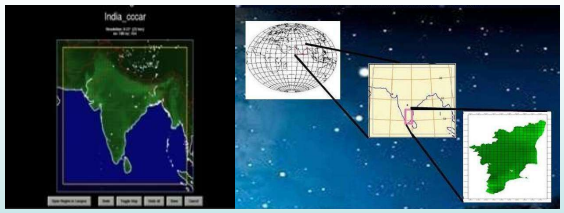
Changes are shown relative to the 1986–2005 period. The number of CMIP5 models used to calculate the multi-model mean is indicated in the upper right corner of each panel.



Climate Modelling

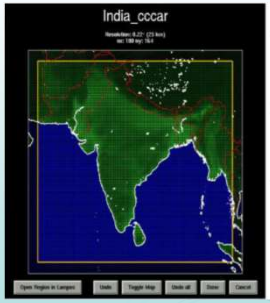
PRECIS-Providing Regional Climate For Impact Studies

Climate Modelling - India



Downscaling:
(0.22x0.22) degree resolution (up to 25 km)
Ensembles :
HadCM3Q0,HadCM3Q1
HadCM3Q5,HadCM3Q7,
HadCM3Q11,HadCM3Q13
Scenario: A1B
Transient run: 1970-2100(130 years)

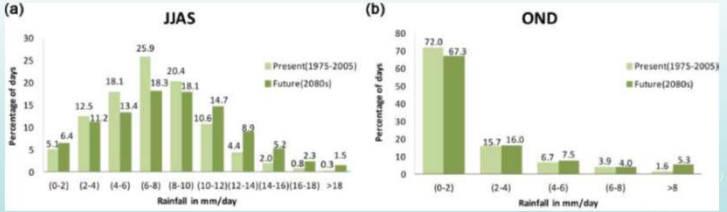
Climate Modelling - India



Six major climatic zones of India with state wise distributions

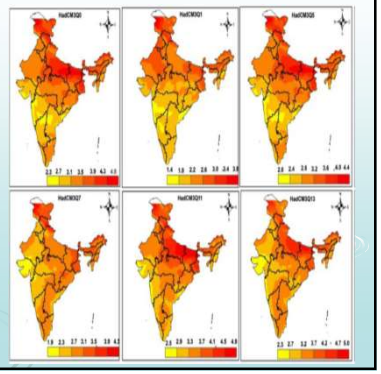
Climatic Zone	Total Area (Sq.Km)	State Name
Peninsular	6,39,098	Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Goa
West Central	7,51,427	Madhya Pradesh, Maharashtra
North West	6,29,846	Punjab, Haryana, Rajasthan, Gujarat
North Central	5,71,020	Orissa, Bihar, Uttar Pradesh
North East	2,70,130	West Bengal, Sikkim, Assam, Nagaland, Meghalaya Manipur, Tripura, Mizoram
Northern Hilly	4,18,239	Jammu & Kashmir, Himachal Pradesh, Arunachal Pradesh
India	36,98,001	Six climatic zones including 25 major states

Frequency distribution (% of days) for the daily rainfall events over the whole India during (a) JJAS (Jun-Sep) and (b) OND (Oct-Dec) periods



India

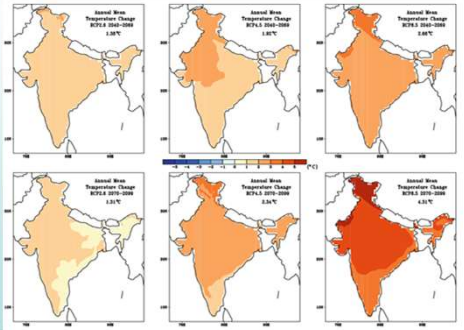
- For the whole India, the projections of maximum temperature from all the six models showed an increase within the range 2.5°C to 4.4°C by end of the century with respect to the present day climate simulations.
- The annual rainfall projections from all the six models indicated a general increase in rainfall being within the range 15-24%.
- Maximum expected increase in rainfall is projected over the West Coast, and central and northeast regions of India
- Extreme rainfall events also indicate an increase of 2-5% over the whole India



(Bal et al, Asia-Pac. J. Atmos. Sci., 52(4), 353-369, 2016)

Projected Changes in Temperature Over India

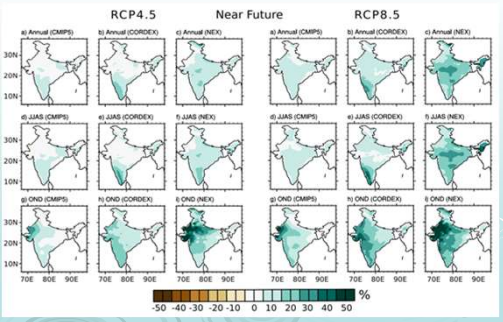
CORDEX South Asia multi-RCM ensemble mean projections of annual average surface air temperature changes (in °C) over India for the mid-term (2040–2069) and long-term (2070–2099) climate relative to 1976–2005 under RCP2.6, RCP4.5 and RCP8.5 emission scenarios. The estimates of all India averaged ensemble mean projected changes are shown in each panel



Krishnan, R., et al. *Assessment of climate change over the Indian region: a report of the ministry of earth sciences (MOES), government of India*. Springer Nature, 2020.

Projected Changes in Precipitation Over India

Multi-Model Ensemble (MME) change (%) in annual, JJAS and OND rainfall as projected by CMIP5, CORDEX-SA and NEX-GDDP models for near future with respect to 1976–2005 from RCP4.5 and RCP8.5 scenario



Krishnan, R., et al. *Assessment of climate change over the Indian region: a report of the ministry of earth sciences (MOES), government of India*. Springer Nature, 2020.

Tamil Nadu Details

- Population: 72,138,958 (6 % of the country)
- Area: 130,058 Square Kilometers
- Capital of the State: Chennai
- Vulnerability Coastal Length: 1076 Km
- Economy: Second Largest economy of India.
- 42% of population employed in Agriculture
- Present Climate:

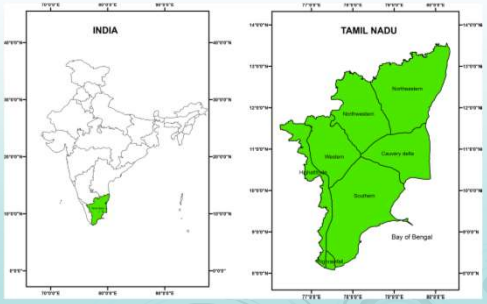
-Warmer summers, with temperature ranging from 23 ° C and 33 ° C

-The principal rainy seasons are SW (June-Sept) and NE (Oct-Dec) monsoon seasons, with an annual rainfall of 950 mm.

Seven agro-climatic zones of Tamil Nadu with district wise distributions

Agro-climatic zone	Total area (sq. km)/vulnerable area (%)	District name
Northeastern	31,194/5.4	Tiruvallur, Chennai, Kancheepuram, Vellore, Thiruvanamalai, Villupuram, Cuddalore
Northwestern	18,271//48	Dharmapuri, Krishnagiri, Salem, Namakkal
Western	15,678/77	Erode, Coimbatore, Karur, Dindigul, Tirupur
Southern	36,655/7	Pudukotai, Theni, Sivaganga, Virudhnagar, Ramanathpuram, Thoothukudi, Tirunelvelli, Madurai
Cauvery delta	24,943/2	Perambalur, Trichy, Ariyalur, Nagapattinam, Thanjavur, Thiruvarur
High rainfall	1684/0	Kanyakumari
High altitude	2549/45	Nilgiris, Coimbatore

Study area: Seven agro-climatic zones of Tamil Nadu



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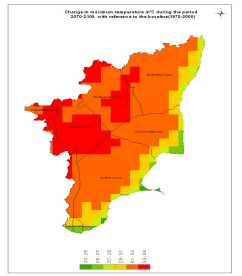
Climate Modeling for Tamil Nadu.

TEMPERATURE PROJECTIONS BY THE END OF THE CENTURY

- An average increase of 3.1 degree Celsius over Tamil Nadu by end of this century.
- Maximum temperature show a increasing gradient from coast to interior ranging between 2.2 to 3.4 degree.
- A Maximum increase of 3 degree is projected over east coast.



Bal, P.K., et.al 2016. Climate change projections for Tamil Nadu, India: deriving high-resolution climate data by a downscaling approach using PRECIS. *Theoretical and applied climatology*, *123*(3-4), pp.523-535.

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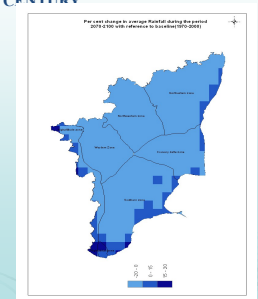
Climate Modeling for Tamil Nadu.

ANNUAL RAINFALL PROJECTIONS BY THE END OF THE CENTURY

General tendency is a decrease in annual Rainfall when taken Tamil Nadu as a whole

- The decrease is about 4% from the baseline .
- Significant exceptions being over some pockets of western hilly areas and Kanyakumari district where an increase of 15-30% from the baseline is seen.
- Extreme coastal areas also indicate an increase in rainfall of about 7%



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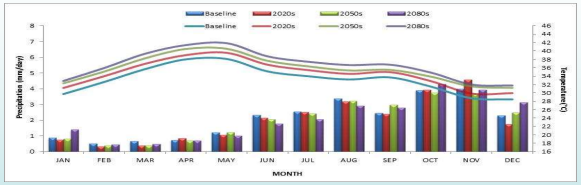
21-01-2022

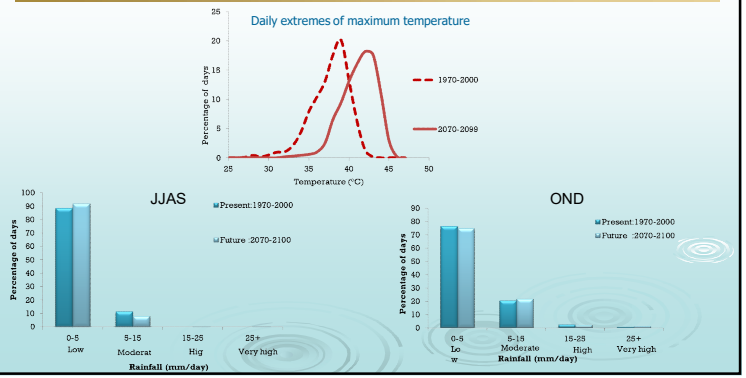
Projected Changes for Temperature and Rainfall in different season



- **For the whole Tamil Nadu state, projections by end of the century indicate warmer summers, Maximum temperature increasing by about 3.1 °C**
- **During Mar- May, the model projections indicate an increase in the percentage of days with temperature above 45 °C with a larger reduction in the percentage of days recording less than 30 °C**
- **Erratic rainfall (above 25mm/day) during the NE monsoon (October-December) season may occur, when compared to SW(June-Sept) monsoon by end of the century.**

21-01-2022

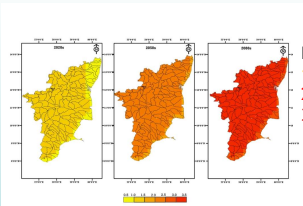
Climate Extremities Projections



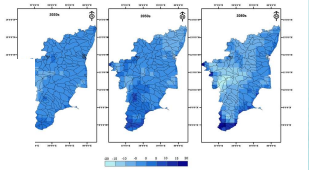
Tamil Nadu

- Maximum temperature projections for Tamil Nadu for the periods 2010-2040,2040-2070 and 2070-2100 are 1.0, 2.1 and 3.1 °C respectively.
- Minimum temperature projections for Tamil Nadu for the periods 2010-2040,2040-2070 and 2070-2100 are 1.1, 2.4 and 3.1 °C respectively.
- Annual rainfall projections for Tamil Nadu for the periods 2010-2040,2040-2070 and 2070-2100 are -2.0, -1.0 and -1.0% respectively.
- For the whole Tamil Nadu state, projections by end of the century indicate warmer summers; maximum temperature increasing by about 3.5 ^{0}C
- Rainfall indicates in general a decreasing tendency , decreasing by about 4% of the existing annual mean by the end of the century. A slight decrease during the SW monsoon (June-Sept) and an increase during the NE monsoon (Oct-Dec) reference to baseline periods (1970-2000)

Projected Climate changes in Tamil Nadu using PRECIS

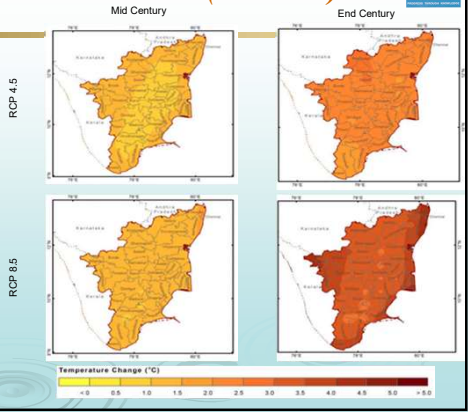


Increase of
1.0°C in 2020's
2.0°C in 2050's
3.1°C in 2080's



Decrease of
1% in 2020's
2% in 2050's
4% in 2080's

Ensemble RegCM Models based on AR5 (CORDEX)



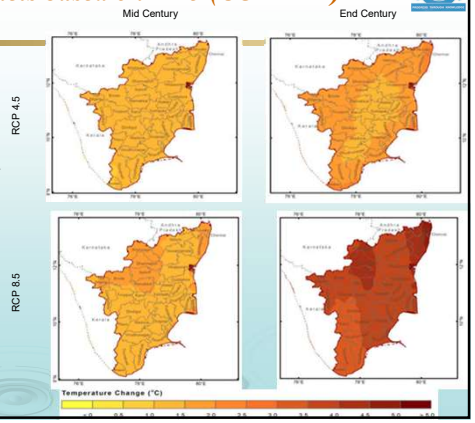
Projected Maximum Temperature for Mid and End-Century RCP 4.5 and RCP 8.5 with respect to baseline 1980-2010

Source: climatevulnerability.in

Ensemble RegCM Models based on AR5 (CORDEX)

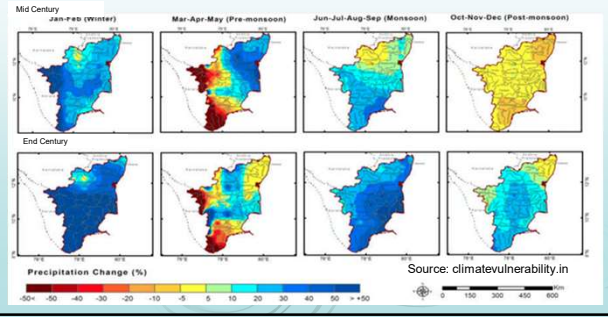
Projected Minimum Temperature for Mid and End-Century RCP 4.5 and RCP 8.5 with respect to baseline 1980-2010

Source: climatevulnerability.in



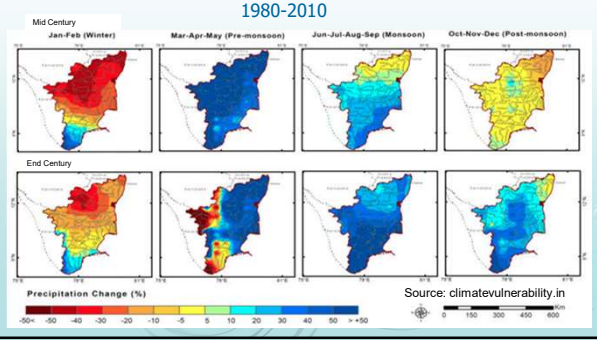
Ensemble RegCM Models based on AR5 (CORDEX)

Projected Change in different seasonal Rainfall under RCP 4.5 with respect to baseline 1980-2010

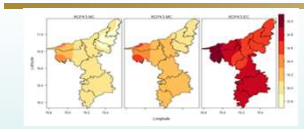


Ensemble RegCM Models based on AR5 (CORDEX)

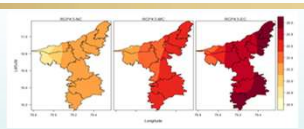
Projected Change in different seasonal Rainfall under RCP 8.5 with respect to baseline 1980-2010



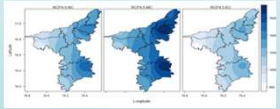
Cadastral level Climate Projection for Thanjavur District using RegCM Modelling



Maxium Temperature range during
i) NC – 33.7 to 34.4 C ii) MC – 33.7 to 34.6 C and iii) EC – 34.4 to 35.1 C



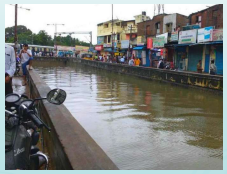
Minimum Temperature range during
i) NC – 24.7 to 25.5 C ii) MC – 25 to 25.8 C and iii) EC – 25.3 to 26.4 C



Rainfall range during
i) NC – 850 to 1690 mm ii) MC – 1065 to 790.3 mm and iii) EC – 790 to 1290 C

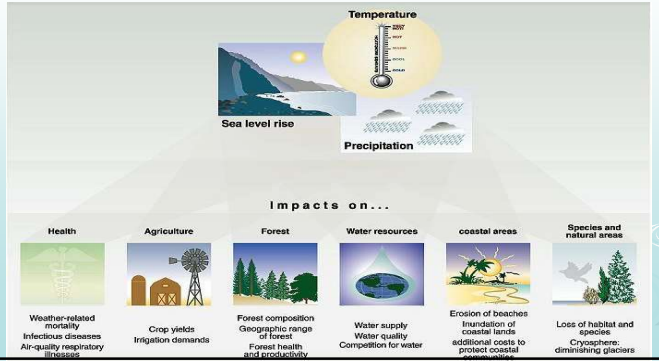
Global Changes, Local Impacts

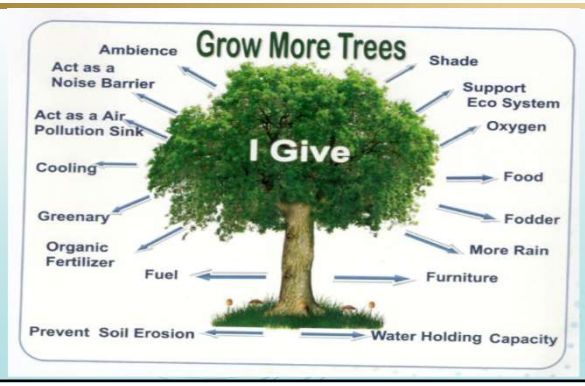
Although climate change is global,
the ecological impacts are often local.



What's happening in your backyard?

Likely Impacts of Climate Change





Conclusion

- **Modeling- Climate knowledge creation and sharing**
- **Limitation-Required finer level of climate data with high resolution is needed for climate projections**
- **Developing Strategies for Action(Adaptation)**
- **Climate Resilient- Green Cover increase - Naturally Sequestrar CO_2**
- **Remote Sensing with GIS plus AI & ML will play a major role in future**

Mother Earth -- Our Home

It has water, oxygen and a hospitable climate

Let us preserve and sustain it

Thank you !

Status of Forests
and
Green Cover
in
Tamil Nadu

Anurag Mishra
APCCF & Research Scholar
Centre for Advanced Studies in Botany
Madras University

Outline of the Presentation

- Why India's State of Forest Report (ISFR)
- History
- Terminologies
- Forest Cover Mapping
- Growing Stock and Carbon
- Trees outside Forests (TOF)

- Time:40 - 45 min

Why India's State of Forest Report(ISFR)

- Primary data on Forests and Tree cover resources
- Used for policy formulation and planning & management of forests
- Investment in forestry sector
- Will be useful as and when finance mechanism for Carbon storage and sequestration is in place
- Reference document for students and researchers

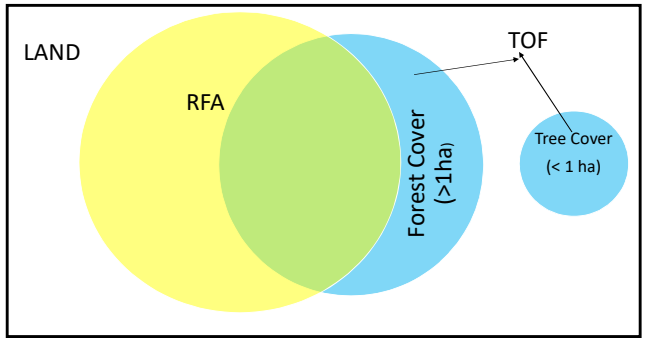
History of Assessment of Forest and Tree Cover

- Forest Survey of India(FSI): Under Ministry of Environment, Forests and Climate Change(MOEFCC)
- First State of Forest Report – 1987
- State of Forest Report 2021 – 17th
- Biennial
- IRS Resourcesat 2- LISS-III
- Resolution 23.5 m, Digital, Scale- 1:50,000
- Minimum mappable area- 1 ha

Terminology

- **Forest Cover**: All lands more than 1 ha, irrespective of ownership and legal status, with a tree canopy density of more than 10%
- **Recorded Forest Area(RFA):**Area recorded as forests in government records i.e. Reserved Forests, Protected Forests and Unclassified forests
- **Tree Cover**: Tree patches of size less than 1 ha outside RFA.
- **Trees outside Forests(TOF):** Tree patches outside the RFA.

Terminologies



Forest Cover

Forest Cover Mapping

- Wall to wall forest cover mapping
- Monitor forest cover changes: Country level, state level and district level
- Forest cover density wise information- Very Dense forests-VDF (>70 %), Moderately Dense Forests -MDF(< 70 % but > 40 %), Open Forests-OF (< 40 % but >10 %)
- Forest cover information: Altitude and slope wise
- 306 scenes, Oct to Dec 2019

Forest Cover Mapping

- Hybrid approach
- Digital image processing, visual image analysis, post classification comparison, ground truthing, validation by state forest department, incorporation of post field corrections
- Ground truthing at 3400 points
- Information of collateral sources
- Knowledge of analysts

Challenges in Mapping

- Coastal areas and North-eastern areas
- Hill areas with deep hill shadows
- Mixing of bushy and agricultural crops with adjoining forests
- Haze
- Forest vegetation under decay
- Young plantations

Statistics for Forest Cover Mapping

(sq km)

Country /State	Geogra-phical Area (GA)	VDF	MDF	OF	Total Forest Cover	% of GA	Change wrt 2019
India	32,87,469	99,779	3,06,890	3,07,110	7,13,789	21.71	+1540
TN	1,30,058	3,593	11,034	11,792	26,419	20.31	+55

- 81.22 of forest cover is within RFA

Statistics for Forest Cover Mapping

- VDF has decreased by 12 sq km, MDF has increased by 4 sq km and OF has increased by 63 sq km in TN.
- VDF has decreased by 10 sq km, MDF has increased by 2 sq km and OF has increased by 23 sq km in TN in RFA
- VDF has decreased by 2 sq km, MDF has increased by 2 sq km and OF has increased by 32 sq km in TN outside RFA
- Cause of worry is decrease in VDF
- Disaster like Tropical Cyclone, Global warming, forest fires etc
- Loss of nutrient material because of exploitation of forests over the years
- Inadequate fund allotment for rehabilitation of forests

Mangroves (in sq km)

- Bio-shield against natural hazards
- Represents coastal bio-diversity
- Community is dependent for livelihood
- Carbon storage
- Despite disaster, stable (9 out of 14 coastal districts)

Country /State	VDF	MDF	OF	Total Mangrove Cover	Change wrt 2019
India	1475	1481	2036	4992	+ 17
TN	1	27	17	45	+ 0.11

Growing Stock and Carbon

- Volume of all living trees.
- Indicator of productivity and sustainability of forests.
- Basis for biomass and carbon stock
- In view of REDD and REDD+ it becomes very important.
- 2017 onwards, 5 Km X 5 Km grid based methodology
- Grids are numbered 1 to 5 for forest area

Growing Stock and Carbon

- Every cycle, grids are selected systematically.
- Grids having specific number are surveyed in a specific year
- Revisit time to same grid is 5 years
- 60,000 sample plots (18,000 in Forest and 42,000 non forest areas)
- Circular plots are being used for sampling in forest areas
- Difficulty in laying square plots in forest areas due to terrain and vegetation

Growing Stock

Country/ State	Volume of Growing Stock (m cum)			Growing Stock in Forest (cum/ha)	Growing stock in TOF (cum/ha)
	Forest	TOF	Total		
India	4388.15	1779.35	6167.50	56.60	8.40
TN	92.27	82.21	174.48	39.79	7.80

- Growing stock in forests has shown a decrease of 4.70 m cum but TOF has shown an increase of 5.91 cu m although TOF area has shown a decrease.

Carbon Stock(in 1000 m ton)

Country/State	AGB	BGB	Deadwood	Litter	SOC	Total
India	23,19,910 (32.50)	7,18,852 (10.07)	47,665 (.67)	1,07,251 (1.5)	40,10,168 (56.18)	72,03,846 (100.92)
TN	60,459 (22.88)	20,671 (7.82)	1,198 (.45)	3,102 (1.17)	1,29,183 (48.90)	214,613 (81.22)

Fig in bracket is in m ton/ha

Trees Outside Forests

History

- Forest Survey of India(FSI)- Inventory of TOF resources from 2002
- Tree cover first figured in State of Forest Report 2001 (Published in the year 2003)
- Country was divided into 14 physiographic zones
- Based on physiography, soil, climate and vegetation
- 60 districts are randomly selected

Current Methodology

- 2017 onwards, 5 Km X 5 Km grid based methodology
- Grids are numbered 1 to 10 for TOF
- Every cycle, grids are selected systematically.
- Grids having specific number are surveyed in a specific year
- Revisit time to same grid is 10 years
- Separate Methodology for TOF(Rural) and TOF(Urban)

TOF (Rural)

- High resolution satellite data (LISS IV 5.8 m)
- 2017 onwards , Multi spectral Sentinel-II (10m) is used.
- Masking of recorded forest areas or green wash areas
- Classified into land use classes such as settlement, water bodies, tree cover, agriculture and other land use classes
- Three strata of TOF - Block, Linear, Scattered
- Area for Block and Linear through classified image

TOF (Rural)

- Area which does not support tree vegetation-Un-culturable Non Forest Area calculated(Water-bodies, rivers, river-beds, snow-covered area etc.)
- It helps in calculating area of scattered trees
- Sample sizes for Block, Linear and Scattered strata
- Non-hilly districts: 35, 50 and 50
- Hilly districts: 35, 50 and 95
- Sample points were randomly generated for each stratum

TOF(Rural)

- Sample plot for block .1 ha square plot, for linear 10 m X 125 m
- For scattered: 3ha square plot (Non hilly areas), 0.5 ha for hilly areas
- Dbh, crown diameter, species name and category of plantation

TOF(Urban)

- Geo-referenced boundaries of urban areas not available
- Urban Frame Survey (UFS) blocks
- National Sample Survey Office (NSSO)
- Well defined boundaries
- Formed on the basis of population (600-800) or number of households (120-150)
- The sample blocks from each class of town (strata) were randomly selected based on the size
- Complete enumeration of all the trees of dbh > =5 cm

Statistics of TOF- Coverage

Country /State	Geographical Area (sq Km)	Tree Cover (sq km)	Forest cover outside RFA (sq km)	TOF (sq km)	% of Geographical Area	Increase/ Decrease compared to 2019 (in sq km)
India	32,87,469	95,748	1,97,159	2,92,907	8.91	-933
Tamil Nadu	1,30,060	4,424	8,888	13,312	10.24	-293

- Growing stock shows an increasing trend as compared to 2019. It is 7.8 cum/ha in 2021 as compared to 7.18 in 2019.

TOF of Tamil Nadu

- ISFR design for growing stock and TOF estimation is for generating national level estimates
- Generating state level estimates for GS and TOF will have less accuracy
- So FSI did a study on TOF in 2014
- TN was stratified based on Agro-climatic zone
- 7 agro-climatic zones
- TOF was generated based on data from 18 districts.

TOF of Tamil Nadu

- Each agro-climatic zone was represented
- For each agro-climatic zone and district: estimated stems, volume, stem/ha and volume /ha according to species and diameter class for rural and urban area

Parameters	Rural	Urban	Combined
Estimated stems(million)	170	30	200
Estimated volume (million cum)	55	10	65
Estimated yield (million cum)	3.3	0.7	4.0

Top 5 species- Rural

- *Cocos nucifera*
- *Borassus flabelliformis*
- *Azadirachta indica*
- *Mangifera indica*
- *Areca catechu*

Top 5 Species-Urban

- *Cocos nucifera*
- *Azadirachta indica*
- *Borassus flabelliformis*
- *Areca catechu*
- *Prosopis juliflora*

Way Forward

- National and State Forest Policy- 1/3 of the Geographical area should have forest and tree cover
- Given the population density of 555 persons/sq km in TN, RFA can't be increased beyond current level 17.83 % of GA.
- It prompted to concentrate on outside RFA
- TN government started Tree Cultivation in Private Land (TCPL)in the year 2007.
- Later on in JICA supported Tamil Nadu Biodiversity Conservation and Greening Project, emphasis on TCPL

Way Forward

- TCPL can't be only ecological activity, it has to be economical activity
- It should support farmer's livelihood
- Successful tree planting will also halt the process of forest degradation
- Majority of forest fringe villages are dependent on Fuelwood, Green fodder and Grazing on forests
- Despite natural hazards in past , growing stock in TOF has increased
- Forest soil has to be taken care by increasing SOC which will support forest cause.

Thanks for your attention

Biodiversity of Tamil Nadu

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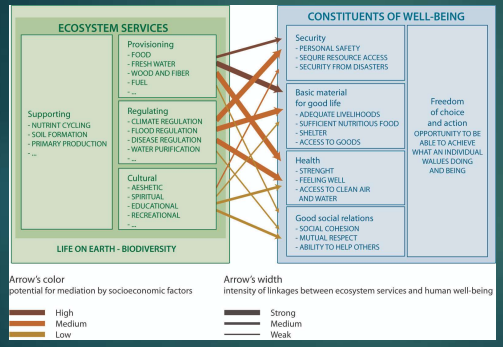
Biodiversity of Tamil Nadu

Biodiversity

- Biodiversity: The variety and variability among the living beings on the earth.

Biodiversity of Tamil Nadu

Why is biodiversity important?
Ecosystem Services:



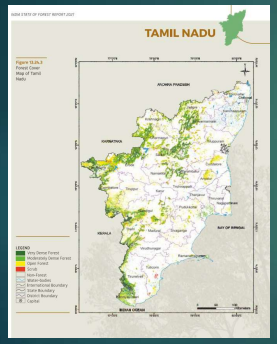
Ecosystem Services
↑
Healthy ecosystem
↑
Rich Biodiversity
↑
Proper management
↑
Deeper understanding
↑
Thorough knowledge on structure and function of different ecosystems

Biodiversity of Tamil Nadu

Tamil Nadu

- Geographical area: 1,30,060 sq.km.
- Variety of habitats
- Elevation >2600 m
- Rainfall ~900 mm
- Temperature – 8°-31 ° C
- No. of Districts – 32
- No. of Hill Districts – 5
- No. of Tribal Districts – 6
- Coastal line >1000 km

Biodiversity of Tamil Nadu

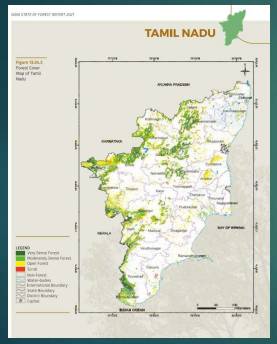


Floral Diversity

- Floral diversity ~ 5600 species (India-17,672)
  - (~ 530 endemic species, 230 red listed species)
  - ~ 1550 medicinal plants,
- 260 species of wild relatives
- Pteridophytes – 184 species (India -1022)
- Gymnosperms
- Fungi
- Lichens
- Algae
- Bacteria

Source: BSI, India

Biodiversity of Tamil Nadu



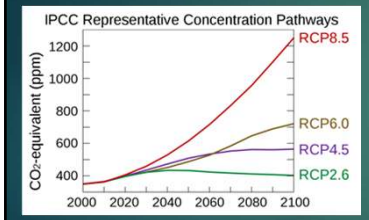
Faunal Diversity

- Terrestrial fauna – 1898
- Freshwater fauna – 595
- Marine fauna – 2247
- Fresh water fishes – 165
- Amphibians – 76
- Reptiles – 177
- Birds – 454
- Mammals – 187

Source: ZSI, India

Biodiversity of Tamil Nadu

India - Global warming & Forest Cover



- Nationally Determined Contribution (NDC) to UNFCCC –
  - India should create 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030
  - India committed (COP 26 at Glasgow, 2021) to reduce carbon emission by 1 billion tonnes by 2030.

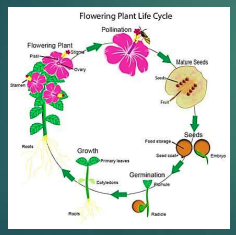
Biodiversity and Climate Change

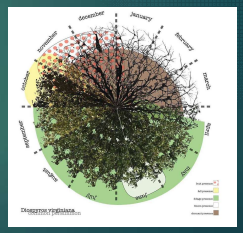
Link between Climate and Biodiversity

Link between Climate and Biodiversity

- All the biological events of every organism is dependent on Season.
- Season – the temperature and humidity of air

For Eg.





https://www.asla.org/2014awards/579.html

Link between Climate and Biodiversity

- Rhythms of nature are living processes
- Why does a plant flower when it does?
  - **Photoperiodism**
    - long-day plants
    - short-day plants
    - day length indifferent plants
  - **Vernalisation**
    - Low temperature
    - High temperature

Link between Climate and Biodiversity

- Photoperiodic induction
  - Minimum number of days – LD/SD – ability to form bud

Eg. Mexican sunflower, *Tithonia speciosa*, - needs long nights of about 14 hours for two to three weeks – to form flower buds

Link between Climate and Biodiversity

Vernalisation - many plants must pass through a period of fairly low temperatures before they can flower

- Composition of LD /SD + low/high temperature varies for different plants
- In temperate climates the majority of plants are long-day (flower in the summer).
- In the tropics, they are mostly short-day (flower in winter)

Link between Climate and Biodiversity

The cocklebur
(*Xanthium pennsylvanicum*)

Highly Sensitive:
This plant will never flower in days of 16 hours or more—it just vegetates, and grows to an enormous size. But if it has just one day 15 hours long or less, it starts flowering, and goes on doing so even if the days revert to 16 hours

"Not all plants are sensitive"

Impacts of Climate change on Biodiversity

Impacts of Climate change on Biodiversity

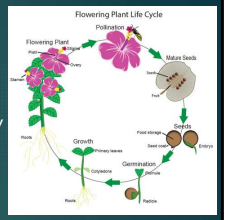
- Change in climate – not uniform
- Climate change – change in start and length of seasons
- Increased extreme weather events
- Change in season affects – species and Ecosystem
  - Species – affects climate envelope of all species
  - Plants – seed germination, establishment, growth, flowering, pollination and seed dispersal, ultimately population
  - Birds and insects – migration, egg laying and breeding
  - Animals – reduced food, increased competition, reduction in population size
- Ecosystem level
  - Distribution, composition and function

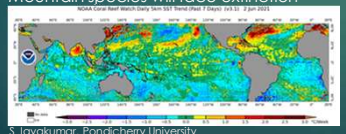
Impacts of Climate change on Biodiversity

- Population size of each species varies
- Endemic species – specific climate envelope – low population size
- Plants can not migrate
- Red listed species – more vulnerable
- More invasive species – less biodiversity
- Change in species composition
- Affects Ecosystem structure and function
- Change in climate cannot favor all the species

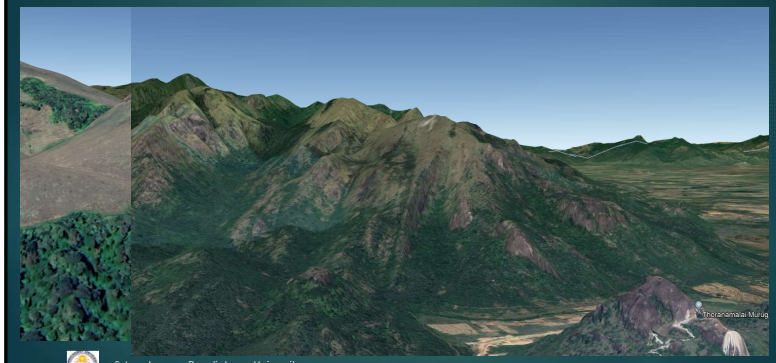
Global warming & Forest Cover

- Changes in temperature and rainfall patterns
- Flowering, Pollination
- Seed dispersal, Germination and Establishment
- Population, community, ecosystem and biodiversity
- Coral bleaching, Sea-Surface Temperature
- Shift in vegetation pattern observed
- Mountain species will face extinction



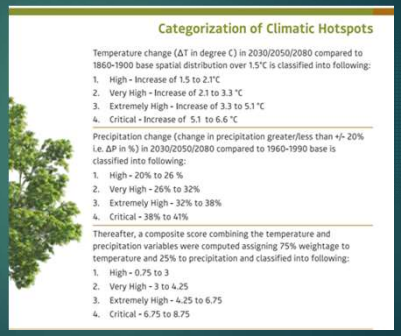


- Mountain species will face extinction



India - Categorization of Climatic Hotspots

INDIA STATE OF FOREST REPORT 2021



Categorization of Climatic Hotspots

Temperature change (ΔT in degree C) in 2030/2050/2080 compared to 1860-1900 base spatial distribution over 1.5°C is classified into following:

1. High - Increase of 1.5 to 2.1°C
2. Very High - Increase of 2.1 to 3.3 °C
3. Extremely High - Increase of 3.3 to 5.1 °C
4. Critical - Increase of 5.1 to 6.6 °C

Precipitation change (change in precipitation greater/less than +/- 20% i.e. ΔP in %) in 2030/2050/2080 compared to 1960-1990 base is classified into following:

1. High - 20% to 26 %
2. Very High - 26% to 32%
3. Extremely High - 32% to 38%
4. Critical - 38% to 41%

Thereafter, a composite score combining the temperature and precipitation variables were computed assigning 75% weightage to temperature and 25% to precipitation and classified into following:

1. High - 0.75 to 3
2. Very High - 3 to 4.25
3. Extremely High - 4.25 to 6.75
4. Critical - 6.75 to 8.75

India – Forest cover area under hotspot in 2030/2050/2085 with RCP 4.5 and RCP 8.5 models

INDIA STATE OF FOREST REPORT 2021

(in sq km)

Hotspot Classes	Year 2030		Year 2050		Year 2085	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
High	314969	448367	367334	260883	11804	0
Very High	698	1552	330602	343726	656094	0
Extremely High	0	0	6899	100569	37196	566442
Critical	0	0	0	0	0	138736
TOTAL	**315667**	**449919**	**704835**	**705178**	**705094**	**705178**

Table 11.1 Forest cover area (sq km) under hotspots in 2030/ 2050/2085 with RCP 4.5 and RCP 8.5 models

It is clearly observed that time period transitions from 2030 to 2050 and 2085; the area under hot spots within forest cover increases. Moreover, the concept of Models RCP 4.5 and RCP 8.5 tells us that RCP 8.5 is the more extreme scenario between these two i.e. the areas under forest hot spot always show higher values in RCP 8.5 scenarios than RCP 4.5 for all the three future projected years i.e. 2030, 2050 and 2085.

Biodiversity of Tamil Nadu

India – Climate change exposure hotspot map of forest cover

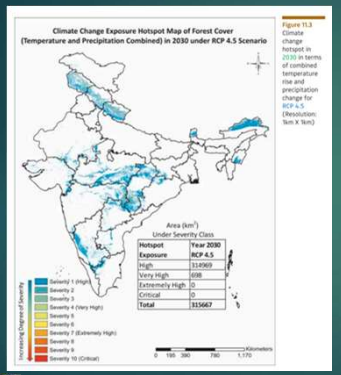


Figure 11.3 Climate change hotspot in 2030 in terms of combined temperature rise and precipitation change for RCP 4.5 (Resolution: 1km X 1km)

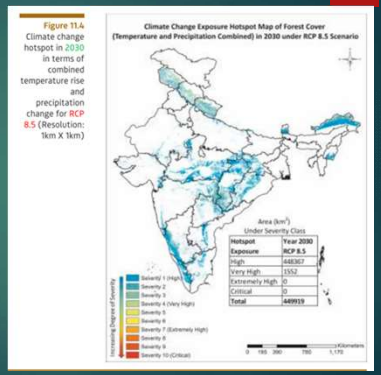


Figure 11.4 Climate change hotspot in 2030 in terms of combined temperature rise and precipitation change for RCP 8.5 (Resolution: 1km X 1km)

Biodiversity of Tamil Nadu

India – Climate change exposure hotspot map of forest cover

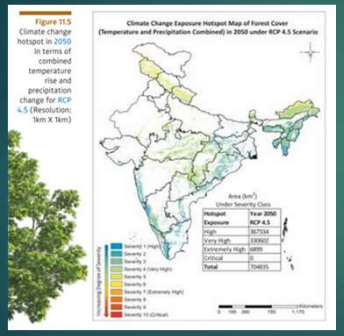


Figure 11.5 Climate change hotspot in 2050 in terms of combined temperature rise and precipitation change for RCP 4.5 (Resolution: 1km X 1km)

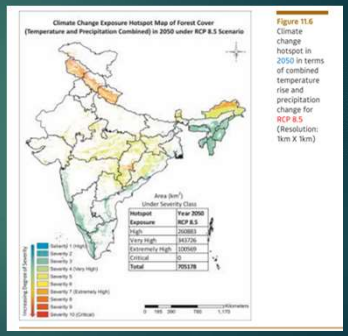


Figure 11.6 Climate change hotspot in 2050 in terms of combined temperature rise and precipitation change for RCP 8.5 (Resolution: 1km X 1km)

Biodiversity of Tamil Nadu

India – Climate change exposure hotspot map of forest cover

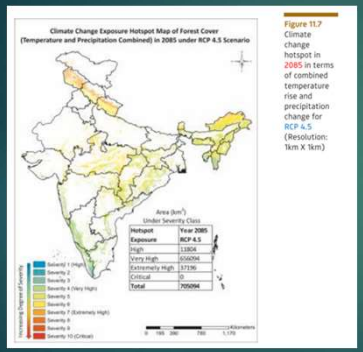


Figure 11.7 Climate change hotspot in 2085 in terms of combined temperature rise and precipitation change for RCP 4.5 (Resolution: 1km X 1km)

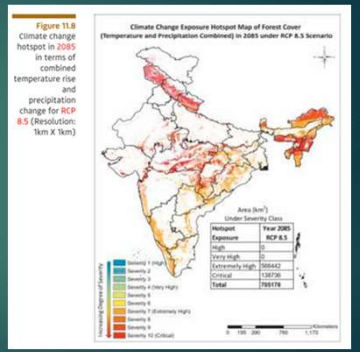


Figure 11.8 Climate change hotspot in 2085 in terms of combined temperature rise and precipitation change for RCP 8.5 (Resolution: 1km X 1km)

Biodiversity of Tamil Nadu

India – Projected Climate change exposure hotspot areas in forest ecosystem

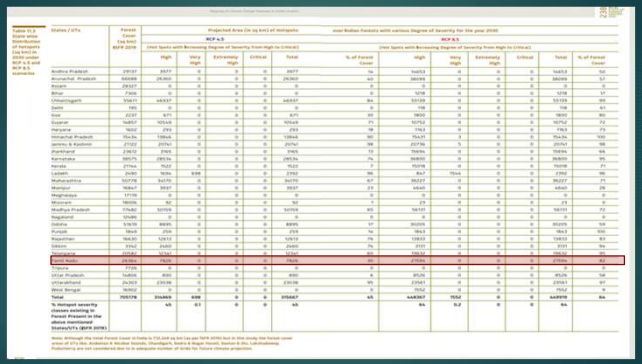
Table 11.2 Projected climate change (temperature and precipitation combined) exposure hotspot area in forest ecosystems in India

Forest Type	Total Area (in 2019), sq km	Climate Change hotspot area under projected temperature and precipitation combined (sq km)					
		2030 RCP 4.5	2030 RCP 8.5	2050 RCP 4.5	2050 RCP 8.5	2085 RCP 4.5	2085 RCP 8.5
1 Tropical Wet Evergreen Forests	20054	4448	10077	16343	19717	19717	19717
2 Tropical Semi-evergreen Forests	71171	28519	43046	71171	71171	71171	71171
3 Tropical Moist Deciduous Forests	135492	63940	85122	135492	135492	135492	135492
4 Littoral & Swamp Forests	5596	542	2003	3808	5596	5596	5596
5 Tropical Dry Deciduous Forests	313617	172719	245501	313617	313617	313617	313617
6 Tropical Thorn Forests	20877	9738	12931	16020	16026	16026	16026
7 Tropical Dry Evergreen Forests	937	6	311	896	896	896	896
8 Subtropical Broad leaved Hill Forests	32706	4934	7080	21116	21116	21116	21116
9 Subtropical Pine Forests	18102	16955	18054	18059	18100	18100	18100
10 Subtropical Dry Evergreen Forests	180	180	180	180	180	180	180
11 Montane Wet Temperate Forests	20435	1039	1641	5333	5333	5333	5333
12 Himalayan Moist Temperate Forests	25743	25743	25743	25743	25743	25743	25743
13 Himalayan Dry Temperate Forests	5627	5627	5627	5627	5627	5627	5627
14 Sub-alpine Forests	14995	14866	14995	14995	14995	14995	14995
15 Moist Alpine Scrub	959	959	959	959	959	959	959
16 Dry Alpine Scrub	2922	2922	2922	2922	2922	2922	2922

Table 11.2 indicates that 'Tropical Dry Deciduous Forests', 'Tropical Moist Deciduous Forests' and 'Tropical Semi-evergreen Forests'; the three top most dominant forest type groups of the country, covering 313617 sq km, 135492 sq km and 71171 sq km area respectively shall be highly vulnerable to climate change. Results from both the models i.e. RCP 4.5 and RCP 8.5, depict that almost the entire area under these dominant forest type groups will be falling within climate hot spots in the coming years from 2050 onwards.

Biodiversity of Tamil Nadu

India – State-wise distribution of hotspot in 2020 under RCP 4.5 and RCP 8.5 Scenarios



Biodiversity of Tamil Nadu

Projected area (sq. km.) of hot spots over TN Forests with various degree of severity

Year	Forest Cover as per SFR 2019 sq.km.	Projected area (sq. km.) of hot spots over Tamil Nadu Forests with various degree of severity											
		RCP 4.5						RCP 8.5					
		Hot spot with increasing degree of severity from high to critical						Hot spot with increasing degree of severity from high to critical					
		High	V.High	Ext. High	critical	Total	% For Cover	High	V.High	Ext. High	critical	Total	% For Cover
2030	26364	7826	0	0	0	7826	30	21594	0	0	0	21594	82
2050	26364	26364		0	0	26364	100	26364	0	0	0	26364	100
2085	26364	3672	22692	0	0	26364	100	26364	0	0	26364	0	100

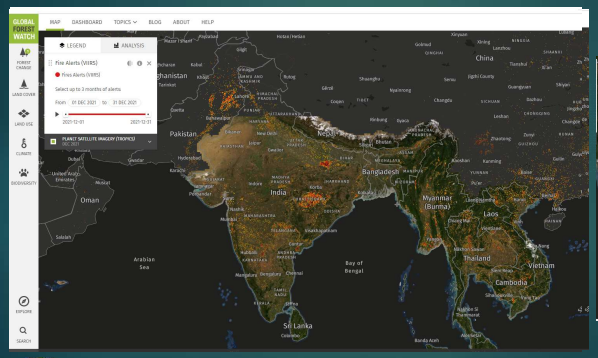
Biodiversity of Tamil Nadu

Forest fire

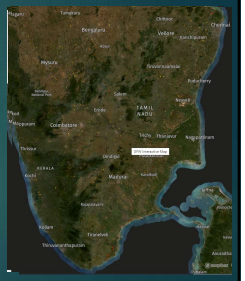
- Types of fire
- Intensive fire – reduces richness, diversity, abundance,
- Promotes set of species
- Reduces ecosystem function

Biodiversity of Tamil Nadu

Forest fire in India



Tamil Nadu



Source: https://www.globalforestwatch.org/

Biodiversity of Tamil Nadu

India - Forest cover in different fire prone classes

Sl. No.	Category	Forest cover (in sq km)	% of Total forest cover
1.	Extremely Fire Prone	20,074.47	2.81
2.	Very Highly Fire Prone	56,049.35	7.85
3.	Highly Fire Prone	82,900.17	11.61
4.	Moderately Fire Prone	94,126.68	13.19
5.	Less Fire Prone	4,60,638.36	64.54
	Total	**7,13,789.03**	**100.00**

Table 5.9 Forest cover in different fire prone classes

Biodiversity of Tamil Nadu

India – Forest cover under different fire prone classes

Table 5.10 Forest cover of State & UTs under different fire prone classes

Sl.No.	State/ UT	Extremely Fire Prone		Very Highly Fire Prone		Highly Fire Prone		Moderately Fire Prone		Less Fire Prone	
		Forest cover (in sq km)	% of total Forest cover	Forest cover (in sq km)	% of total Forest cover	Forest cover (in sq km)	% of total Forest cover	Forest cover (in sq km)	% of total Forest Cover	Forest cover (in sq km)	% of total Forest cover
1.	Andhra Pradesh	1,150.13	3.86	3,832.50	12.87	4,915.11	16.50	4,153.69	13.95	15,732.57	52.82
2.	Arunachal Pradesh	35.36	0.05	959.78	1.44	2,744.51	4.13	4,459.73	6.71	58,231.82	87.67
3.	Assam	3,166.11	11.38	4,871.05	17.20	3,400.46	12.01	2,653.93	9.37	14,220.45	50.24
4.	Bihar	24.38	0.33	471.89	6.39	984.48	13.34	1,173.58	15.90	4,726.67	64.04
5.	Chhattisgarh	1,935.04	3.47	3,655.58	6.56	8,159.70	14.64	11,275.57	20.24	30,691.11	55.09
6.	Delhi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	195.00	100.00
7.	Goa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,244.00	100.00
8.	Gujarat	8.08	0.05	384.42	2.58	523.32	3.51	975.10	6.53	13,035.08	87.33
9.	Haryana	0.00	0.00	20.40	1.27	66.81	4.17	154.50	9.64	1,361.29	84.92
10.	Himachal Pradesh	0.00	0.00	6.81	0.04	305.56	1.98	999.03	6.47	14,131.60	91.51
11.	Jammu & Kashmir	0.00	0.00	17.90	0.08	321.68	1.50	857.95	4.01	20,189.47	94.41
12.	Jharkhand	47.36	0.20	480.45	2.03	2,159.16	9.10	4,227.02	17.82	16,807.01	70.85
13.	Karnataka	71.58	0.18	930.93	2.40	2,506.25	6.47	2,989.30	7.72	32,231.94	83.23
14.	Kerala	0.00	0.00	54.79	0.26	461.06	2.17	1,266.42	5.96	19,470.73	91.61
15.	Madhya Pradesh	336.52	0.43	4,730.92	6.10	10,889.70	14.05	15,231.85	19.66	46,304.01	59.76
16.	Maharashtra	470.68	0.93	3,585.37	7.06	8,540.70	16.81	9,377.92	18.46	28,823.33	56.74
17.	Manipur	1,636.46	9.85	6,167.06	37.16	5,423.48	32.68	2,096.16	12.63	1,274.84	7.68
18.	Meghalaya	1,588.24	9.32	3,505.49	20.56	3,716.73	21.80	2,900.24	17.02	5,335.30	31.30
19.	Mizoram	4,683.50	26.28	8,862.58	49.73	3,369.82	18.91	543.28	3.05	360.82	2.03
20.	Nagaland	352.24	2.88	3,129.20	25.54	4,849.90	39.59	2,477.96	20.23	1,441.70	11.76
21.	Odisha	1,226.66	2.35	3,930.36	7.54	7,634.76	14.64	10,086.77	19.34	29,277.45	56.13
22.	Punjab	0.00	0.00	53.86	2.92	254.95	13.80	375.30	20.32	1,162.89	62.96
23.	Rajasthan	0.00	0.00	197.33	1.18	366.57	2.20	705.56	4.24	15,385.54	92.38
24.	Sikkim	0.00	0.00	0.00	0.00	0.00	0.00	25.30	0.76	3,315.70	99.24
25.	Tamil Nadu	0.00	0.00	38.76	0.15	470.00	1.78	1,910.94	7.23	23,999.28	90.84
26.	Telangana	571.87	2.70	2,970.26	14.00	3,920.18	18.48	3,522.07	16.60	10,229.62	48.22

https://bm.adhpesfo.org/web/Web_Feature_Service

Biodiversity of Tamil Nadu

Tamil Nadu
Fire prone forest area

13.24.3 Fire Prone Forest Areas

Forest Cover under different classes of forest fire proneness is given in following table.

Table 13.24.9 Forest Fire Prone Classes (in sq km)

Sl. No.	Forest Fire Prone Classes	Forest Cover	% of Total Forest Cover
1.	Extremely fire prone	0.00	0.00
2.	Very highly fire prone	38.78	0.15
3.	Highly fire prone	470.00	1.78
4.	Moderately fire prone	1,910.94	7.23
5.	Less fire prone	23,999.28	90.84
	Total	**26,419.00**	**100.00**

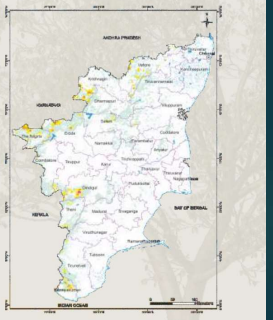


Figure. 13.24.4 Fire prone forest areas under different fire prone classes

Biodiversity of Tamil Nadu

Mudumalai – Impact forest fire

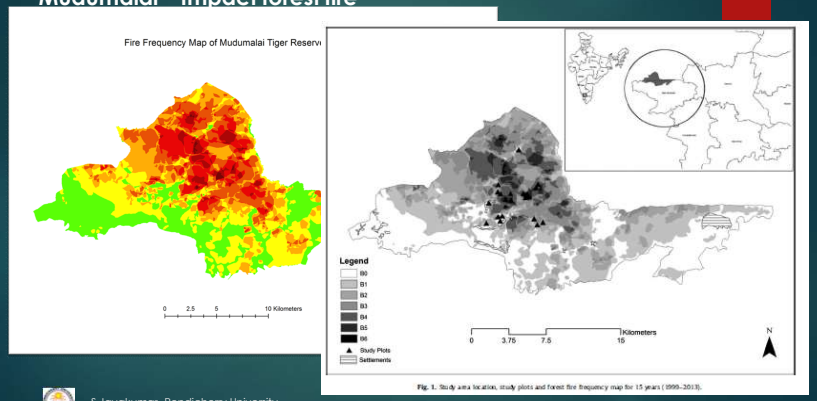


Fig. 1. Study area location, study plots and forest fire frequency map for 15 years (1990–2013).

Forest fire in Tamil Nadu Forests

Table 1
Description of site characteristics; fire frequency, fire return interval (FRI), year of burn, area burned and tree stem density.

Class code	Fire frequency class	Year of occurrence	No. of plots	FRI (year)	Area (dry deciduous forest) (%)	Basal area (SD) (m^2 ha^{-1})	Tree density (SD) (ha^{-1})
B0	Unburned (control)	Never burned in past 15 year	3	0	11.76	36.81 (2.19)	407 (41.63)
B1	Burned once	2009	3	15	24.21	29.70 (7.21)	463 (32.15)
B2	Burned twice	2002, 2010	3	7.5	24.99	36.53 (10.09)	430 (60.00)
B3	Thrice burned	2002, 2007, 2012	3	5	21.40	25.48 (0.90)	427 (25.17)
B4	Four time burned	2000, 2002, 2007, 2012	3	3.75	13.38	18.04 (8.59)	387 (85.05)
B5	Five time burned	2000, 2002, 2007, 2010, 2012	3	3	3.86	12.12 (2.69)	280 (34.64)
B6	Six time burned	2000, 2002, 2004, 2007, 2010, 2012	3	2.5	0.40	14.20 (2.35)	210 (10.00)

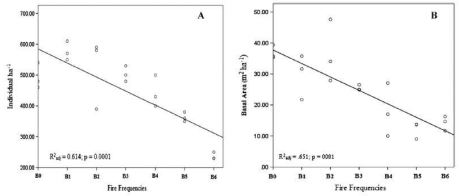


Fig. 3. Relationships of forest fire frequencies with (A). Stem density (DBH > 1 cm) and (B) basal area.

Biodiversity of Tamil Nadu

Thank you

S Jayakumar, Pondicherry University

Carbon Sequestration and Carbon Sink

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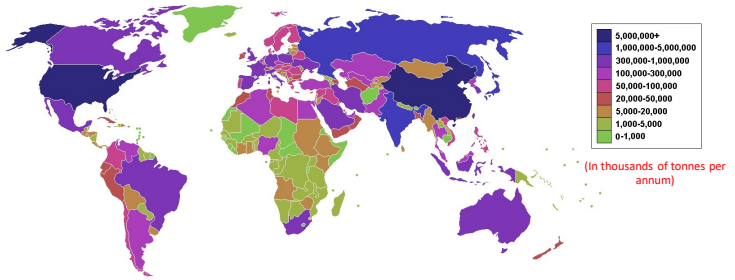
Emeritus Professor
Centre for Climate Change and Disaster Management
Anna University
Chennai-600025

Country wise CO_2 emissions 2016 the burning of fossil fuels



Kyoto Protocol - 1997

- Energy efficiency
- Decarbonization of the energy system
  zero carbon energy sources (gas, nuclear, biomass, wind, solar).
  CO_2 Capture and storage
- Carbon Sequestration
- Reducing other GHGs from Waste management

2015 – A Landmark on Environment

- New York Transforming our world: the 2030 Agenda for SDGs with 17 Goals was adopted at the UN (September 2015).
- Paris Agreement on Climate Change (December 2015)
- India's Nationally Determined Contribution (NDC)

India's Nationally Determined Contribution

MITIGATION COMPONENT

- **To Reduce the emissions intensity of its GDP By 33 - 35% by 2030 from 2005 level.**
- ***Increase the Share of Non Fossil Fuel to achieve 40% by 2030***

ENHANCING FORESTS CARBON SINK

- ***To Create additional carbon sink of 2.5 -3 billion tonnes of CO_2 equivalent through additional forest and 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***

India's INDCs

To create Opportunity to Enhance CS

- REDD-plus
- National Agro-forestry Policy (NAP)
- Joint Forest Management
- National Afforestation Programme
- NHAI

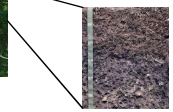
Carbon sequestration and Carbon Sink

Photosynthesis equation $6H_2O$ (water) + $6CO_2$ + sunlight energy = $C_6H_{12}O_6$ (glucose) + $6O_2$ (oxygen)
glucose = carbon storage.

The Carbon stored are eventually sinked in to the soil permanently by death and decomposition by the Microbes, in two forms

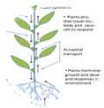
Humic and Fulvic acids

Increased SOC will provide rich biodiversity and wild life



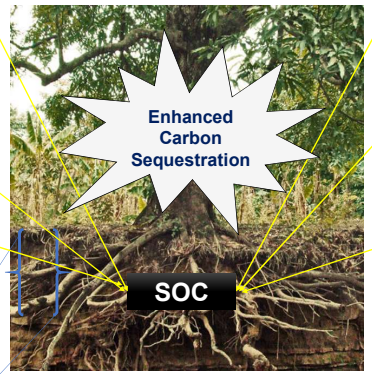
Soil Organic Carbon

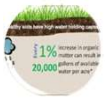
Soil Aggregation



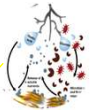
Increases auxin content

Root Proliferation





Water Holding Capacity



Liberates Minerals

Provides Microbial inoculums to sub-soils

Soil Organic Carbon in different Forest

SOC 0.2 to 0.3 %

SOC 0.2 to 0.8 %

SOC > 5%

Thorn Forest ⟷ Deciduous Forest

CRITICAL ISSUE OF FOREST CARBON SINK IN TAMIL NADU

Total area of degraded forest : (42% of total forest cover).	11,07,300 ha
Very Vulnerable degraded forest: (21% of the degraded forest)	2,32,000 ha
Total Carbon requirement @1.2 tonne/ha: (Available mean SOC : 0.21% ; Needs additional 0.79% to make it up 1%)	7,85,000 tonnes
Required Organic material @ 18%C:	43,61,000 tonnes (4.36 Million tonnes)

We can meet these requirements from MSW (Biodegradable)

CONCLUSION

- Needs of Carbon Enrichment Program
- Demonstratable and verifiable long term projects
- Integrating Climate Change based Water
- Management and AR Program