

Kerala Climate

Monthly Newsletter of Institute for Climate Change Studies (ICCS), Kottayam, Kerala-686 004
(Research Organisation under Environment Department, Government of Kerala)

Research Highlights

Ongoing Projects:

Palaeoclimate Records in the High Ranges

The ongoing project entitled “Investigation on Palaeoclimate Records in the High Ranges of Kerala” is funded by the Environment Department, Government of Kerala. The project started during September 2015. Recent advancements in archaeological investigations along the coast have indicated shifts in human settlements in accordance with changing climate in Kerala. In fact, investigations on the Late Quaternary deposits in the plateaus and sholas of Nilgiris also strengthened our understanding on palaeoclimate during the Late Quaternary period. But, such a study is lacking as far as High Ranges of Kerala are concerned. In addition, knowledge on palaeoclimate will have a vital role in modelling and prediction of future climate changes in this part of the subcontinent. Therefore the main objectives of the study are – (i) to prepare a detailed depositional framework of the Quaternary deposits the High Ranges; (ii) to document the carbon sequestration in the Late Quaternary deposits; (iii) to unfold the Later Quaternary Climate Changes/events and landform evolution; and (iv) to unravel the palaeoclimatic and palaeoecological conditions responsible for the evolution of Western Ghats during Quaternary Period.

Detailed fieldworks were carried out for collecting preliminary primary data during the period. Out of the 24 sites visited, 74 soil samples were collected from 9 suitable sites. The samples were collected from 0 cm to 195 cm, at an interval of 15 cm. Soil analysis was carried out for the parameters namely, Organic Carbon, Nitrogen, Potassium, Phosphorus, Calcium and Magnesium. The



Soil core sampling in progress at Idukki

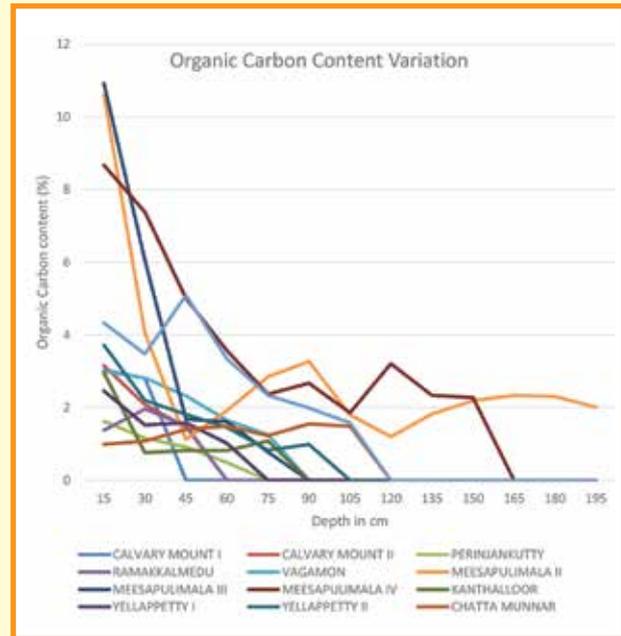


Figure 1 shows variations in organic carbon content across the nine sites. The highest value given was at Meesapulimala and the lowest was at Chatta Munnar. Detailed soil core sampling will be carried out based on the analysis of preliminary data. Data collection is continued.

Climate Change Impacts and Vector-borne Diseases

ICCS is carrying out the project entitled “Climate Change Impacts and the Prevalence of Vector-Borne Diseases in Kerala” with the funding of Environment Department, Government of Kerala. The project started during the month of January 2016. The State is believed to be one of the hotbeds of communicable diseases, due to its geographical location, topography, tropical weather patterns and varied land use. All vector borne disease outbreaks can be linked to climate variability in recent times. The case of dengue outbreaks in the State can be taken as an example. Therefore the current study explores the linkage between vector-borne disease incidences and cases and the local weather parameters like temperature, relative humidity, and rainfall for the past 10 years of Alappuzha, Kottayam and Pathanamthitta districts. The study proposes to develop a database on vector-borne diseases as part of Health Information System, and to create awareness on climate change related health impacts and its mitigation strategies among people at large.



Data collection from Public Health Centre at Maravanthuruthu, Kottayam

Data collection involved primary interview of the public health staff followed by collection of the disease incidence and location details from the institution records. The data collection methodology, linking disease data, climate data and geographical location, was formulated after a brainstorming session and a pilot study conducted by the research team at the beginning of the project. Different schedules were prepared for data collection. Data from Kottayam district was collected from 80 health institutions (53 Primary Health Centres, 20 Community Health Centres, 3 Taluk Hospitals, 3 General Hospitals, and 1 District Hospital). With the completion of data collection in Kottayam District within a period of four months, incidences of vector borne diseases have been noted even at drought conditions. Extended study and analysis of data to be collected from other two districts (Alapuzha and Pathanamthitta) may lead to more findings relating to climate variability and disease incidence.

New Project

Vulnerability of Vembanad-kol Wetland to Climate Change

ICCS has recently taken up a study on the vulnerability of Vembanad-kol Ramsar Wetland to Climate Change funded by the Kerala State Council for Science Technology and Environment, Science and Technology Department, Government of Kerala. Major objectives of the Study are: to identify issues related to climate change affecting the Vembanad-kol wetland system; to delineate the human caused factors that act as a risk addition in the climate change scenario of the wetland system; to identify climate change hotspots which are vulnerable in the Vembanad-kol region; to measure the adaptive capacity of the people of the region, and to develop short-term and long-term climate change adaptation strategies; and to develop a common framework

Climate Change Knowledge Centre to be set up in ICCS

In order to strengthen the research capability of ICCS and to improve the infrastructure facilities for undertaking world class research and monitoring in Climate Change Science, ICCS has submitted a proposal to National Mission on Strategic Knowledge for Climate Change, DST, Government of India, for establishing a Climate Change Knowledge Centre. The budget proposed for the project is Rs. 4.75 crore.

Main objectives of the project are: (i) build data bank and a knowledge repository for storing and retrieving Climate Change information at the State Level to be useful to all sectoral line department, institutes, universities, public, etc.; (ii) assess risk and vulnerability due to Climate Change in the State; (iii) develop benchmark relevant for all adaptation and mitigation sectors; and (iv) capacity building of all relevant departments/agencies of the State Government/stakeholders to create awareness on Climate Change. The Centre is expected to facilitate chalking out appropriate adaptation strategies at regional, and sectoral levels besides becoming a Knowledge Hub catering to the needs of policy makers, scientific community, and general public on Climate Change issues in the State.

for vulnerability assessment of coastal wetlands of Kerala by integrating socio-economic, and ecological factors. It is also intended to create awareness among all stakeholders in the Vembanad-kol and related regions about climate change, its local impacts, and adaptation measures. The vulnerability assessment will be focussed on three main components - (i) Exposure (impacts of climate change on wetlands); (ii) Sensitivity (extent to which the people and the ecosystem is affected); and (iii) Adaptive capacity (ability to adjust or adapt to changing environment). It is expected that the Vulnerability Map delineating hotspots of Vembanad-kol wetland system, to be prepared as part of the Study, could be used for devising climate change adaptation strategies.



Training Project

Training Programme on Climate Change and Disaster Risk Reduction

ICCS is organising a series of training programmes on 'Climate Change and Disaster Risk Reduction' for the officials of Local Self Government Department, and elected representatives of Local Self Government Institutions under the Training Project funded by the Environment Department, Government of Kerala. A total of 800 officials, mainly gram panchayat secretaries, covering 11 Districts, have been trained under the project. The programmes are conducted with a view that adaptation and mitigation of climate change impacts require awareness at the grassroots level with the mission of 'local actions, global effects', and local bodies are the most important functionaries in environmental



Group discussion during training at Malappuram



Dr Keshav Mohan, former Director, ICCS, takes class in the training programme at Kollam

planning and mitigating climate change effects. Besides giving sensitisation on climate change science and its impacts in the global, national and state level, opportunity is given to the participants to identify impacts specific to their respective area through Problem Tree Analysis exercise.

A total of 357 officials from six districts (Kollam, Thrissur, Palakkad, Malappuram, Kozhikode and Wayanad) were trained during January – March 2016. The programme at Kollam was held on 07 – 08 January 2016, at Thrissur on 19 – 20 January 2016, at Palakkad on 09 – 10 February 2016, at Malappuram on 16 – 17 February 2016, and at Kozhikode and Wayanad on 09 – 10 March 2016. The training of gram panchayat officials of three districts (Thiruvananthapuram, Kannur and Kasargod) will be conducted during June 2016. It is scheduled to conduct the training programmes for officials of Block Panchayats and District Panchayats, and those for elected representative of rural and urban local bodies within four

About ICCS

The Institute for Climate Change Studies (ICCS) is an autonomous research organisation under the Department of Environment, Government of Kerala. Hon'ble Chief Minister of Kerala is the chairperson of the Governing Body of ICCS, and the Hon'ble Minister for Environment is the chairperson of the Executive Committee. Director, ICCS, is the Member Secretary of both the Committees. The Scientific and Academic Council with experts in the Climate Change related sectors, constituted under the chairmanship of the Director, ICCS, is the research and academic policy making body. The general objectives of ICCS are focussed research on state specific impacts of climate change on water, agriculture, forestry, biodiversity, sea level rise, natural hazards, health and socio-economic scenario of the State; and propose appropriate action for climate change management and adaptation strategy on various sectors and zones of the State. The specific objectives of ICCS are:

- to act as the State Level Apex Agency for Climate Change research and advocacy;

- to assist the Government of Kerala in achieving coherence between strategies on climate change and help in the implementation of the State Action Plan on Climate Change;
- to perform as an interdisciplinary research organisation to conduct basic and applied research focussed on the State's climatic, ecosystem and other environmental matters particularly connected to the Western Ghats and to promote indigenous knowledge for Climate Change Adaptation;
- to assist the Government of Kerala in prioritizing financial allocation for Climate Change Adaptation and resilience building; and
- to perform as the Knowledge Centre of best practices for Climate Change Adaptation and to act as the State Level repository of climate data and resource centre for devising mitigation and adaptation policies and for the implementation of those provisions and actions given in the State Climate Change Action Plan.

Workshops/Seminars Conducted

Workshop on Climate Change and Water

ICCS and Centre for Water Resources Development and Management (CWRDM) jointly conducted Workshop on "Climate Change and Water: Way Forward in Management Strategy for Kerala" at Kottayam on 22 March 2016, as a part of observing World Water Day. The Workshop was inaugurated by Dr E J James, Chairman, Research Council, CWRDM, and former Vice Chancellor, Karunya University. Dr N B Narsimha Prasad, Executive Director, CWRDM, presided over the inaugural meeting. Dr Keshav Mohan, Director, Institute of Land and Disaster Management, Dr George Chackacherry, Director, ICCS, and Scientists of CWRDM, Dr George Abe and Dr Celine George, spoke in the meeting.

Dr N P Kurian, former Director, National Centre for Earth Sciences Studies, and Scientists of CWRDM, Dr E J Joseph and Dr V P Dineshan, made presentations on different dimensions of Climate Change and Water. Dr N B Narsimha Prasad was the moderator. Lively discussion was there followed by the presentations. Dr K K Ramachandran, Scientist, NCESS, and Dr A P Thomas, Director, Advanced Centre for Environmental Studies and Sustainable Development, M G University performed as moderators. Shri U V Jose IAS, District Collector, and Dr K P Joy, Chairman, State Environment Impact Assessment Authority delivered special addresses in the valedictory meeting. Shri Pratheesh C Mammen, Project Scientist, ICCS, proposed a vote of thanks. A total of 65 officials, experts, and representatives of NGOs attended the Workshop. Recommendations of the Workshop include the following:

- Environment friendly coastal protection measures like beach nourishment, geo-textile bags, planting of salt tolerant non-mangrove species and sand dune management may be given importance and location specific studies may be undertaken to deal with it.
- A framework for climate resilient developmental activities may be formulated for the adaptation of coastal region to Climate Change.
- Tide related data from the tidal stations of Harbour Engineering Department may be used effectively for studies on impact of Climate Change on coastal processes.
- An effective methodology for the restoration of sand dune ecosystem in the Kerala coast may be formulated as part of adaptation to Climate Change.
- Climate Change related water quality issues may be studied on a priority basis.
- How increasing in temperature affect flora and fauna in the water bodies may be studied for protecting the biodiversity in the water systems.
- R&D organisations and Departments, which are doing climate observations, should have a network and the observations should be standardized assuring quality, and shared for devising strategies to tackle Climate Change.



Dr E J James, inaugurates the workshop on climate change and water. Dr George Abe, Dr N B Narsimha Prasad, Dr Keshav Mohan, Dr George Chackacherry, and Dr Celine George are also seen



Shri U V Jose IAS, District Collector, delivers special address in the workshop on climate change and water

- Climate Change impacts on agricultural crops in Kerala, especially in terms of altered physiology, advanced maturity, poor pollination and fruit set, may be studied on priority basis, and results may be transferred to farmers for mitigation/ corrections possible.
- Efficient measures and patterns of communication may be adopted for the dissemination of scientific findings related to Climate Change through local self-government bodies aiming at increasing preparedness and adaptive capacity of stakeholders in dealing with Climate Change issues.
- Climate Change may be given due importance in the school curriculum and teachers may be trained for dealing with them.

Workshop on Climate Change and Technological Development

ICCS has organised a Workshop on "Climate Change and Technological Advancements" at Kottayam on 04 May 2016, as a part of National Technology Day Celebration, under the sponsorship of the Kerala State Council for Science Technology and Environment. Dr B G Sreedevi, Director, National Transportation Planning and Research Centre, Thiruvananthapuram, inaugurated the Workshop. Dr George Chackacherry, Director, ICCS, presided over. Shri Pratheesh C Mammen, Project Scientist, ICCS, welcomed the gathering.

Dr MGManoj, Research Scientist, Advanced Centre for Atmospheric Radar Research, CUSAT, Dr Dinesh Gopinath, Associate Professor, Electrical and Electronics Department, Government Engineering College, Idukki, Shri P Kalaiarasan, Scientist, NATPAC, and Dr D Ambikadevi, Professor, Regional Agriculture Research Station, Kumarakom, made brief presentations on various aspects of Climate Change impacts due to technological advancements.

Dr George Abe, Head, CWRDM Sub Centre, Kottayam, and Dr R Krishna Kumar, Joint Director, Rubber Research Institute of India, were the moderators. Discussion, after the presentations, was led by Dr C T Aravind Kumar, Director, School of Environment Sciences, MG University. Smt Bindu C Thomas, Technical Expert, ICCS, proposed a vote of thanks.



Dr B G Sreedevi, Director, NATPAC, inaugurates the workshop on climate change and technological advancement. Shri Pratheesh C Mammen and Dr George Chackacherry are also seen

A total of 55 persons including experts, and officials from various agencies concerned attended the Workshop. Major suggestions of the Workshop are:

- Government may establish a high level committee to suggest energy efficient technologies that should be encouraged in Kerala
- Extended Polluter Responsibility may be made applicable in all possible sectors
- Efficiency, product life cycle and environmental impact may be given priority while adopting newer technologies such as LED to CFL and Mercury to Lithium Oxygen Batteries/ Lithium Air Batteries



Workshop on climate change and technological advancement - a view of participants

- Reduce and Recycle mechanisms should be promoted whereby carbon emissions can be lowered substantially
- To withstand the changing climate scenarios encourage farmers to use indigenous varieties by offering incentives
- Develop climate resilient crops for higher yielding purposes
- Before implementing power production from the renewable energy sources, a cost benefit analysis and life cycle assessment should be made mandatory
- Studies to be done regarding the biofuels and its applications and economic viability and implementation of biofuel production to be initiated after carbon footprint analysis

- Climate friendly habits which have been part of our traditional knowledge system have to be popularized for the sustainable living
- Awareness may be given to general public about various climate smart technological innovations.

Information from Staff

Dr George Chackacherry, Director

- Served as member in the State Expert Appraisal Committee of the State Environment Impact Assessment Authority constituted by MoEF&CC, Govt. of India
- Presented paper on the 'Conundrum on Waste Management in Kerala' in the National Seminar on Kerala's Development Oximora: Revisiting Kerala Model of Development organised by M G University, at Kottayam on 19 March 2016.
- Presented paper on 'Socio-economic Dimensions of Climate Change in Kerala' in the Brainstorming Session on Climate Change and Challenges Faced by Plantation Crops, at Rubber Research Institute of India, Kottayam, on 05 April 2016.
- Delivered lecture on 'Integrated River Basin Management - Case Study on Holy River Pampa' in the National Training Programme on "Audit of Waste and Water Issues" at the International Centre for Environment Audit and Sustainable Development, Jaipur, Rajasthan, on 13 May 2016
- Made presentation on 'Draft Wetland (Conservation and Management) Rules 2016 in the Kerala Context' in the brainstorming session organised by KSCSTE, Government of Kerala, at Thiruvananthapuram, on 17 May 2016

Shri Pratheesh C Mammen, Project Scientist

- Attended three-day training programme on Climate Change Adaptation and Mitigation organised by the DoECC, Government of Kerala, for the officers of the State Government Departments at Thiruvananthapuram during 04 - 06 January 2016
- Delivered invited talk on 'Climate Change' at Chengannur Christian College on 24 February 2016
- Attended Brainstorming Session on Climate Change and Challenges Faced by Plantation Crops, at Rubber Research Institute of India, Kottayam, on 05 April 2016.

Smt Bindu C Thomas, Technical Expert

- Attended three-day training programme on Climate Change Adaptation and Mitigation organised by the DoECC, Government of Kerala, for the officers of the State Government Departments at Thiruvananthapuram during 04 - 06 January 2016
- Delivered invited talk and attended Panel Discussion on 'Climate Change and Kerala' for Victors Channel (organised by Centre for Environment Education sponsored by MoEF&CC, Government of India) on 28 March 2016
- Attended Brainstorming Session on Climate Change and Challenges Faced by Plantation Crops, at Rubber Research Institute of India, Kottayam, on 05 April 2016.

Unprecedented Temperature Increase in Kerala



Unprecedented events of Heat wave conditions were reported in many parts of Kerala State during the summer months of April-May, 2016. As per media reports, casualties were reported more from the northern districts of Kerala on the heels of Palakkad registering maximum temperature of 41.9 °C, the highest temperature ever recorded in the State. Heat waves are anomalous episodes with extremely high surface air temperatures exceeding the long-term average by about 4.5 °C, and lasting for several days with serious consequences.

The maximum temperatures recorded in many parts of the State either crossed or reached near the critical level of 40 °C, leading to unpleasant living condition. For example,

mercury levels in Kannur town rose to 39.2 °C surpassing the earlier all-time highest temperature record of 38.3 °C observed on 16 April 1998 (Fig. 1). Similar conditions existed over other districts too.

Generally, the weather during the pre-monsoon months April-May is hot with ample humidity. This peculiar characteristics lead to the formation of widespread thundershowers with occasional severe thunder and lightning, and bring about a temperature drop by about 2-3 °C. However, the summer rainfall this year was very sparse (Fig. 2) over the State with exception of a few showers. Yet, this spell of rain was not good enough to bring significant respite from the intense heat. As a result, most

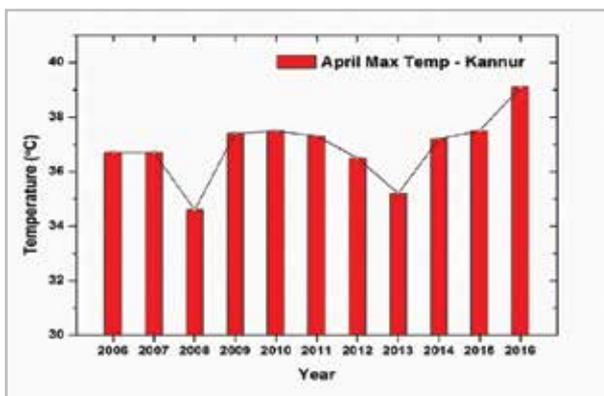


Fig. 1. Maximum temperature recorded in the month of April for the last ten years at Kannur

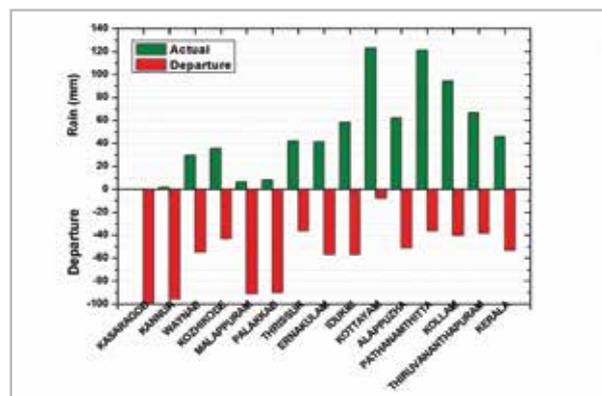


Fig. 2. Departure of pre-monsoon rainfall (from 01 March to 22 April, 2016) for different stations in Kerala.

of the drinking water sources dried up, which is a strange phenomenon for the last 3-4 decades. The excess amount of humidity in the atmosphere intensifies the adverse effect of heat on human and animal body by slowing the natural evaporative cooling mechanism, a special concern for the Kerala in the context of heat burn and sun-stroke related health risks and deaths.

Causes for the Temperature Rise

The most important causative factor attributed to this year's unusual warming is the El-Nino (anomalous warming of the sea surface temperature of the equatorial Pacific Ocean), as reported by the Advanced Centre for Atmospheric Radar Research, CUSAT. Though the El-Nino, which produced severe monsoon droughts over the Indian region, was observed to be in the moderate intensity stage during this summer, the weather over Kerala during April-May had produced unprecedented sweltering heat associated with anomalous circulation pattern triggered by El-Nino.

Usually, wind comes from different directions at different height levels in the atmosphere. In Kerala, this happens from the Arabian Sea, Indian Ocean and Tamil Nadu-Karnataka region. Interestingly, during the period of heat wave in Kerala, the wind direction at almost all the levels was observed to be from our neighbouring States (mostly Tamil Nadu) where hot and dry weather prevailed, crossing the Western Ghats. The dry wind crossing the mountains move downwards. In that motion, compression takes place and leads to a process known as compressional warming or adiabatic warming by which heat increases.

The presence of non-precipitating cloud cover during the evening and early night hours adds to the warming by

trapping the energy that otherwise should have escaped into the outer space. Due to increase in anthropogenic activities and emissions, global temperatures have shown a warming trend of 0.85°C over the period 1880-2012. This is a permanent factor in increasing the surface temperatures, even at our State too. During the recent years, minimum temperatures (night-time) have increased more than daytime temperatures, suggesting the possible role of moisture and the greenhouse gases. The changes in mean value or variance in temperatures may cause increase in extreme temperatures and therefore occurrence of heat waves.

We have to Open Our Eyes

Among the present global scenario of climate change, one important alternative to prevent the warming to some extent is the relative role of microclimate and land use to biodiversity. In Kerala, the degradation of environment and bio-diversity has contributed to another pace of warming, which has so far attracted series of discussions among environmental activists and the common public. All the current events points to the fact that Kerala needs to invest special attention in dealing with the climate change scenario which could be devastating in the nearest future otherwise.

State Action Plan on Climate Change

It has been pointed out that though the information and knowledge base about causes and consequences of the global warming and resultant climate change are building up generally, the assessment of impacts on the living environment can only be understood by understanding the pattern of impacts, and the actions in response can only be planned by internalizing the understanding in all the spheres of public order. Kerala State is vulnerable to the changing climatic dynamics owing to its location along the sea coast and steep gradient along the western slopes of the Western Ghats. Though high potential growth rate of forests and perennial agriculture in Western Ghats provide high resilience against mild climatic variations, high population density, especially in the coastal areas, adds to the vulnerability to the climate related problems. Considering the facts, the State Action Plan of Kerala on Climate Change has attempted to name broad

domains for suggesting a focus of strategic attention for planning and implementation purposes. Therefore, areas proposed by the State as a strategy for response to Climate Change are:

- Enabling Environment through General Policy and Governance (Green House Gas Emission Optimization, Infrastructure for long term sustainability, options for energy)
- Governance for sustainable human development
- Monitoring and Strategic Knowledge Management
- Assessment of the impacts of Climate Change on Natural Resource Sectors and adaptation/mitigation (Water Resources, Forests Resources, Agriculture, Fisheries and Coastal ecosystems)
- Information, Education and Communication (IEC) for the capacity development of stakeholders

Paris Climate Change Agreement and India



As an outcome of the 21st Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 21) held in Paris during 30 November – 12 December 2015, as much as 195 nations agreed to combat Climate Change and unleash actions and investment towards a low carbon, resilient and sustainable future. Later the agreement was signed on the Earth Day (22 April 2016) by 175 countries including India. The key elements of the agreement are:

- Keep global temperature rise below 2°C above pre-industrial times and endeavour to limit them even more, to 1.5°C
- To limit the amount of greenhouse gases emitted by human activity to the same levels that trees, soil and oceans can absorb naturally, beginning at some point between 2050 and 2100
- To review each country's contribution to cutting emissions every five years so they scale up to the challenge
- Rich countries should help poorer nations by providing "climate finance" to adapt to climate change and switch to renewable energy..

The Agreement covered areas of action such as: (i) Mitigation (reducing emissions fast enough to achieve the temperature goal), A transparency system and global stock-take (accounting for climate action), Adaptation (strengthening ability of countries to deal with climate impacts), Loss and damage (strengthening ability to recover from climate impacts), and Support (including finance, for nations to build clean, resilient futures).

India's commitment to fight climate change was pledged when Shri Prakash Javadekar, Minister for Environment, Government of India, signed the historic Paris Climate Change Agreement on 22 April 2016, calling it "the triumph of collective wisdom" in the global race to save the planet. India's main commitments are to reduce its emissions intensity - the amount of carbon output per unit of Gross Domestic Product (GDP) - by 35 percent, to build up the non-fossil fuel power generation capacity to 40 percent, and to undertake a massive afforestation effort that will absorb 2500 million tonnes of carbon dioxide from the atmosphere, in response to COP decisions 1/CP.19 and 1/CP.20 for the period 2021 to 2030.

Intended Nationally Determined Contribution (INDC) communicated by India keeping in view its development agenda, particularly the eradication of poverty coupled with its commitment to following the low carbon path to progress and being sanguine about the unencumbered availability of clean technologies and financial resource from around the world, are:



- 1 To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
- 2 To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
- 3 To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
- 4 To achieve about 40 percent cumulative electric power installed capacity from nonfossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).
- 5 To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.
- 6 To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
- 7 To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
- 8 To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.

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