

Inaugural Lecture of the Climate Change Lecture Series

on

# Impact of Climate Change on Forest and Biodiversity of Chhattisgarh



*Organised by*

**Chhattisgarh State Centre  
for Climate Change**

## Speaker's Profile



**Prof N.H. Ravindranath,  
IISc Bengaluru**

**Prof N.H. Ravindranath** was the Guest Speaker at the inaugural Climate Change Lecture Series organised by Chhattisgarh State Center for Climate Change on 14th July 2017. He is a professor at the Centre for Sustainable Technologies, Indian Institute of Science, Bengaluru and has focused his research, advocacy and publications on various dimensions of Climate Change, Bio-energy, Bio-fuels and Environmental Services. His work includes eight books on climate change, renewable energy, community forestry and biomass energy besides producing several assessment reports for the Intergovernmental Panel on Climate Change (IPCC).

His contribution includes firstly, research into various areas of climate change, forests, renewable energy and ecosystem services; secondly, participation in various international and national efforts to address climate change (IPCC, Global Environment Facility, Committees of the Ministries of Environment and Science and Technology, World Bank and UN Agencies); thirdly, creating awareness on the science, impacts, mitigation and adaptation aspects of

climate change - nationally and internationally; fourthly, designing climate change mitigation and adaptation projects, and; fifthly, building capacity in institutions to address climate change mitigation and adaptation. His contribution includes firstly, research into various areas of climate change, forests, renewable energy and ecosystem services; secondly, participation in various international and national efforts to address climate change (IPCC, Global Environment Facility, Committees of the Ministries of Environment and Science and Technology, World Bank and UN Agencies); thirdly, creating awareness on the science, impacts, mitigation and adaptation aspects of climate change - nationally and internationally; fourthly, designing climate change mitigation and adaptation projects, and; fifthly, building capacity in institutions to address climate change mitigation and adaptation.

## About Chhattisgarh State Centre for Climate Change

The State Centre for Climate Change and Knowledge Management Cell was established in August 2015 by State Government order and is housed in the campus of State Forest Research and Training Institute, Raipur. The State Centre on Climate Change is the apex body to coordinate and implement the Chhattisgarh State Action Plan on Climate Change (CSAPCC). The Centre is guided by a Steering Committee, which has already been constituted by the State Government under the chairmanship of the Chief Secretary with members; Additional Chief Secretaries, Principal Secretaries and Secretaries from concerned departments, representatives from national Institutions and subject experts. The Nodal Officer for CSAPCC is the member secretary of this Steering Committee.

### Objectives of Chhattisgarh State Centre on Climate Change (CGSCCC):

- To set a platform for interdepartmental coordination on implementation of CSAPCC.
- To act as a knowledge management centre, by strengthening existing knowledge and information base on climate change.
- To provide a platform for Stakeholder engagement to develop climate adaptation and mitigation in a participatory manner.
- To act as a Monitoring and Evaluation agency in the implementation of CSAPCC.
- To promote capacity and skills among State Government officials to mainstream climate change issues in development activities, raise awareness on climate change & risk reduction in development activities.
- To plan and budget the activities to effectively utilize the available resources and coordinate on accessing international climate funds.

## **About the Initiative of Climate Change Lecture Series**

Chhattisgarh State Centre for Climate Change was established in the year 2015 and since then has served as the centre for research and information on Climate Change in the State. The initiative to hold a series of lectures on Climate Change was taken by the State Centre for Climate Change under the directions of the Nodal Officer, Climate Change-Dr. A.A Boaz (PCCF&HoFF) with the vision to build the technical capacity of the government officials and general public awareness on Climate Change by the eminent speakers of the world. The Inaugural lecture of this series was delivered by India's eminent expert on Climate Change Professor N.H. Ravindranath from Indian Institute of Science, Bengaluru on the topic-Impact of Climate Change on Forest and Biodiversity of Chhattisgarh. The lecture was attended by IFS officers, Government Officials from State agriculture, health, forest and water resource department, representatives from the Civil Society organisations, students and university scholars.

## **Inauguration Session**



The inaugural lecture of the lecture series was inaugurated by the Hon'ble Smt. Champa Devi Pawle, Parliamentary Secretary, Forest. The Hon'ble minister stressed on the need to organise such awareness building programs from time to time. She also shared her concerns towards the impact of climate change felt on the forests of the State, which will mostly affect the forest dependent community and biodiversity of the State; in this scenario experts view and support on tackling the challenges of Climate Change will help the State in developing the coping mechanisms and roadmap on adaptation.

## **Background setting by Dr. A.A. Boaz, PCCF & HoFF and Nodal Officer, Climate Change**

In his key note address, Dr. A. A. Boaz, PCCF & Head of Forest Force (Forestry Research, Training and Climate Change) and State Nodal Officer on Climate Change, Government of Chhattisgarh shared about efforts being made by State Centre for Climate Change and expressed his concerns over the recent fragmentation that has happened in the international arena. Dr. Boaz expressed confidence that the ultimate success of all the efforts being undertaken at the international level would be determined by the level of successful implementation at the ground level and therefore the role of sectoral department and State Centre for Climate Change is increasing in greater proportions with each passing day. State Centre for Climate Change was approved in the year 2014 under which State level steering committee, Climate Change Cells in departments and district level coordination committee has been established. Knowledge management centre is being established in the State Climate Change Centre under the financial support received from Department of Science and Technology. Under National Adaptation Fund for Climate Change, a four-year project for Mahanadi basin has been approved for three districts i.e. Baloda Bazar, Dhamtari and Mahasamund.

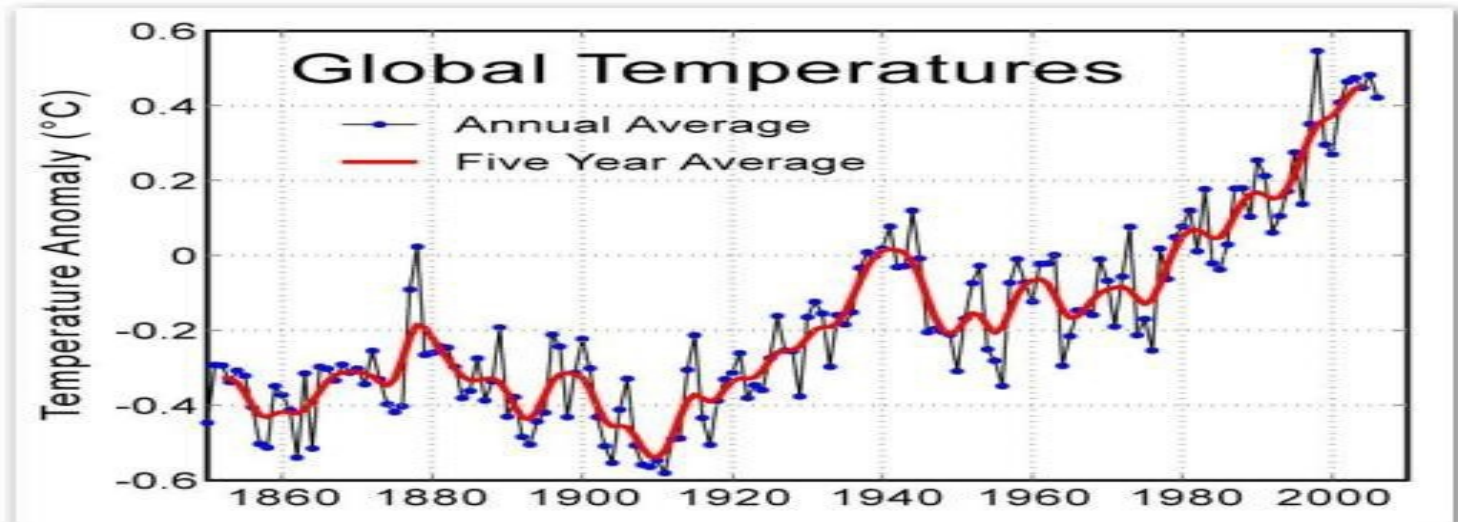


## Lecture Delivered by Professor N H Ravindranath

I am very happy to be here today to speak on the topic of “Impact of Climate Change on Forests and Biodiversity of Chhattisgarh” as I have been associated with Chhattisgarh in past as well as in recently while developing greening strategy for Naya Raipur.

Air and water are at the heart of Climate Change because oceans and rains are very critical for human survival. All the countries are facing a lot of different kinds of development challenges and problems, such as India is facing problems of poverty, food production and floods etc. and top of that we have Climate Change. While there are already a lot of challenges and problems, Climate change has added to the list and it will have impact on all spheres of life. Even rich countries would be adversely affected by Climate Change and no one would be spared.

Forest fires has become one of the biggest challenge across the world. Cases of forest fires have been reported from US, France, Germany, Australia and Indonesia. Canada witnessed one of the worst forest fires in its recorded history. In next four to five years, we don't know what will happen to forests? People living in vicinity of forests are blaming forests for their losses and damages. The increased incidences of forest fires across the globe is due to climatic changes resulting in droughts leading to forest fires. Some people are raising doubts over climate change and increase in global mean temperature. The fact is that it is scientifically proven now and we have started feeling the change.



Source:- IPCC 2007

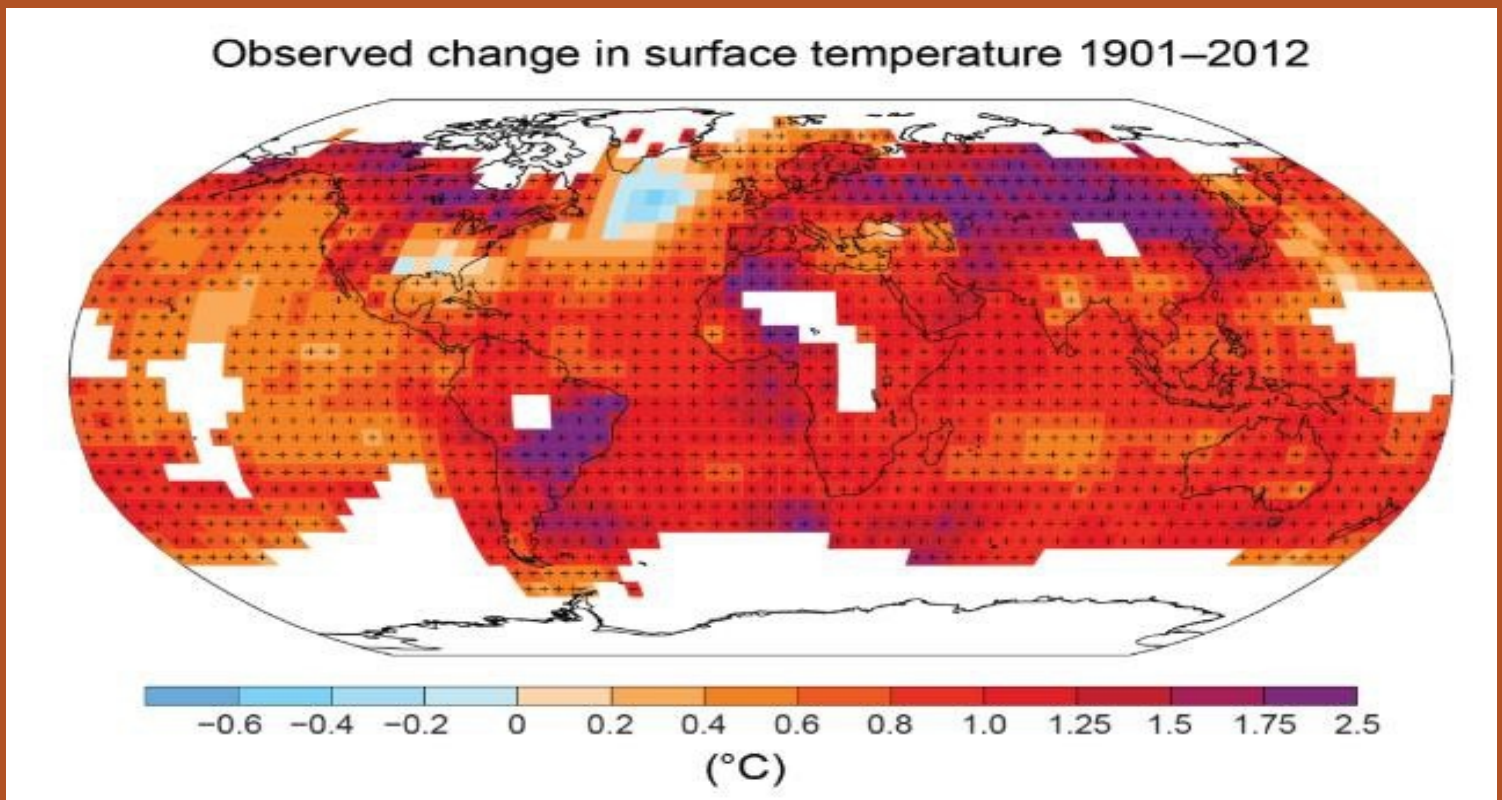
Unfortunately, Climate Change has remained as a global problem or at best as the national issue and has not been translated into the state and district level issue. At the state level, Chief Ministers and senior officials do recognise Climate Change as a problem but also say that it is not the priority at the state since they have a lot other problems and challenges to address, which is also true. Climate Change is not something that would destroy crops or forests tomorrow itself, but the changes would be seen on the decadal scale. The imminent challenge is how to bring Climate Change issue from global and national level to state, district and Panchayat level. If you ask any farmer from any part of the country that “is the climate changing?” each one of them would agree to it.

Farmers are now unable to predict rainfall whereas earlier about till twenty years back farmers knew when and how much rain would fall. In all the states of the country, the situation is that farmers are of the view that climate is changing, because of which farmers are unable to decide which crop to sow. In Karnataka, just recently there has been a drought which was unprecedented, in fact some parts of the state remained in drought permanently for last three to four years. Maharashtra has a similar story. Even in Chhattisgarh, there have been a lot of rain but that has happened at the wrong time. Even less rainfall at the right time is more useful for agriculture and forest plantations than more rainfall at the wrong time. Too much rain initially (say in June) and no rain in the following six weeks would mean double loss to the farmers. Farmers invest a lot of money in June if there is good rainfall but later if it



does not rain for next six weeks it would not only mean loss of opportunity to earn in the season but also on the investments made. On failure of crop, farmer would again have to go for another crop.

So, the big challenge is how to make the science help the farmer, fisherman, forest people and everybody? How we can help them all cope better with the Climate Change? Climate Change impacts would happen in fields, forests and coastal areas. Government of India is busy with many bigger things and then also Climate Change is a big agenda- on how to make districts and Panchayats cope with the Climate change? States need plan for Climate Change as they would have to face the challenges of migration, debt due crop failure etc. Climate change could be viewed from both the village level as well as from the international level. Unfortunately, the science is good at the national and regional level but at Panchayat level, watershed or forest division level, there aren't good models available to help planning. At Forest Division and Watershed level we are progressing towards developing such models. Science is not good enough to say that it will rain on this day in this village. At best science, could predict rainfall say in a district with some probability. That means we must develop strategies to help farmer.



Source:- IPCC 2013

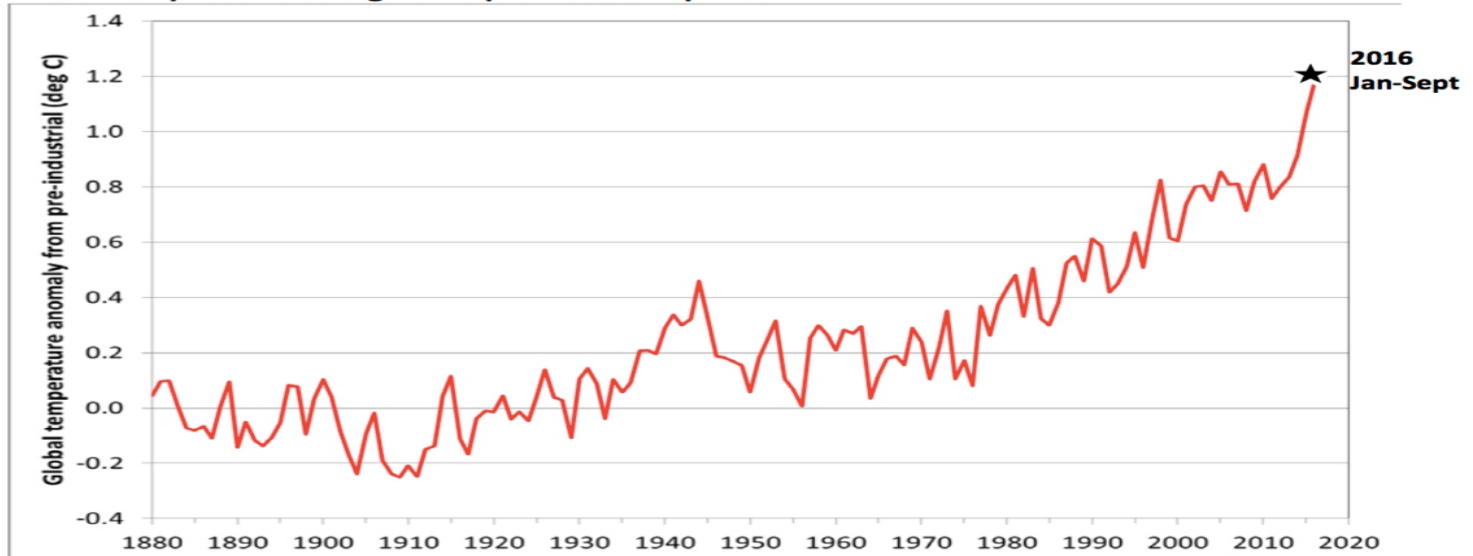
In many districts, where malnutrition in children is a big challenge, there is a problem at the state and village level. On the other hand, ground water table is decreasing, in fact more areas have been brought under ground water irrigation than surface water irrigation. In most of the villages, one may find many abandoned bore wells across the country. Farmers invest one to one and half lakhs in a bore well and after couple of years the water level is gone and so does the investment. There is huge ground water problem. On top of that, land is degrading. According to ICAR about 100 million hectares of crop land in India is facing land degradation.

Just imagine with degradation of land, soil erosion, salinity, wind erosion, ground water decline and silting of dams, would we be able to provide food grain to meet the demand of 1.3 to 1.5 billion people? There is already a crisis even now, many big cities are facing a lot of challenges such as water having to be transported from hundreds of kilometres. It is difficult to meet the present demand then how would the increase in demand be met from? On top of that we have climate change whose impact would only worsen in coming years.

## Climate change, vulnerability and exposure

A study is being carried out in which it is seen how Climate Change aspects could be incorporated in designing the structures made under MGNREGA as huge investments are made to develop assets across the country. In Rajnandgoan, for example we witnessed, almost 40% increased change in rainfall is predicted which is not good for farming as no farmer wants too much or very less rainfall. By 2030, as per the climate modelling done at block level, it clearly predicts that there is 70% likelihood of floods and increase in probability of the same. According to the Paris agreement, its endeavoured to limit the rise in global mean temperature by 1.5 to 2 degrees Celsius. It is believed that increase in temperature more than 2 degree Celsius would be catastrophic. In parts of central India, we are already witnessing increase in temperature more than that so we can imagine what will be the scenario in next 20-30 years.

**Global Temperature change from pre-industrial period**



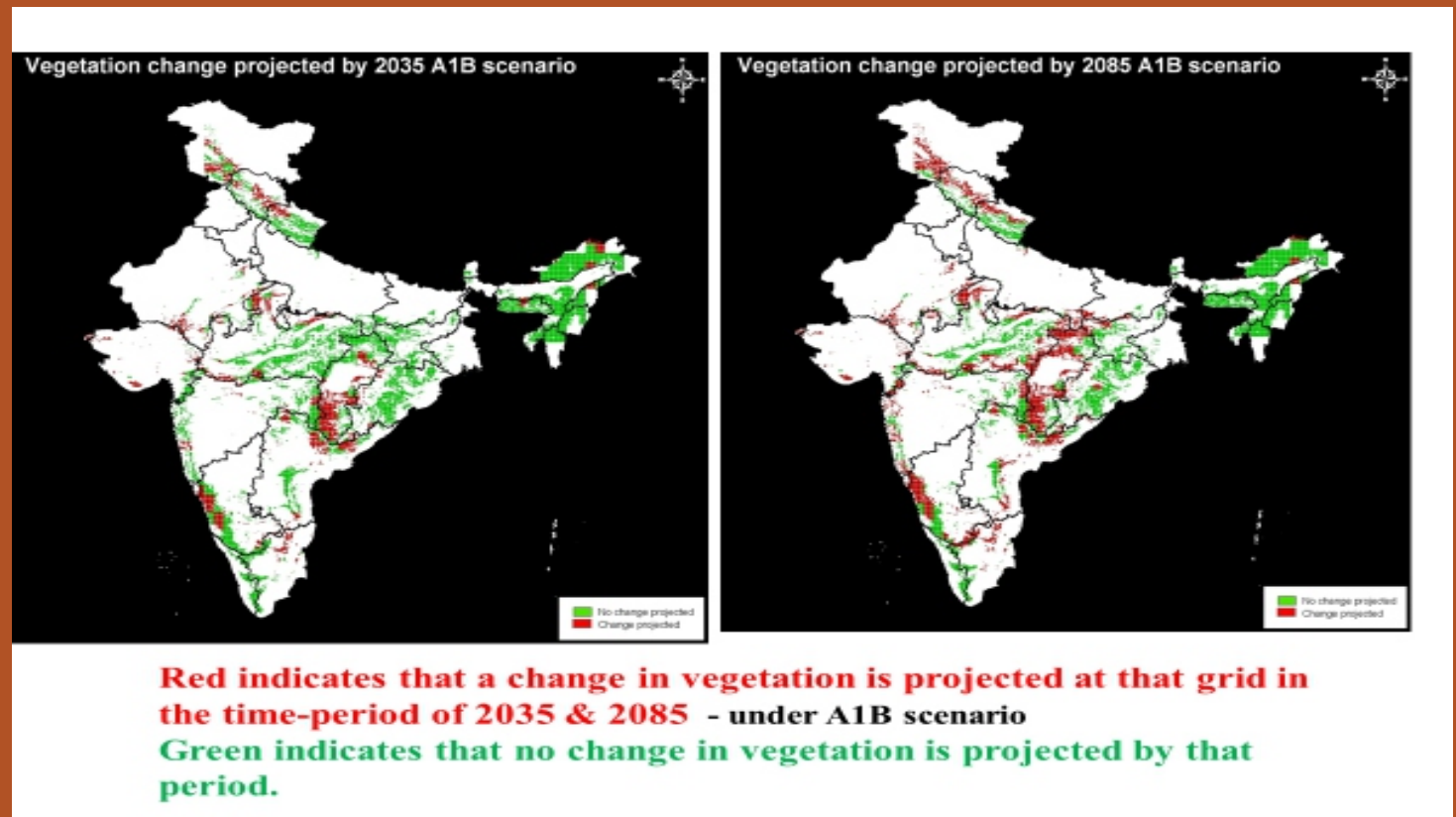
Some districts of Chhattisgarh are already experiencing the temperature around 49 degrees Celsius. Extreme weather events are already occurring and these are expected to increase in future.

A study undertaken some 4-5 years back by IRI, Pusa, New Delhi highlighted the impact of Climate Change on irrigated fields by 2020. The study highlights yield of rice and wheat would decline by more than 20%. These predictions have been made by India's best agriculture scientists. Even if there is no change in rainfall, just two-degree change in temperature would have huge adverse impact on yields of both irrigated rice and irrigated wheat.

We need to understand climate change, vulnerability and exposure. Climate change involves risk of changing weather patterns including temperature, rain, patterns of cyclones, drought, floods etc. there is a risk of all of that. Hazards like droughts, floods, hurricanes cause huge losses. People living in areas such as mountains, coastal areas, desert areas are more exposed to hazards. Some people are more vulnerable than others. For example, people living in hilly areas are more vulnerable than people living in plains, people of Assam flood plains are more vulnerable than other households of the state. Vulnerability depends on capability to cope with the hazard and wherever you are. Farmers are more vulnerable than people like us who are salaried. We need to understand what determines vulnerability to floods, droughts etc.

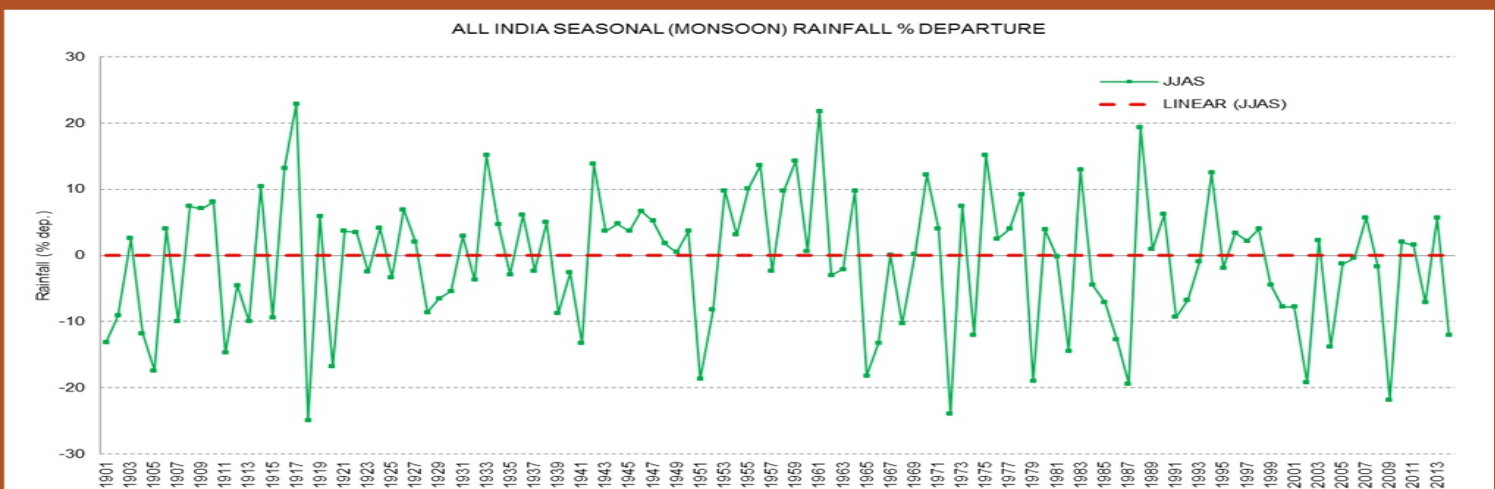
Inter-Governmental Panel on Climate Change (IPCC) did a global study to assess the impact of climate change on forests. According to the study, tree mortality and associated forest dieback will occur in many regions in the next one to three decades, with forest die-back posing risks for bio-diversity of ecosystems and ecosystem services. Many species face increased extinction risk during the 21st century under the projected climate change scenario.

Other pressures such as habitat modification, pollution and invasive species would compound the stress on species. It is assessed that increased severe drought together with land-use change and forest fire would cause much of the Amazon forest to transform to less-dense, drought- and fire-adapted ecosystems which would increase the risk for bio-diversity while decreasing net carbon uptake from the atmosphere



Various studies are being carried out using various models under different climate change scenarios. Changes in vegetation is projected in many parts across the country as well as in Chhattisgarh in the period 2035-2085. Already, as the FSI data indicates, forests in Chhattisgarh have undergone quite a huge change in last one and half decade in terms of total degradation of forests from dense forests to moderately dense forests.

Vulnerability Assessment of Forest Ecosystems to Climate Change in Madhya Pradesh, which is not very different from forests of Chhattisgarh. The study assesses that present forest ecosystems and dependent communities are subjected to climate variability and climate change. There are changes in the mean variables as well as in number and frequency of extreme events. The vulnerability is expected to increase in the projected climate change scenarios. The vegetation of the state is expected to witness change and the more the temperature increased more pronounced is the change.





Under the study, climate change driven vulnerability of forests both under low emission (RCP4.5) and high emission (RCP8.5) scenarios in short and long-term were assessed. A district-wise vulnerability assessment under high emission (RCP8.5) scenarios for short term period was also done in which it was found that forest areas in the districts of Dewas, East Nimar, Raisen and West Nimar are extremely vulnerable in this scenario. In the same scenario in the long term, it was found that forests in the districts of Dewas, East Nimar, Raisen, Sehore, Shivpuri and West Nimar are extremely vulnerable. Similarly, in short term a vegetation shift is expected in Himachal Pradesh.

## Need for adaptation

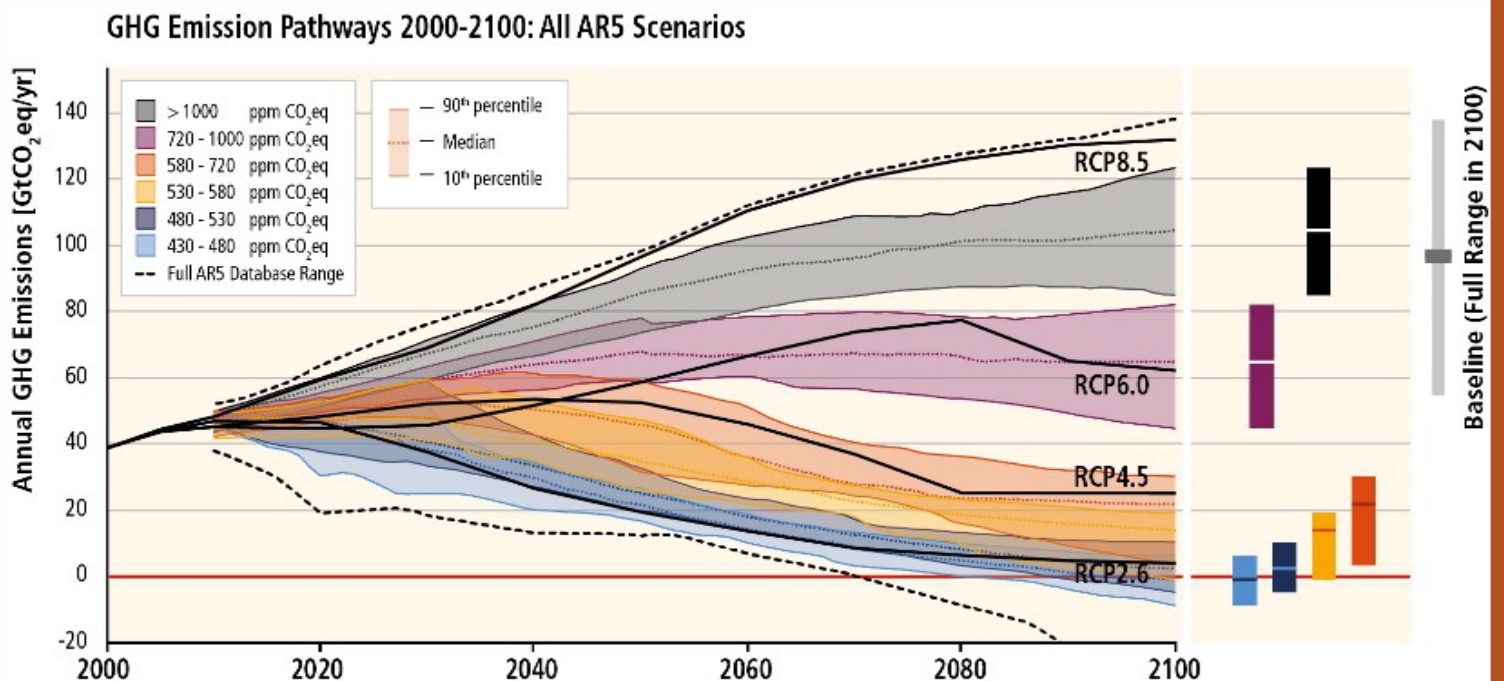
There is concrete evidence that suggests the need for change in present vegetation, since future climate will not suit existing vegetation. This will also lead to damage and loss of bio-diversity but how soon and with what the vegetation would be replaced could still not be said with surety. Forest dieback is projected to occur. Increased incidences of forest fires and pests are expected. NPP is expected to increase initially due to CO<sub>2</sub> fertilization effect, but ultimately decline due to higher levels of warming. The climate change would have long term impacts on forest ecosystems and biodiversity, and these changes would be irreversible requiring adaptation.

Therefore, there is need to undertake adaptation measures immediately to build resilience in forest ecosystems and forest dependent communities. There is a need to develop adaptation strategies for forest which would require a lot of effort and time. The capacity of forest ecosystems to adapt to climate change can be increased by (1) reducing the other stresses operating on them (2) reducing the rate and magnitude of change (3) reducing habitat fragmentation and increasing connectivity (4) maintaining a large pool of genetic diversity (5) manipulation of disturbance regimes to keep them within desired ranges.

India has volunteered to contribute Paris agreement commitment through NDCs. Three important NDCs are: -

- To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
- To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance (GCF).
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO<sub>2</sub> equivalent through additional forest and tree cover by 2030.

The graph shows GHG Emission Pathways in all AR5 Scenarios.





The above graph clearly shows that even if the all present pledges and INDC commitment are honoured, which appears far from the reality, in the present emission scenario there would be a change in temperature of 3.3 to 3.9 degree centigrade. Even 1.5-degree change would bring havoc, what a 3-degree temperature change would bring is incomprehensible and presently we are least prepared for such a mean global change of temperature. Therefore, it must be understood that the present level of efforts will not be able to prevent huge changes in climate resulting in incomprehensible climatic changes and disasters.

## **Measures to address climate change**

Climate change is already happening and with present level of emission and mitigation, it is expected that soon we will cross 20C, even if Paris Agreement is fully implemented and India is able to achieve its ambitious targets it has set for itself. Agriculture is particularly vulnerable and therefore farmers would be subjected to increased climate variability and extremes. Farmers of the state of Chhattisgarh and across the state are highly sensitive and have low adaptive capacity despite continuous efforts from the national and the state government. It is important to put in place robust assessment systems of climate change projections or impacts assessments at the regional and local level. The problem of farmers and agriculture needs to be seen in totality as there is increased incidence of land degradation, ground water decline, pests attack, high current climate variability etc. and these would/are expected to increase in future. On top of all that climate change would be additional stress.

In the emerging climate change scenario, there is increased need to protect our natural resources especially our forests. This would require undertaking the following measures: -

- There is need for improved fire management to cope with increased frequency and intensity of forest fires, especially in deciduous forests.
- There is need for linking of protected areas, corridors and fragmented forests to facilitate species migration under a changing climate. Activities for ecosystem restoration through climate-resilient afforestation and by reducing non-climate disturbances or stresses.
- Regenerate degraded natural forests through natural regeneration to promote native plant species.
- Promote natural regeneration and mixed species planting in the afforestation programmes to enable risk spreading, and increase genetic diversity
- Anticipatory planting of tree species across latitudinal and longitudinal gradients, identification of species from warmer districts and their promotion in districts projected to become warmer.
- Assisted migration to maintain or improve migration corridors, including active management to improve survival along the shifting vegetation especially in the transitional zones and by translocation of species.
- Enhanced focus on research and monitoring of forest response to changing climate.
- Initiate mainstreaming climate change in forest working plans by incorporating climate concerns to build resilience of the forest ecosystems and identify mitigation opportunities in forest management and afforestation programmes.
- Resilience building activities in rural communities and farmers;
- Conserve forest biodiversity, promote agro-forestry and plantation forestry on farm lands, community lands incorporating multiple tree species providing
- Diverse livelihood opportunities from forests including economic products (fruits, seeds, etc.), apart from timber and fuelwood to build resilience among the farmers by supplementing their income and to reduce their dependence on forests.



## Questions and Answers Session

Q.1. Should developing nations take strong measures to control emissions and not repeat the mistakes done by the developed nations in the name of development?



By-Anurag Verma, Student of Ecology and Environment, Nalanda University

Ans:Earlier Kyoto Protocol mostly covered the rich countries but now it has also included many developing countries under its mandate. Asian countries like India, Japan, China have a greater role to play. Solar energy which is a cheaper and cleaner source of energy than coal energy needs to be encouraged. Countries producing solar panels should export it at subsidized prices to developing countries. India has set the target to produce 1.7lakh

MW of energy from renewable sources, which is a great step forward. Apart from the government steps, market also needs to accommodate climate concerns and supply cheaper and cleaner source of energy

Q.2.What are the challenges of Climate Change for which the Government of India needs to be prepared and what are the steps that you suggest should be taken?

By-Loreen Regnander, Intern at PRIA, University of Victoria

Ans:Rate of change in climatic conditions has increased and unpredictable due to which the capability of the farmers to cope up with climatic stress has also decrease as the traditional methods are failing. The reason for this fail in the traditional methods is because they were designed to tolerate drought in every 10 years earlier now there is drought in every 3-4 years which is failing their coping up mechanisms.We need quick knowledge to cope up with this kind of climatic changes.India has made adaptation plans,and set goals under NAPCC and REDD++ but these are still the small steps to fight the problem which is very huge in its impact and the reason behind this small action is due to the lack of availability of funds for larger activities.



Q.3. What needs to be done at the planning level in the State to balance GDP growth without comprising with the environment development?



By-Shri.Vishal Vasvani, Emergency Officer,UNICEF-Chhattisgarh

Ans:One example of this type of balance is Europe and South Korea. Both were war ridden and witnessed a lot of environment destruction, but after war they have completely changed their development tracks and have done development and environment regeneration parallelly. In South Korea, every hectare of forest and every water body is protected and pollution is declining.

Opportunity needs to be developed to identify the practices where no forest needs to be cut down to produce more food. Environment and economic development is possible together. Earlier increase in GDP rate also meant increase in Energy requirement rates, but now I have seen countries where GDP rate have increased and energy requirement rates have decreased, this decoupling of energy and growth is possible.



Q.4.What are the initiatives an urban dweller can take at individual level to combat climate change?



By-Shri Pravin Kumar Sahu, Research Scholar, Environment Science, Pt. Ravi Shankar University

Ans: Urban dwellers have an important role to play in climatic concerns they can switch to lesser energy consuming devices at their homes like LED bulbs, energy efficient electronic equipment's etc. It will save not only energy but also will reduce the cost of the monthly household energy. Many State Governments in India are promoting LED lights by providing them at subsidised rates and using LED street lights, solar lights etc. In the State of

Karnataka 10 LED bulbs are distributed free of cost to each household, the state government advertised it by a very big film star to encourage use of LED bulb yet only 20% people in Bangalore city could be mobilized for using the bulbs. This is bad, when people are so careless about energy and its cost.

### Images of Lecture Series



Prof. N. H. Ravindranath, IISc Bengaluru delivering the Lecture on Impact of Climate Change on Forest & Biodiversity of Chhattisgarh.



From Left to Right, Speaker:- Dr. Arvind Anil Boaz, PCCF & Head of Forest Force & Nodal Officer, Climate Change, Chhattisgarh. ; Smt Champa Devi Pawle, Parliamentary Secretary, Forest, Law and Legislative Affairs, Chhattisgarh ; Prof. N. H. Ravindranath, IISc Bengaluru.



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For more information, Please contact



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