



Organized jointly by IIT Delhi, IIT Madras and Centre for Science and Environment

# Second National Research Conference on Climate Change Report November 5-6, 2011

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## Chapter 1: Executive Summary

The Second National Research Conference on Climate Change was held at IIT Delhi on November 5-6, 2011. Over 100 people participated at the conference organized by IIT Delhi, IIT Madras and the Centre for Science and Environment. Of the 100-plus participants, 50 presented talks on their ongoing research.

The talks were broadly divided into three categories: climate science/impacts, mitigation and adaptation. The conference saw a range of different kinds of presentations under each category. Papers related to climate science included study of climate parameters, precipitation trends, statistical methods, aerosol-cloud interaction and data assimilation using different methods; papers related to impact of climate change included impact on rainfall and storm surges, extreme weather events and economy, health, agriculture, livelihood, livestock and electricity demand. Those under mitigation covered green energy deployment, low carbon initiatives, production, technology and patents, geo-engineering research, REDD (Reduced Emissions from Deforestation and Degradation), transport sector, power sector and burden sharing. Adaptation saw an equally broad range of presentations—for example, researchers covered livelihoods in rainfed areas and drought-affected areas. Researchers also talked about adaptation from a community's perspective, their vulnerabilities, whether they are capable of adapting to climate change. Presentations were also given on how resilient a city can be in the event of a natural disaster and what could be the policy implications for the changing hydro-climates of India. Mangroves as well as Himalaya eco-system were also discussed in the light of sustainable development.

Apart from running three parallel sessions over two days, there were discussions with government officials. The government officials included a representative each from the Ministry of Earth Sciences, Ministry of Environment and Forests and the Department of Science and Technology. The idea was to get younger scholars to interact with government officials who presented an overview of government's existing programmes to promote climate-related research in the country. K J Ramesh of the Ministry of Earth Sciences talked about the Centre for Climate Change Research in Pune in Maharashtra and that the centre was focused on studying gaps in research areas such as aerosol-cloud interaction, impact of climate change on

monsoon and biogeochemistry of special ecosystems. S Satpathy of the Ministry of Environment and Forests talked about the ministry's programme of studying impact of black carbon in different regions of India, besides making greenhouse gas inventory an annual publication. Akhilesh Gupta of the Department of Science and Technology described the Climate Change Programme, which aimed at building human and institutional capacities in crucial areas of climate change research.

The conference, second in the series of such conferences on climate change, achieved its goals. The idea was to broaden engagement on the climate issue and develop an arena to promote interaction among researchers and climate-related practitioners in the country. The idea also was to gain an understanding of the gaps in research on climate change in the country.

From the discussions during the conference and the initial feedback obtained from participants, the organizers found that younger scholars need mentoring on research methodology and scientific modeling techniques. They also need more of such platforms and more frequent meetings to stay updated on research activities and funding opportunities. Younger scholars said they got a fresh perspective and feedback that would help them better their research significantly.

There are plans to keep the network of scientists alive and expand it as well. It will be done either through a newsletter and/or a website where scientists can meet, share and exchange notes on their research activities. A mentoring plan is also in the works whereby senior scientists can train younger scholars through workshops or seminars. In a nutshell, the future activities will include the following:

**Network Website:** A website that acts as a common platform for researchers to keep the network alive

**Newsletter:** A trimestral newsletter with updates on funding for research, current research and jobs

**Policy brief:** A policy brief on climate change resulting out of inputs from crucial research papers in the country

**Mentoring programme:** Identification of mentors in

different regions in the country and organizing workshops/seminars to benefit younger scholars

**Annual conference:** An annual meet with expanded participation of students and researchers from all over the country

## Chapter 2: Introduction

The Second National Research Conference, organized by Indian Institute of Technology Delhi, Indian Institute of Technology Madras and Centre for Science and Environment, was held at IIT Delhi on November 5-6, 2011. Fifty researchers/scientists from all over the country presented talks on their ongoing research areas. Of the 50 presenters, 17 are among India's top scientists affiliated to reputed research institutions such as the Indian Institute of Science in Bengaluru, Indian Statistical Institute in Delhi and Tata Institute of Social Sciences in Mumbai. The others included PhD students from different universities and institutions such as Delhi University, Jawaharlal Nehru University and Centre for Environmental Planning and Technology in Ahmedabad (For detailed list of presenters with their affiliations see Annexure I).

The talks were broadly divided into three themes: climate science/impacts, mitigation and adaptation, which ran simultaneously in three parallel sessions in the morning and the afternoon over two days. There were 16 presentations on climate science/impacts, 18 presentations on climate change mitigation and 16 presentations in climate change adaptation (For detailed list of presentations see 'Agenda' in Annexure II).

In addition to researchers, the organizers had invited one government official each from the Ministry of Environment and Forests, Ministry of Earth Sciences and Department of Science and Technology. The idea behind inviting ministry officials was to build capacity and, more specifically, to get

officials to interact with younger scholars and discuss government programmes related to climate research and funding opportunities.

The conference was the second in the series of such conferences. The first conference was organized in March 2010.

### 2.1 GOALS OF THE CONFERENCE

The aim of the series of conferences is to enhance capacity for climate research and action in India by:

- a. Developing an arena for promoting interaction among researchers, analysts and practitioners from across the country
- b. Enhancing understanding of the current state of activities and research capabilities in the country and thereby identifying key lacunae
- c. Deepening and broadening engagement on the climate issue with a particular focus on smaller academic institutions, NGOs and younger scholars
- d. Strengthening a sense of 'community' among researchers
- e. Exploring ways to more effectively link climate research and action programmes

## Chapter 3: Sessions in detail

### 3.1 INTRODUCTORY SESSION

The introductory session began with a welcome address by Professor Krishna Achutarao of Indian Institute of Technology (IIT) Delhi. The welcome address was followed by a brief overview of last year's conference. Achutarao reaffirmed the need for such a conference because in India there is no such platform that covers the gamut of aspects under climate change, especially from a research point of view. The platform was not intended for any advocacy purpose, he said. The idea of the conference was to create a cross-pollination of ideas as well as provide a sense of community and opportunity for emerging researchers in the country. The researchers would also benefit from mentoring by senior scientists, Achutarao concluded, as Chandra Bhushan of the Centre for Science and Environment took over from him.

Chandra Bhushan presented an overview of the current state of affairs with respect to climate change negotiations at the global level and what is to be expected of the forthcoming Climate Conference of Parties meeting at Durban in South Africa. He explained the politics surrounding developed world's demand to push for single-track negotiations instead of the two-track negotiation process envisaged in the Bali Action Plan and the consequence of such a demand—end of the Kyoto Protocol.

### 3.2 SCIENCE/IMPACTS OF CLIMATE CHANGE

The sessions on science/impacts of climate change were spread over two days, November 5-6, 2011. There were two sessions each, on both days. Presented below are highlights of the presentations in each of the sessions.

#### 3.2.1 Science/Impacts I

**November 5:** (Morning Session)

SPEAKERS

**S K Dash:** Study of Changes in climate parameters at regional level: Indian Scenarios

**Sharad K Jain:** Climate Change and Hydropower generation

**Shreekant Gupta:** Economic Impact on Climate Change

**Naresh Kumar:** Long term trends of heavy precipitation over northwest Himalayas

**SK Dash:** Dash's work is related to temperature and rainfall regional models. He said temperatures as well as short rainfall events are, in general, increasing in India. Dash and colleagues have done modeling, which indicates that Madurai and Vizag will experience maximum temperature rise in future. He also mentioned that the number of actual working days—strenuous labour and factory work—in Delhi was decreasing as a result of increase in average temperature and that it could translate into loss of economy. Dash also said that IMD has historical data, but it is not available online. Sunita Narain of the Centre for Science and Environment, present at the session, said that more of such data should be made available in the public domain.

**Sharad K Jain:** Jain talked about the risks climate change would pose on hydropower generation. The risks would be

more for run of the river projects because variability in rainfall might affect storage of water, which in turn would affect the demand-supply balance. He suggested larger storage would make it easier to even out seasonal variation. Citing a UK study, Jain said deglaciation flows in many Indian rivers would first increase and then quickly decrease—especially close to the source, while downstream would be affected less by a changing climate. Indus will be most affected, he added. Jain also pointed out another problem that river flow figures are classified.

**Shreekant Gupta:** Gupta talked about the limits of how much we can and should adapt to climate change. He argued that there are some extreme events that we shouldn't prepare for as it would be too expensive to do so. He also argued that climate impact should be studied at a state-level rather than regional level, for example Western

Ghats, since any action is linked to politics and would depend on political will.

**Naresh Kumar:** Kumar has looked at precipitation resulting from western disturbances (weather phenomenon emerging from the Black Sea via western Himalayas). He

said Srinagar experienced higher precipitation than earlier. He pointed out that one of the problems of measuring precipitation was that weather stations were mostly located in cities—far away from places that experienced worse weather conditions.

### 3.22 Science/Impacts II

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**November 5:** (Afternoon session)

SPEAKERS

**Subimal Ghosh:** Finer scale temperature and rainfall projections using statistical downscaling for climate change studies

**Sagnik Dey:** Examination of aerosol-cloud-climate interaction in the India Ocean

**Sampa Das:** Data assimilation using optimal interpolation: Correcting chemical transport model predictions with satellite observations

**WN Paunikar:** The phage-host interaction as a model for studying carbon regulation in aquatic system

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**Subimal Ghosh:** Ghosh discussed how to get results downscaled from climate models into a more finely detailed picture using statistical tools. Downscaling is required for any kind of local intervention including flood planning and drought management, he said. This downscaling is crucial because climate models are rough. Ghosh added that he had found an increased incidence of inequal distribution of rainfall in India—the rainfall pattern differed more and more in different parts of the country.

**Sagnik Dey:** Dey talked about the interaction between aerosols and cloud-formation. In general, aerosols have been found to cause a cooling effect both by reflecting heat and creating cloud cover, counter-acting some of the effects of CO<sub>2</sub> and other greenhouse gases. It is also believed that changes in alteration of cloud active aerosol can alter the precipitation efficiency of clouds.

However, over the Indian subcontinent and the Indian Ocean there is a semi-direct effect of aerosols, where the aerosols, because of their high amounts and large sizes, absorb heat. The heat absorbed by the aerosols dissipates clouds causing a net climate heating effect.

One of the limitations of cloud cover studies, however, is results have not been accurate enough to be able to study the aerosol-cloud interaction. Dey and his team seem to have overcome this shortcoming. Dey said his study included a more accurate method of measuring small cumulus clouds through the use of high-resolution satellite images. With a more accurate idea of cloud-cover, Dey's team has been able to confirm the semi-direct effect that aerosols have on clouds and the amount (and size) of aerosol needed for the semi-direct effect to take place.

**Sampa Das:** Das's talk focused on how to adjust certain models against observed data of aerosols using statistical tools.

**WN Paunikar:** Some of the CO<sub>2</sub> in the atmosphere is bound up in the ocean as carbonic acid. But, how this carbon reacts and how the oceanic carbon cycle works has not been sufficiently studied. Paunikar's in-vitro study shows how a phage (virus) in a certain bacteria can convert organic carbon to inorganic carbon. He showed that with the phage the conversion of the organic carbon into inorganic carbon was higher, than without it.

### 3.23 Science/Impacts III

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**November 6:** Morning Session

SPEAKERS

**AS Unnikrishnan:** Extreme sea-level changes along the east coast of India

**RC Dhiman:** Climate Change and vector borne diseases in India

**Aditi Phansalkar:** Exploring the impacts of climate variability on traditional agricultural practices in the villages of Thar

**RB Sharma:** Changing climate and its impact on productivity of cowpea and bajra in semi-arid regions

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**AS Unnikrishnan:** Mean sea level rise is what gets discussed in the popular climate change discourse; extreme sea level rise events occur mostly in the form of storm surges. Though there are no clear evidences of changes in the frequency of tropical cyclones in several ocean basins, intense events are on the increase in many regions, said Unnikrishnan. The drivers of extreme sea level rise are forced winds, climate variability, tides and an increase in mean sea level rise. Fifty-year return levels of total sea levels using tide gauge data were computed along the east coast for Unnikrishnan's study. If one calculated surges alone along the same coast, this looks different taking into account the geographical variations. Combining both the 20th and 21st century projections shows us that these storm surge events mainly arise from mean sea level rise.

To project into the future, combined effects of mean sea level rise, wind effects and pressure fields were used. The study showed that composite tracks between 1970 and 2000 and projected track for 2071-2100 do not show any significant trends. Whereas, combined effects of mean sea level rise and storminess lead to changes in 100-year return levels and will be to the order of 5-20 per cent along the east coast of India.

**RC Dhiman:** Dhiman's paper looked at the impacts of climate change on vector-borne diseases by studying its projected impact on Transmission Windows of Malaria and Dengue using PRECIS model by 2030. Dhiman found the transmission windows becoming longer in northeastern India and new regions opening for malaria in western Himalayas. At the same time there appeared to be a reduction in transmission in south and southeastern India, he said. But, this may be counter-acted as mosquitoes can adapt by hiding in forests or in homes with ACs or in water tanks when the weather becomes too warm.

Dhiman added that diseases such as Chikungunya and Kala-azar—borne by mosquitoes and sandflies that benefit from warmer climates—have been re-emerging in India since the mid 2000s. The spread of dengue and Japanese encephalitis depends on sanitary standards and access to clean water. The climatic zone for dengue spread already covers most of India. Dhiman also cautioned that certain non-vector borne diseases such as asthma may become more prevalent as cities become hotter—heat and sunlight intermingle with pollution and exacerbate the amount of dangerous ground-level ozone, or smog.

**Aditi Phansalkar:** The study looked at the impacts of climate change on evolving agricultural practices of the Thar Desert, focusing on the districts of Barmer and Jodhpur, and how such mechanisms compound with the existing impacts of climate change. Traditional agricultural practices have been gradually replaced with modern tools such as the tractor and tube wells in the last 20 years driven by the increasing occurrence of droughts, groundwater depletion levels, increase in family size and increasing commercial crop production. What used to be mainly rain fed agriculture was beginning to be supplemented with irrigated agriculture.

Studies show that climate change is one of the main reasons leading to the onset of the western storms pushing the moisture laden monsoon winds away further delaying the onset of the monsoon winds. Such winds were leading to the sown seeds getting blown away. The traditional coping mechanism comprised of either building *baads* or afforestation which now due to the scarcity of the baad species has given way undertaking of resowing or buying food from the market. The study charts the unsustainable practices that using tractors and bore wells could lead to notwithstanding advantages such as increased resilience and social security.

It also charts the application of an intervention called horti pasture initiated by an NGO, which encouraged the planting of local species and provided the villagers with water and pesticides. Post-intervention, it was found that the land condition improved, out migration reduced, better livelihood generation and lower castes depended lesser on upper castes. Hence, the study advocates for combining traditional knowledge systems with climate smart agricultural practices and the introduction of alternative income generating options and collective field management practices.

**RB Sharma:** For studying the impacts of climate change on the productivity of cowpea and bajra, two time periods of 1990-99 and 2000-09 were considered, during which weekly maximum temperature was found to increase and weekly minimum temperature was found to decrease along with a decrease in weekly rainfall days. The increase in weekly maximum temperature led to a decrease in bajra productions and an increase in cowpea production.

## 3.24 Science/Impacts IV

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**November 6:** Afternoon Session

SPEAKERS

**Sarath Guttikunda:** Non-Traditional Sources of Pollution in Indian Cities

**Eshita Gupta:** Global warming and local cooling: Impact of Climate Change on electricity demand of India

**Puneeta Pandey:** Assessing the Summer-time Urban Heat **Island over Delhi:** A case study of micro-level Climate Change

**M Karthik:** Impact of methane emissions from wastewater sector in India through a case study of an effluent treatment plant

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**Sarath Guttikunda:** Guttikunda explained non-traditional sources of emission and their interaction in the atmosphere. A number of India-related case studies were presented, which demonstrated the changes in air pollution parameters due to such non-traditional sources. The study revealed the pollution caused due to high congestion during 2010 Commonwealth Games in Delhi. The PM<sub>2.5</sub> emissions of Delhi and the PM<sub>10</sub> emissions of Chennai were spatially analyzed to recognize the different sources of pollution. The four major non-traditional sources of pollution are brick kilns, high altitude sources, freight movement and domestic sector. Guttikunda suggests strategies to tackle these sources of pollution and also presents the benefits of these strategies in six Indian cities by 2020.

**Eshita Gupta:** Using electricity demand-temperature curves, Gupta has investigated the link between rising global temperatures and electricity demand in India. This analysis, conducted for a number of states, revealed that the temperature corresponding to minimum electricity consumption is decreasing and the cooling demand during summers is increasing rapidly.

**Puneeta Pandey:** The study aims at assessing the formation of Urban Heat Island in Delhi and its relationship with aerosols using remote sensing and GIS.

**M Karthik:** Karthik first discussed the global scenario of methane gas emissions from the wastewater sector. India contributes 19 per cent of the world's total methane emissions from wastewater. Then, the author described the methodologies of how he estimated the amount of methane produced in the city of Nagpur. The methane generation calculated (in kg/day) by the different methodologies showed significant variance. The author concluded that methane gas emissions from wastewater sector are increasing annually with rise in population, urbanization and consumption.

### 3.3 CLIMATE CHANGE MITIGATION

The sessions on climate change mitigation were spread over two days, November 5-6, 2011. There were two sessions each on both the days. Presented below are highlights of the presentations in each of the sessions.

## 3.31: Mitigation I

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SPEAKERS

**E Somanathan:** Learning rates and green energy deployment game

Soumen Maity: Low carbon Initiatives in the Indian Brick Sector

**Soumyananda Dinda:** Production, Technology, Patents and Carbon emission

**Gagan Preet Kaur:** Developing Capacity of stakeholders towards green factories: An action review

**K Ravi Srinivas:** Open Innovation, open source models in the context of technology development

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**E Somanathan:** US, China and Japan have the highest deployment rates with the EU leading the group. Within five years, the EU has increased its PV capacity from 5 GW to 40 GW, also suggestive of the very high learning rate in solar. Owing to the drastic increase in solar PV deployment that has happened internationally in the past few years, the authors developed a model to compute what parameters would give policymakers the edge in bringing down global

solar deployments costs and whether cooperation—and the extent to which it will—impact the reduction in deployment costs. Results of the model showed that solar costs levelled with that of coal in almost the same time period regardless of whether countries cooperated or not. It was found that cooperation between countries did not matter as much as looking forward (jumping in first). Hence, for short-sighted policymakers, some foresight was better than none. A Nash

regime (without cooperation) was good enough but cooperation was better.

**Soumen Maity:** India is the second largest producer of bricks in the world. It produces 170 billion bricks per year and this number is expected to almost double by 2020. The current production contributes 150 million tonnes of greenhouse gas emissions per year, apart from being the largest consumer of agricultural soil. Despite the large numbers, it remains an unorganized and even ignored sector. A rough estimate is it employs 12 million people, seasonally, and has an annual turnover of Rs 460 billion. The industry uses dated technology and there is huge potential for emissions reduction in the sector.

**Soumyananda Dinda:** The study tries to form links between technological and income growth to study the policy implications that such a link might hold for controlling pollution or lowering CO<sub>2</sub> emissions. For this Dinda used income data and the number of patents registered at the US patent and trademark office. The discussion raised questions regarding the use of only design patents as a proxy for the innovating capacity of a country.

**Gagan Preet Kaur:** In evaluating the need and effectiveness of stakeholder participation in the transition to green factories, this study focused on indoor environmental quality among other parameters such as water and material conservation, energy efficiency and site selection. Participants from both the factories were provided training to increase their awareness on issues such as indoor environmental quality and green rating system. Pre- and post-intervention assessments showed the stakeholders' perceptions and knowledge levels were impacted in a positive manner.

**K Ravi Srinivas:** Intellectual Property Rights (IPRs), as used in the top-down technology transfer approach, can lead to protectionism and stifle sharing of knowledge and adapting technology to local conditions. The study looked at means and ways to overcome this by using IP towards encouraging others to contribute and still protect IP, such as non-exclusive licencing. Examples such as biopharmaceutical initiative between 39 organizations, WBCSD eco-patents and Green Exchange were discussed.

### 3.32: Mitigation II

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**November 5:** Afternoon Session

SPEAKERS:

**G Bala:** Should we do geo-engineering research?

**NH Ravindranath:** Climate change and forests as well as implications: REDD

**Ridhima Gupta:** Emissions from agricultural residue burning in north-west India: Causes and the evaluation of a technology-policy response

**Sudheesh Ramapurath Chemmencheri:** REDD+ in India: Social costs of climate mitigation

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**G Bala:** Bala presented his paper on the consideration of geo-engineering research as a technology to deal with climate change issues in case of a planetary urgency. Geo-engineering is defined as the intentional, large scale, manipulation of the climate system and deals with two major schemes: Solar Radiation Management (SRM) and Carbon Dioxide Removal (CDR). He stressed, however, that prevention—reduction in early emissions—rather than cure should be the approach.

**NH Ravindranath:** Ravindranath highlighted the fact that deforestation contributes largely to CO<sub>2</sub> emissions and discussed the Greening India Mission and its objectives. He concluded that there is a limitation of data on area, biomass and carbon stock.

**Ridhima Gupta:** Burning of crop residues is a major source of generation of black carbon, the second-highest

contributor of global warming after CO<sub>2</sub>. At high elevations, black carbon accelerates melting of glaciers and contributes to the formation of atmospheric brown clouds that negatively impact rice yields. A viable alternative is to encourage development of machines that allow farmers to plant wheat into the loose rice residue. This is the recently developed Happy Seeder technology that performs this function. It is a tractor mounted machine that can sow wheat into the rice residues left by the combine harvester thereby precluding its burning. Charles Stuart University, NSW Department of Primary Industries, International Rice Research Institute and the Punjab Agricultural University have developed the technology. Gupta and team found that Happy Seeder technology was a viable alternative to open-field burning of rice residue in Punjab and that it was a cheaper alternative to conventional tillage. Compared to plots that were conventionally tilled, Happy Seeder technology users saved about Rs 1000-Rs 1060 (\$23) on

average in field preparation costs.

**Sudheesh Ramapurath Chemmencheri:**

Chemmencheri's presentation focused primarily on the legal policies and issues that exist in India pertaining to the

society in the context of climate change. He presented a detailed background of the origin of REDD and REDD+ and discussed how to work towards sustainable management of forests by enhancing carbon sinks, afforestation and revival of degraded forestland.

### 3.33: Mitigation III

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**November 6:** Morning Session

SPEAKERS

**Dinesh Mohan:** Moving in slow cities for survival

**Geetam Tiwari:** Low carbon mobility plans for Indian cities

**Deepak Singh:** Simulating the changing electrical consumption patterns and rebound effects: A foresight scenario for 2050

**Parul Gupta:** Tracking the anthropogenic drivers of carbon dioxide emissions

**Pankaj Sadavarte:** Climate footprint of selected Indian emission sectors

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**Dinesh Mohan:** Mohan's study discussed the need to have a negative feedback mechanism system to achieve sustainable urban transportation. He said that the current economic philosophies in urban transport systems violate the fundamental principle of achieving stability. Moreover most transportation policies have positive feedback systems embedded in them. Mohan showed the relationship between private transport energy use per capita and urban density of people/ha in major cities of the world. As the urban density decreases the private transport energy use per capita increases. Mohan also presented the life cycle emissions of rail and road modes. The study also estimated CO<sub>2</sub> emissions per passenger in Delhi Metro and Delhi bus. The CO<sub>2</sub> emission per passenger for Delhi Metro is more than double than that of Delhi Bus. Mohan also presented the pros and cons of solutions that have been used in cities of high-income countries.

**Geetam Tiwari (Her research assistant Deepty Jain presented the paper):** To restrain the rising CO<sub>2</sub> emissions levels in cities, public transport system and infrastructure to promote non-motorized transport need to be improved. The study showed the modal share in six different cities in India. The study developed three scenarios

to assess the impact of bus infrastructure and non-motorized infrastructure on CO<sub>2</sub> emission. Jain showed that improving non-motorized infrastructure and bus infrastructure was required to reduce emissions from mega and large cities.

**Deepak Singh:** Singh explained the concept of rebound effect and its relationship with electrical consumption pattern.

**Parul Gupta:** For the analysis, Gupta categorized states on the basis of emission and income. Using IPAT identity procedure, she found income to be the primary driver of emissions for most states. Gupta concluded that emissions in the future are expected to be high and highlighted the importance of environmental federalism.

**Pankaj Sadavarte:** The objective of Sadavarte's study was to calculate emissions from four different industrial sectors: thermal power plant, transport, brick kiln and open burning in agriculture. Sadavarte concluded that while there are rules to keep tabs on the thermal power plant sector, it was time the focus moved to transport as well as agriculture to achieve any emissions reduction.

### 3.34: Mitigation IV

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**November 6:** Afternoon Session

SPEAKERS

**Surender Kumar:** Carbon sensitive productive growth

**T Jayaraman:** A paradigm for equitable access to sustainable development

**Anubhab Pattanayak:** Climate change burden sharing: A reappraisal of the equity debate

**Pradeep Gautam:** Climate change, environmental security and regional cooperation

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**Surender Kumar:** Kumar linked factors of productivity, innovation, CO<sub>2</sub> mitigation and a host of other factors in a multi-country study through a statistical regression analysis. He found that mitigation is cheaper (although still highly expensive) for developing countries than developed ones. But growth is impacted more in developing countries compared to developed countries. He reiterated the existing divergence between developing and developed countries in terms of growth.

**T Jayaraman:** Jayaraman talked about carbon budget and considering historical emissions, the Annex I countries should get no carbon space at all. He, however, cited a possible division for emitting carbon for the 2010-2050 period. Of 371 gigatonne of carbon (GTC) emitted by 2050, Annex I countries could emit 50 GTC and the non-Annex I countries could emit the remaining.

**Anubhab Pattanayak:** Pattanayak showed calculations on how to share the climate mitigation burden, which includes the principle of victim compensation while computing the cost of the burden. Other factors such as loss in agricultural production and per capita idea of burden

sharing should be followed, he said. In a multi-country study grouping countries after income, population, emissions and the impact climate change would have on the country, he showed how different calculations yielded different results and which was most appropriate to compensate countries where emissions and income is low and impact of climate change would be high. He stressed that while developing countries should focus on green innovation, they should not be pressured with the mitigation burden.

**Pradeep Gautam:** Gautam lobbied for more regional thinking on climate change. He stressed that more basic research and sharing of data is needed in South Asia. He also talked about climate refugees and how it can affect relations in South Asia.

### 3.4 CLIMATE CHANGE ADAPTATION

The sessions on climate change mitigation were spread over two days, November 5-6, 2011. There was one sessions on November 5 and two sessions on November 6. Presented below are highlights of the presentations in each of the sessions.

#### 3.4.1 Adaptation I

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**November 5:** Morning Session

SPEAKERS

**Arivudai Nambi:** Community based adaptation

**H Pathak:** Efficient nitrogen management for climate change mitigation and adaptation in agriculture

**Hita Unnikrishnan:** Rural-urban transition and vulnerabilities to climate change: A case study of a village in Bengaluru city

**Bhaskar Padigala:** Social capital and local institutions: A perspective to assess communities' adaptation potential to climate change

**Rajeev Ranjan:** The value of natural resource management in adaptation and building resilience to climate change

**Architesh Panda:** Adaptation to climate variability and change among small and marginal farmers in Odisha

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**Arivudai Nambi:** Nambi approached adaptation to climate change from a community's point of view saying it is the grassroots component of climate change adaptation and that community's knowledge is fundamental for developing adaptation strategies. Nambi also pointed out the priority areas for research with respect to climate change adaptation.

**H Pathak:** Pathak explained how nitrogen from the agriculture sector needs better attention and management by exploring linkages between fertilizer use, food production and nitrogen emission.

**Hita Unnikrishnan:** Unnikrishnan's research site was Parappana Agrahara village, looking at land use change,

current impacts of climate change faced by the village and urban transition and climate vulnerability.

**Bhaskar Padigala:** Padigala talked about how to assess communities' adaptation potential in Miyar watershed in the northeastern part of Lahaul and Spiti districts of Himachal Pradesh.

**Rajeev Ranjan:** Ranjan talked about the value of natural resource management in adaptation and building resilience to climate change with a case study based in Jharkhand. His site was in Bero block of Ranchi and he looked at drought management from the perspective of climate change adaptation.

**Architesh Panda:** Variations in monsoonal rains and little institutional support towards adaptation have put farmers of Bolangir and Nuapada districts in Odisha in a tizzy. Even the autonomous adaptation, something that the farmers could have carried out on their own were no longer possible as the traditional varieties of paddy which the farmers used

during drought or water-stressed seasons were all lost because they were no longer in cultivation. The distribution of rains has also changed and higher losses were reported from such crop damages, Panda found from his survey on over a hundred farmers households to map their personal level adaptation strategies.

### 3.42 Adaptation II

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**November 6:** Morning Session

SPEAKERS

**Ramasamy Krishnamurthy:** Applying a climate disaster resilience index to enhance planning decisions in Chennai

**Upasna Sharma:** The role of education in enhancing adaptive capacity to climate risk: Empirical evidence from coastal zones in India

**Sakshi Saini:** Communication for development enabled approaches for climate change adaptation and mitigation: A case study of urban poor women

**Sujit Kumar Mishra:** Adaptation and sustainable livelihoods: Policy implications in the challenging hydro-climates of India

**PK Viswanathan:** Development of restoration of mangrove ecosystems in the context of emerging climate risks: Interventionist policies and outcomes in India

**Arijit Das:** Collective action in mid-Himalayan region for sustainable development

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**Ramasamy Krishnamurthy:** Krishnamurthy talked about Chennai in the light of urban disaster risks. Increase in population density, social conflict, urban infrastructure and deteriorating infrastructure have put the city at a high risk of climate disaster. His study developed a methodology to assess the climate disaster resilience index, which included a 5\*5 matrix having five parameters and five different variables for every parameter. The study found areas with higher economic development, lower population density and better environmental condition had higher resilience levels. Low values of resilience were found for old and densely populated areas.

**Upasna Sharma:** Sharma's paper brought out that education reduces the impacts one faces during natural disasters. The study was conducted in the cyclone-affected states of Tamil Nadu and Andhra Pradesh and the events administered for research included cyclonic events in 2005 and 2006 in Krishna, Nagapattinam and Guntur districts.

**Sujit Kumar Mishra:** The main objectives of Mishra's study were to study different adaptation options to drought in Orissa and Andhra Pradesh. The study analyzed the capability of poor rural households to adapt with the changing pattern of livelihood and the key factors that determine difference in outcome.

**Sakshi Saini:** Women impacted by poverty are more severely affected by climate change, Saini said. By 2025, more than 50 per cent of the population in developing countries would inhabit cities and the urban poor, especially women, would face the brunt of climate change. The study covered 300 households in Delhi. She found that Communication for Development integrates the use of communication strategies, media and processes to enable people and institutions to share knowledge and information and reach consensus towards common action. A communication module based on AIDA (Attention, Interest, Desire and Action) was developed for urban poor women.

**PK Viswanathan:** Viswanathan studied mangroves, their benefits and how their absence would affect livelihoods. He also talked about the mangrove restoration in Gujarat and about climate change issues, challenges, policies and institutional imperatives.

**Arijit Das:** Das worked on developing an econometric model and emphasized the four major areas that influence successful collective action. They are resource characteristics, group characteristics, relations between resource and users and institutional organization and external environment.

### 3.43 Adaptation III

**November 6:** Afternoon Session

SPEAKERS

**Jagriti Kher:** Climate Change and water vulnerability at the household level in India

**Mrutyunjay Swain:** Drought, vulnerability, coping capacity and residual risk: Evidence from Bolangir district in western Odisha

**Asmita Bharadwaj:** Livelihoods in rainfed areas and the challenge of climate adaptation

**Sujata Majumdar:** Does adaptation provide positive effects at the farm level?

**Jagriti Kher:** Given that climate change will have significant impacts on the availability and access of water in the future, it was noted that the current HDI/HPI assess overall development but do not capture water-related poverty problems. A climate vulnerability index was developed, the different components for which used water-related impacts as the basis.

**Mrutyunjay Swain:** Swain's study assesses the impacts of climate change and repeated drought occurrence in Bolangir district. It also analyzes the vulnerability based on socioeconomic and biophysical conditions. For this, it uses a multi-stage sampling method selecting from blocks, households, villages and households to represent the necessary spatial cross section. It also develops indicators such as drought vulnerability index and drought adaptability index. Based on different index scores, small farmers were found to be among the most vulnerable while large farmers, the least. Also, marginal farmers would be the most challenged in adapting whereas service holders were most likely to adapt to drought conditions. The one recurrent cause of vulnerability across the different study blocks and livelihood groups was the lower crop insurance coverage. Some of the other reasons included high poverty levels, high level of illiteracy and higher level of unirrigated land. The analysis revealed that while the drought risk level varies widely across the blocks and the extent of drought vulnerability and physical exposure to drought varies moderately, the coping capacity of different blocks vary marginally. Some of the concluding policy measures identified were increase in irrigation coverage, increase in groundwater usage by providing better electricity access to farmers, increasing crop insurance coverage and occupational diversification.

**Asmita Bharadwaj:** Bharadwaj presented a brief overview of various challenges faced in rainfed agriculture and adaptation strategies involving methods such as crop rotation, mixed cropping patterns and change in crop duration.

**Sujata Majumdar:** Majumdar studied the cost of cultivation practices before and after adaptation in two

villages in the state of West Bengal. She measured them using farm business income, family labour income and net income.

### 3.5 GOVERNMENT OFFICIALS' SESSION

The government officials' session comprised three talks. The officials invited were KJ Ramesh of the Ministry of Earth Sciences, Akhilesh Gupta of the Department of Science and Technology and S Satpathy of the Ministry of Environment and Forests. They all discussed various initiatives respective ministries have taken to support research activities in the arena of climate change. Following are the highlights from their talk:

**K J Ramesh:** Ramesh mentioned the ministry had set up the *Centre for Climate Change Research* in Pune. He emphasized that the research focus was on gap areas like aerosol interaction, impact on monsoon and biogeochemistry of special ecosystems.

**S Satpathy:** Satpathy talked about the report, *India's Greenhouse Gas Emissions 2007*, released in 2010. Prior to this, the only official greenhouse gas emission estimates were available for the year 1994. He mentioned that the ministry is keen on making it an annual publication. He also discussed the new programme meant to assess the impacts of black carbon in different regions of India. In this regard, the environment ministry has collaborated with other ministries, research organisations and academic institutes.

**Akhilesh Gupta:** Gupta described the Climate Change Programme (CCP), which is aimed at building human and institutional capacities in the thrust areas of climate change research. This capacity building programme has three broad categories-Creation of New Centres of Excellence on Climate Change, Strengthening of existing institutions, and Major Human Capacity Building Programmes on climate change. He mentioned that the CCP has included all the broad areas of research on climate change. DST has identified top 30 institutions in the country, which are working on climate and climate change related aspects. These were invited to submit proposals for project support

from DST. Twenty-nine proposals from 21 institutions were received. These proposals went through a rigorous selection process and finally 11 projects were selected for project support. IIT Bombay and ICRIASAT Hyderabad have been selected to become centres of excellence. Gupta also discussed a few problems that the CCP was facing. He said scientists are not keen on working together for the same research category and also that DST is getting similar project proposals from different departments of the same institute.

### 3.6 CONCLUDING SESSION

The organizers—Sunita Narain of CSE, Ambuj Sagar of IIT Delhi and Sudhir Chella Rajan of IIT Madras—presided over the concluding session. They discussed plans and future possibilities and asked suggestions of participants on how

to keep the scientists network active so that there is constant learning and knowledge sharing between researchers. Emphasizing that science and research would remain at the centrestage of a future conference and the network, Narain said there is an increasing need to understand climate science better. Besides, it was important to build capacity especially among younger scholars, said Sagar of IIT Delhi. "In future, the conference would be more comprehensive in covering research areas. We have felt the need to expand our reach and we will involve more students," said Sagar. Welcoming the ministries' initiatives towards promoting climate change research, Rajan of IIT Madras recommended engaging senior scientists and experts to mentor younger scholars. The areas of research methods and climate modelling need special attention and workshops could be organized as a part of the mentoring process, researchers suggested.



2<sup>ND</sup> NATIONAL  
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2011

## Chapter 4: Conclusion

The Second National Research Conference on Climate Change, organized by Centre for Science and Environment, IIT Delhi and IIT Madras, achieved its objectives. The conference helped promote interaction among researchers, analysts and practitioners of climate change research. Along with the senior scientists present at the conference, the moderators for sessions—Ambuj Sagar of IIT Delhi, Sunita Narain of CSE, Sudhir Chella Rajan of IIT Madras, Krishna Achutarao of IIT Delhi and Chandra Bhushan of CSE—interacted with and guided younger scholars on how to take their research forward and facilitated interesting discussions with other participants during the conference. Because of the conference—and the abstracts researchers sent, which went through a rigorous selection process—there was an enhanced understanding of the existing research capabilities and certain gaps could be identified. Among the issues that came to the forefront were more emphasis (guidance) is needed on research methods and scientific modeling techniques. Different avenues were discussed to strengthen the sense of 'community' among researchers.

The organizers are currently exploring possibilities of a website dedicated to the researchers' network and/or a newsletter that will keep researchers regularly informed about research and funding opportunities and ongoing research in the country, besides hosting another conference next year. The organizers are also planning to select the interesting papers and publishing it.

Most participants said they gained a lot of exposure as a result of attending the conference. They said they got valuable feedback on their research and they now have a range of new research papers to read so that they can stay

updated. A few participants suggested workshops/seminars should be organized in cities so that researchers can meet and discuss each other's work.

Emails have been sent to all the participants for their feedback on the conference and suggestions on networking activities.

Overall, the conference met its objectives and helped gain clarity on what to do next to keep the researchers' network alive and to promote research on climate change in the country.

In a nutshell, the following measures would be undertaken to ensure a network is created and maintained so that researchers can continue to benefit from each other:

**Network Website:** A website that acts as a common platform for researchers to keep the network alive

**Newsletter:** A trimestral newsletter with updates on funding for research, current research and jobs

**Policy brief:** A policy brief on climate change resulting out of inputs from crucial research papers in the country

**Mentoring programme:** Identification of mentors in different regions in the country and organizing workshops/seminars to benefit younger scholars

**Annual conference:** An annual meet with expanded participation of students and researchers from all over the country

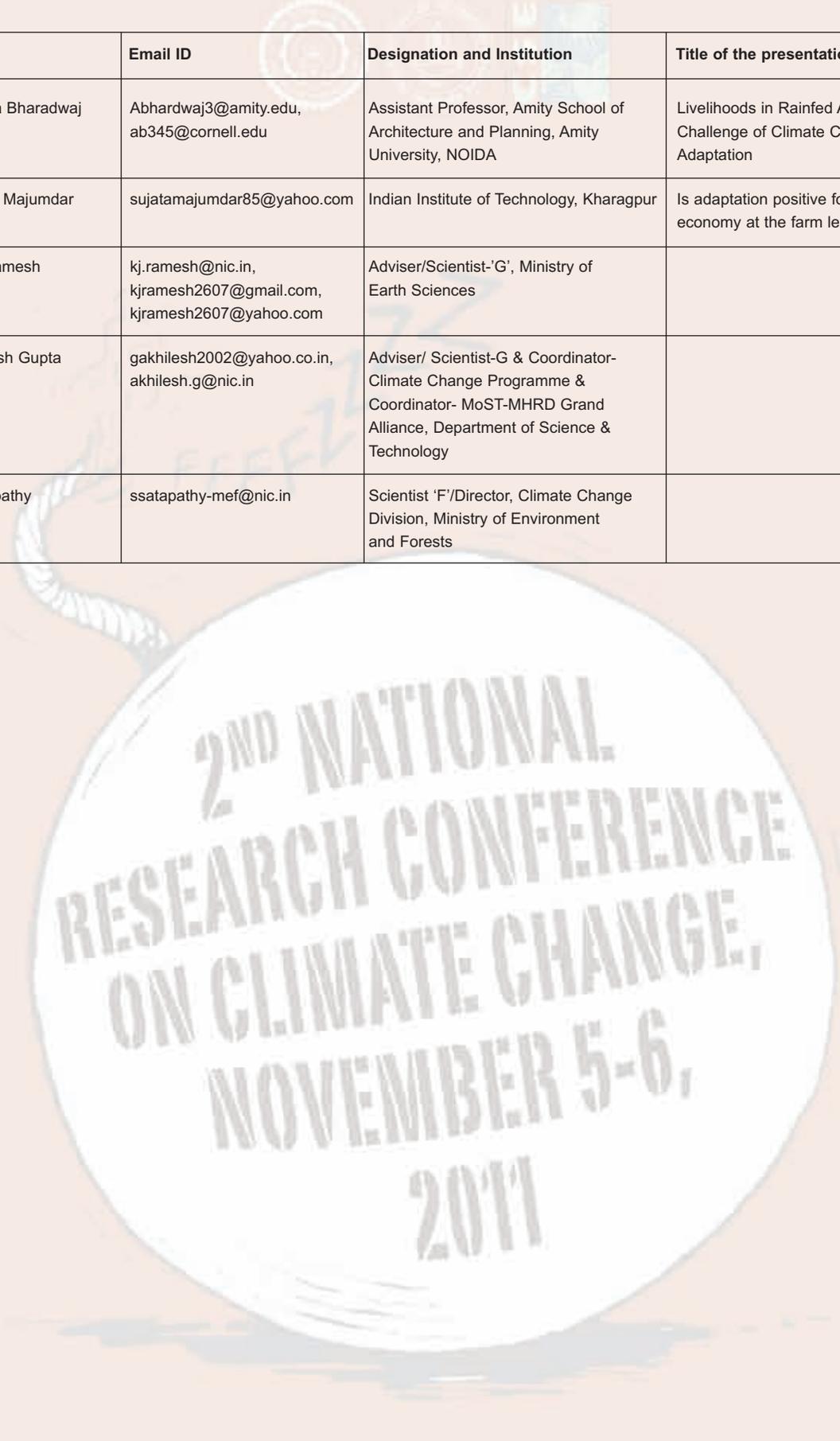
## Annexure I

Name	Email ID	Designation and Institution	Title of the presentation
S K Dash	skdash@cas.iitd.ac.in	Professor and Head, Centre for Atmospheric Science, IIT Delhi	Study of changes in climate parameters at regional level: Indian scenarios
Sharad K Jain	jainsftw@iitr.ernet.in	Professor (Neepco Chair), Department of Water Resources Development and Management, IIT Roorkee	Climate change and hydropower generation
Shreekant Gupta	sgupta@nus.edu.sg	Professor, Department of Economics, Delhi School of Economics	Economic Impacts of Climate Change
Naresh Kumar	naresh.nhac@gmail.com	Meteorologist (Himalayan Meteorology Cell), National Weather Forecasting Centre, India Meteorological Department	Long-term trends of heavy precipitation over northwest Himalayas
Eswaran Somanathan	som@isid.ac.in	Planning Unit, Indian Statistical Institute, Delhi	Learning rates and the green energy deployment game
Soumen Maity	smaity@devalt.org	Team Leader - Technology Transfer & Management, TARA and Programme Director, Development Alternatives	Low carbon initiatives in the Indian brick sector
Soumyananda Dinda	sdinda2000@yahoo.co.in	Associate Professor, Department of Economics, Chandragupt Institute of Management Patna	Production, technology, patents and carbon emission
Gagan Preet Kaur	gaganpreet66@gmail.com	Research Scholar, Dept. of Resource Management and Design Application, Lady Irwin College, University Of Delhi	Developing capacity of stakeholders towards green factories: An action review
K Ravi Srinivas	Krsriniv@gmail.com	Associate Fellow & Managing Editor: Asian Biotechnology & Development Review RIS - Research & Information System For Developing Countries	Open innovation, open source models in the context of technology deployment and transfer in adaptation and mitigation strategies for climate change
A Nambi	arnambi@yahoo.com	Project Director [Climate Change] MS Swaminathan Research Foundation	Community based adaptation
H Pathak	him_ensc@iari.res.in	Senior Scientist, IARI	Efficient nitrogen management for climate change mitigation and adaptation in agriculture
Hita Unnikrishnan	hita.unnikrishnan@atree.org	PHD Student, ATREE, Bengaluru	Rural urban transition and vulnerabilities to climate change— A case study of a village in Bengaluru
Bhaskar Padigala	padigala.bhaskar@gmail.com	Student, Faculty of Sustainable Environment and Climate Change, Center for Environmental Planning and Technology	Social capital and local institutions: A perspective to assess communities' adaptation potential to climate change
Rajeev Ranjan	raj.ranjan4u@gmail.com	Programme Officer Lohardaga Gram Swarajya Sansthan, Lohardaga, Jharkhand	The value of natural resource management in adaptation and building resilience to climate change

Name	Email ID	Designation and Institution	Title of the presentation
Architesh Panda	architesh@gmail.com	PhD student, Institute for Social and Economic Change, Bangalore	Adaptation to climate variability and change among small and marginal farmers in Orissa, India
Subimal Ghosh	subimal.ghosh@gmail.com	IIT Bombay	Finer scale temperature and rainfall projections using statistical downscaling for climate change studies
Sagnik Dey	sagnik@cas.iitd.ac.in	IIT, Delhi	Examination of Aerosol-Cloud-Climate Interaction in the Indian Ocean
Sampa Das	sampa.iitb@gmail.com	IIT Bombay	Data assimilation using optimal interpolation: Correcting chemical transport model predictions with satellite observations
WN Paunikar	wn_paunikar@neeri.res.in	Principal Scientist, Applied Aquatic Ecosystem Division, National Environmental Engineering Research Institute	The phage-host interaction as a model for studying carbon regulation in aquatic system
G Bala	gbala@caos.iisc.ernet.in	IISc Bengaluru	Should we do geoengineering research?
NH Ravindranath	ravi@ces.iisc.ernet.in	IISc Bengaluru	Climate change and Forests as well as implications REDD
Ridhima Gupta	rydhma7p@isid.ac.in	Planning Unit, Indian Statistical Institute, Delhi	Emissions from Agricultural Residue Burning in North-west India: Causes and the Evaluation of a Technology Policy Response
Sudheesh Ramapurath Chemmencheri	rsudheesh@gmail.com	Final year student, Integrated Master of Arts in Development Studies	REDD+ in India: Social Costs of Climate Mitigation
AS Unnikrishnan	unni@nio.org	National Institute of Oceanography, Goa	Extreme sea level changes along the east coast of India
RC Dhiman	r.c.dhiman@gmail.com	National Institute of Malaria Research	climate change and vector borne diseases in India
Aditi Phansalkar	araditiphansalkar@gmail.com	B.Arch. M.Tech (Climate change and Sustainable Development), Center for Environmental Planning and Technology, (CEPT), Ahmedabad.	Exploring the Impacts of Climate Variability on Traditional Agricultural Practices in the villages of THAR
Suresh Sharma	scsharma@scientist.com	Senior Scientist, CSWRI Avikanagar (Rajasthan)	Changing climate and its impact on productivity of cowpea and bajra in semi-arid region
Dinesh Mohan	dmohan@cbme.iitd.ac.in	IIT-D	Moving in slow cities for survival
Geetam Tiwari	geetam@gmail.com	IIT-D	Low Carbon Mobility Plans for Indian Cities
Deepak Singh	deepaksinghconvent@gmail.com	Research Scholar, Centre for the Studies in Science Policy, Jawaharlal Nehru University,	Simulating the Changing Electrical Consumption Patterns and Rebound Effect: A Foresight Scenario for 2050
Parul Gupta	parul.gupta@teri.res.in	Research Associate, Centre for Global Environment Research,TERI	Tracking the Anthropogenic Drivers of CO <sub>2</sub> Emissions Growth in India: A State Level Analysis
Pankaj Sadavarte	pankaj.sadavarte@gmail.com	IIT Bombay	Climate footprint of selected Indian emission sectors

Name	Email ID	Designation and Institution	Title of the presentation
Upasna Sharma	upasna.sharma@gmail.com	Post-doc Research Scholar, International Institute of Applied Systems Analysis (IIASA), Schlossplatz 1, A-2361, Laxenburg, Austria	The role of education in enhancing adaptive capacity to climate risk: empirical evidence from coastal zones in India
Sakshi Saini	aatishkaa@gmail.com	PhD Scholar, University of Delhi, Dept. of Development Communication and Extension	Communication for Development (C4D) enabled approaches for Climate Change adaptation and mitigation: a case study of urban poor women
Ramasamy Krishnamurthy	rrkrishnamurthy@gmail.com	Principal [on deputation], University of Madras Arts and Science College	Applying a climate disaster resilience index to enhance planning decisions in Chennai
Sujit Kumar Mishra	sujitkumar72@gmail.com	Assistant Professor, Council for Social Development	Adaptation and Sustainable Livelihoods: Policy Implications in the Challenging Hydro-climates of India
PK Viswanathan	pkviswam@gmail.com	Associate Professor, Gujarat Institute of Development Research, Ahmedabad	Development and Restoration of Mangrove Ecosystems in the Context of Emerging Climate Change Risks: Interventionist Policies and Outcomes in India
Arijit Das	arijitdas22@gmail.com	Ph.d Scholar, Center for Economic Studies and Planning, Jawaharlal Nehru University	Collective action in mid-Himalayan region for sustainable ecosystem
Sarath Guttikunda	sguttikunda@gmail.com	Urban Emissions Info	Non-Traditional Sources of Pollution in Indian Cities
Eshita Gupta	eshita8r@isid.ac.in	Indian Statistical Institute, Delhi	Global Warming and Local Cooling: The impact of climate change on electricity demand in India
Puneeta Pandey	puneetapandey@gmail.com	Assistant Professor, Centre for Env Sciences & Technology, School of Env & Earth Sciences, Central University of Punjab	Assessing the Summer-time Urban Heat Island over Delhi: A case study of micro-level Climate Change
M Karthik	m_karthik@neeri.res.in	Wastewater Technology Division, National Environmental Engineering Research Institute	Impact of methane emissions from wastewater sector in India through a case study of an effluent treatment plant
Surender Kumar	surender672@gmail.com	University of Delhi	Carbon Sensitive Productivity Growth
T Jayaraman	tjayaraman@tiss.edu	TISS	A paradigm for equitable access to sustainable development
Anubhab Pattanayak	anubhab.pattanayak@gmail.com	Madras School of Economics,	Climate Change Burden Sharing: A Reappraisal of The Equity Debate
Pradeep Gautam	pkgautam2003@yahoo.co.in	Research Fellow, Institute for Defence Studies and Analyses, New Delhi	Climate Change, Environmental Security and Regional Cooperation
Jagriti Kher	jagriti28@gmail.com	Ph.D Scholar, University of Delhi	Climate change and Water Vulnerability at the Household level in India
Mrutyunjay Swain	mrutyunjay77@gmail.com	Research Officer, Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar - 388120, Gujarat	Drought Vulnerability, Coping Capacity and Residual Risk: Evidence from Bolangir District in Western Orissa, India

Name	Email ID	Designation and Institution	Title of the presentation
Asmita Bharadwaj	Abhardwaj3@amity.edu, ab345@cornell.edu	Assistant Professor, Amity School of Architecture and Planning, Amity University, NOIDA	Livelihoods in Rainfed Areas and the Challenge of Climate Change Adaptation
Sujata Majumdar	sujatamajumdar85@yahoo.com	Indian Institute of Technology, Kharagpur	Is adaptation positive for rural economy at the farm level?
K J Ramesh	kj.ramesh@nic.in, kjramesh2607@gmail.com, kjramesh2607@yahoo.com	Adviser/Scientist-'G', Ministry of Earth Sciences	
Akhilesh Gupta	gakhilesh2002@yahoo.co.in, akhilesh.g@nic.in	Adviser/ Scientist-G & Coordinator- Climate Change Programme & Coordinator- MoST-MHRD Grand Alliance, Department of Science & Technology	
S Satpathy	ssatpathy-mef@nic.in	Scientist 'F'/Director, Climate Change Division, Ministry of Environment and Forests	



**2<sup>ND</sup> NATIONAL  
RESEARCH CONFERENCE  
ON CLIMATE CHANGE,  
NOVEMBER 5-6,  
2011**

# Annexure II



Organized jointly by IIT Delhi, IIT Madras and Centre for Science and Environment

## National Research Conference on Climate Change Indian Institute of Technology Delhi November 5-6, 2011

### DETAILED PROGRAMME

#### DAY 1: NOVEMBER 5, 2011

REGISTRATION (VENUE: V LT I) - 08.00 to 09.00

TEA (VENUE: V LT I) - 09.00 to 09.15

INTRODUCTION (VENUE: V LT I)

Dr. Krishna Achutarao, IITD — 09:15 to 09:30

Chandra Bhushan, CSE — 9.30 to 09.45

#### SESSION I - 10:00 to 13:00

SCIENCE & IMPACTS (VENUE: II LT 2)

Moderator: Chandra Bhushan

S K Dash	Study of changes in climate parameters at regional level: Indian scenarios	10.00 to 10.30
Sharad K Jain	Climate Change and hydropower generation	10.30 to 11.00
Shreekanth Gupta	Economic Impacts of Climate Change	11.00 to 11.30
Akram Javed	Impact of climate change on watershed levels in Rajasthan	11.30 to 12.00
Naresh Kumar	Long-term trends of heavy precipitation over northwest Himalayas	12.00 to 12.30

MITIGATION (VENUE: III LT I)

Moderator: Ambuj Sagar

Eswaran Somanathan	Learning rates and the green energy deployment game	10:00 to 10:30
Soumen Maity	Low carbon initiatives in the Indian brick sector	10.30 to 11.00
Soumyananda Dinda	Production, technology, patents and carbon emission	11.00 to 11.30
Gagan Preet Kaur	Developing capacity of stakeholders towards green factories: An action review	11.30 to 12.00
K Ravi Srinivas	Open innovation, open source models in the context of technology development and transfer in adaptation and mitigation strategies for climate change	12.00 to 12.30

ADAPTATION (VENUE: III LT 2)

Moderator: Krishna Achutarao

Arivudai Nambi	Community based adaptation	10:00 to 10:30
H Pathak	Efficient nitrogen management for climate change mitigation and adaptation in agriculture	10.30 to 11.00
Hita Unnikrishnan	Rural-urban transition and vulnerabilities to climate change: A case study of a village in Bengaluru city	11.00 to 11.30
Bhaskar Padigala	Social capital and local institutions: A perspective to assess communities' adaptation potential to climate change	11.30 to 12.00

<b>Rajeev Ranjan</b>	The value of natural resource management in adaptation and building resilience to climate change	12.00 to 12.30
<b>Architesh Panda</b>	Adaptation to climate variability and change among small and marginal farmers in Odisha	12.30 to 13.00

LUNCH (VENUE: THE PAVILION, IIT SPORTS GROUND) - 13.00 to 14.30

### SESSION II - 14.30 to 16.30

SCIENCE & IMPACTS (Venue: III LT I)

Moderator: Sudhir Chella Rajan

<b>Subimal Ghosh</b>	Finer scale temperature and rainfall projections using statistical downscaling for climate change studies	14.30 to 15.00
<b>Sagnik Dey</b>	Examination of aerosol-cloud-climate interaction in the Indian Ocean	15.00 to 15.30
<b>Sampa Das</b>	Data assimilation using optimal interpolation: Correcting chemical transport model predictions with satellite observations	15.30 to 16.00
<b>W N Paunikar</b>	The phage-host interaction as a model for studying carbon regulation in aquatic system	16.00 to 16.30

MITIGATION (VENUE: III LT 2)

Moderator: Sunita Narain

<b>Govindaswamy Bala</b>	Should we do geo-engineering research?	14.30 to 15.00
<b>N H Ravindranath</b>	Climate change and forests as well as implications: REDD	15.00 to 15.30
<b>Ridhima Gupta</b>	Emissions from agricultural residue burning in north-west India: Causes and the evaluation of a technology-policy response	15.30 to 16.00
<b>Sudheesh Ramapurath Chemmencheri</b>	REDD+ in India: Social costs of climate mitigation	16.00 to 16.30

TEA (VENUE: II LT 2) - 16.30 to 16.45

### SESSION III - 16.45 to 18.00

RESEARCH FUNDING OPPORTUNITIES (VENUE: II LT 2)

Moderator: Ambuj Sagar

**K J Ramesh, Ministry of Earth Sciences**  
**Akhilesh Gupta, Department of Science and Technology**  
**S.Satpathy, Ministry of Environment and Forests**

DINNER (Venue: SILVER OAK LAWNS, INDIA HABITAT CENTRE) - 19.00 onwards

## DAY II: NOVEMBER 6, 2011

### SESSION I - 09.30 to 12.30

SCIENCE & IMPACTS (VENUE: II LT I)

Moderator: Sudhir Chella Rajan

<b>A S Unnikrishnan</b>	Extreme sea-level changes along the east coast of India	09.30 to 10.00
<b>R C Dhiman</b>	Climate change and vector borne diseases in India	10.00 to 10.30
<b>Aditi Phansalkar</b>	Exploring the impacts of climate variability on traditional agricultural practices in the villages of Thar	10.30 to 11.00
<b>Ramesh Upadhyay</b>	Climate change and long-term impacts on livestock in India	11.00 to 11.30
<b>Gaurav Arya</b>	Impact of climate change on food security and cereal production in India	11.30 to 12.00
<b>Suresh Sharma</b>	Changing climate and its impact on productivity of cowpea and bajra in semi-arid regions	12.00 to 12.30

**MITIGATION (VENUE: II LT 2)****Moderator: Ambuj Sagar**

<b>Dinesh Mohan</b>	Moving in slow cities for survival	09.30 to 10.00
<b>Geetam Tiwari</b>	Low carbon mobility plans for Indian cities	10.00 to 10.30
<b>B Sengupta</b>	Status of fine particulate matter/black carbon management in India with special reference to climate change	10.30 to 11.00
<b>Deepak Singh</b>	Simulating the changing electrical consumption patterns and rebound effects: A foresight scenario for 2050	11.00 to 11.30
<b>Parul Gupta</b>	Tracking the anthropogenic drivers of carbon dioxide emissions growth in India: A state-level analysis	11.30 to 12.00
<b>Pankaj Sadavarte</b>	Climate footprint of selected Indian emission sectors	12.00 to 12.30

**ADAPTATION (VENUE: III LT 2)****Moderator: Krishna Achutarao**

<b>Upasna Sharma</b>	The role of education in enhancing adaptive capacity to climate risk: Empirical evidence from coastal zones in India	09.30 to 10.00
<b>Sakshi Saini</b>	Communication for development enabled approaches for climate change adaptation and mitigation: A case study of urban poor women	10.00 to 10.30
<b>Ramasamy Krishnamurthy</b>	Applying a climate disaster resilience index to enhance planning decisions in Chennai	10.30 to 11.00
<b>Sujit Kumar Mishra</b>	Adaptation and sustainable livelihoods: Policy implications in the challenging hydro-climates of India	11.00 to 11.30
<b>P K Viswanathan</b>	Development of restoration of mangrove ecosystems in the context of emerging climate risks: Interventionist policies and outcomes in India	11.30 to 12.00
<b>Arijit Das</b>	Collective action in mid-Himalayan region for sustainable development	12.00 to 12.30

**LUNCH (VENUE: THE PAVILION, IIT SPORTS GROUND) - 13.00 to 14.00****SESSION II - 14.00 to 16.30****SCIENCE & IMPACTS (VENUE: II LT I)****Moderator: Chandra Bhushan**

<b>Sarath Guttikunda</b>	Non-traditional sources of pollution in Indian cities	14.00 to 14.30
<b>Eshita Gupta</b>	Global warming and local cooling: The impact of climate change on electricity demand in India	15.00 to 15.30
<b>Puneeta Pandey</b>	Assessing the summer-time urban heat islands over Delhi: A case study of micro-level climate change	15.30 to 16.00
<b>M Karthik</b>	Impact of methane emissions from wastewater sector in India through a case study of an effluent treatment plant	16.00 to 16.30

**MITIGATION (VENUE: II LT 2)****Moderator: Sudhir Chella Rajan**

<b>Surender Kumar</b>	Carbon sensitive productivity growth	14.00 to 14.25
<b>T Jayaraman</b>	A paradigm for equitable access to sustainable development	14.25 to 14.50
<b>Tejal Kanitkar</b>	Energy in a carbon budget regime	14.50 to 15.15
<b>Anubhab Pattanayak</b>	Climate change burden sharing: A reappraisal of the equity debate	15.15 to 15.40
<b>Monica Dutta</b>	Implementing efficient pricing of emissions trading in an exchange economy	15.40 to 16.05

<b>Pradeep Gautam</b>	Climate change, environmental security and regional cooperation	16.05 to 16.30
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**ADAPTATION (VENUE: III LT 2)**  
**Moderator: Ambuj Sagar**

<b>Jagriti Kher</b>	Climate change and water vulnerability at the household level in India	14.00 to 14.30
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<b>Mrutyunjay Swain</b>	Drought, vulnerability, coping capacity and residual risk: Evidence from Bolangir district in western Odisha	14.30 to 15.00
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<b>Asmita Bharadwaj</b>	Livelihoods in rainfed areas and the challenge of climate change adaptation	15.00 to 15.30
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<b>Kirtika Rana</b>	Policy spaces for individual and collective strategies for adaptation	15.30 to 16.00
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<b>Sujata Majumdar</b>	Is adaptation positive for rural economy at the farm level?	16.00 to 16.30
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**TEA (VENUE: SEMINAR HALL LOBBY) - 16.30 to 16.45**

**CONCLUSION (Venue: SEMINAR HALL)**

16.45 to 17.30

Sunita Narain, CSE, Sudhir Chella Rajan, IIT Madras and Ambuj Sagar, IIT Delhi

**REIMBURSEMENTS**

November 5: Venue—V LT 1

November 6: Venue—Seminar Hall

**IIT DELHI - MAP**

