INSEE

Indian Society for Ecological Economics

INSEE - CESS International Conference on

Climate Change and Disasters: Challenges, Opportunities and Responses

The Tenth INSEE Biennial Conference

Organised jointly with

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
&
National Institute of Rural Development and Panchayati Raj, Hyderabad

6 - 8 November 2019

Venue : Centre for Economic and Social Studies, Hyderabad

Programme and Abstracts

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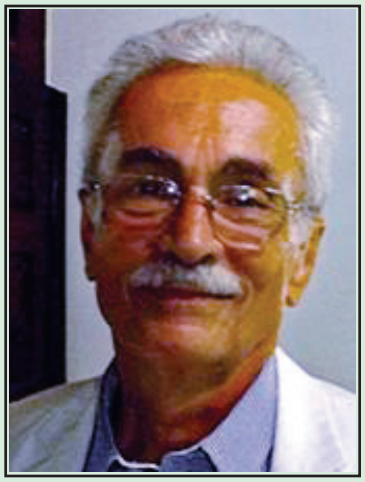
The International Society for Ecological Economics



Clóvis Cavalcanti
President, The International Society for Ecological Economics (ISEE)

Message

It is a great honor for me to send this greeting to the 10th biennial conference of INSEE. I am sure that during this meeting you will do your best to promote our field of work, created in the 1980s. INSEE-2019 is a precious opportunity to achieve progress in this process. We need to demonstrate that ecological economics is a path to a saner, truly sustainable world. Without forgetting that INSEE is a fundamental piece of ISEE, being its only regional society in Asia.

When I decided to stop being a conventional economist, and follow the guidance of Nicholas Georgescu-Roegen, I was convinced of his proposal for introducing thermodynamics in the economic approach by changing the understanding of the field of conventional economics. I was fortunate to hear Georgescu in Rio when I was 23 and an admirer of Neoclassical theory. Some years later, I met Herman Daly and then my adherence to the entropic vision of the economic process was completed. Ecological economics is for me the ecological view of the economy, against the economic view of the economy of Neoclassical and Keynesian economics. The economic view of nature, in contrast, is the perspective of the environmental economics. In essence, our discipline is not a branch of economics.

I have always adopted the view of strong sustainability and assumed the steady-state economy model. I also realize that our commitment is to work with the notions of the incommensurability of values, socio-environmental conflicts and injustice, and different languages of valuation. With these references, I cannot be a "light" ecological economist. This is one reason why I have worked for ISEE to be a scientific society committed to promoting the art of life, good living, happiness, social equity, studying how to achieve that much with a minimal ecological footprint. I would like thus to propose that we be more militant. May we have the courage to take on values such as those exposed by the papal encyclical *Laudato Si'*, and like those adopted in the philosophy of GNH (gross national happiness), introduced in the Kingdom of Bhutan from 1972 on. With a view to these commitments, I have sought an involvement with the encyclical *Laudato Si'*, whose ecological-economics credentials seem to be straightforward.

I consider the theme of the 10th INSEE conference – "Climate Change and Disasters: Challenges, Opportunities and Responses" – very appropriate for what I imagine. In this sense, I agree with some of my fellow ecological economists that a deeper and more radical epistemological and ethical rupture is required of ecological economics with the premises of Neoclassical economic rationality. Climate change is a

demonstration of the dangers that the prevailing unsustainable growth model poses for the future of the human species.

I am sure that we agree that humans are the planet's top predator. In this capacity, as David Suzuki has said, "our species remains dependent on clean air, water and soil and biodiversity, making our ability to survive catastrophic planetary disruption questionable." This is a perception we catch also from the Global Footprint Network's calculations leading us to the conclusion that there must be a demarcation of the commitment ecological economists must make to the sustainability of life on the planet.The challenges are clear. Our world has moved into an increasingly frightening picture of unsustainability. The collapse of the Genoa bridge, Italy, in August 2018, indicates this sense of unsustainability. Something can happen suddenly in complex socio-ecological systems, totally beyond our imagination. The commitment of ecological economists is with sustainable bridges, sustainable health, sustainable human well-being, broad equity, and the prudent use of life-support systems. We have to face the reality that what we are doing corresponds to the title of a book by our colleague in ISEE, Brian Czech: "shoveling fuel for a runaway train".

I hope and wish that you can leave Hyderabad assured of our historical responsibilities as ecological economists, rejecting any image that we are a branch of economics. No, our field of work is that of a revolutionary, post-normal, dialectical science, committed to the supreme value of life, with equality, efficiency and sustainability.

In Rio's ISEE conference in June 2012, I said that our affection for humanity should lead us to think about improving the human condition. This is the task I conceive for ecological economics following the diagnosis of Alfred North Whitehead that we are here, first, to live, second, to live well, and, thirdly, to live better. We are not here to own more and more gadgets – some plainly stupid.We do not want to see our world collapsing like that fateful bridge in Genoa. We love life. We want to preserve Nature for our descendants. This takes us to affection as the basis of sustainability and of ISEE. In other words, we do not want to see our world collapsing for we love life, we love nature and we want to preserve nature for our descendants – we love them.

Let's build a field that works towards promoting our ideal of sustainability, justice and efficiency. And let's hope that ours will be a fruitful job involving more activism and more activities that leave smaller ecological footprints as strong features both of INSEE and ISEE. In other words, let us make Ecological Economics a humane enterprise revolving around affection. If you do not lose sense of this commitment, you will be contributing to the steady and consistent development of ecological economics. Have a very good conference.

Clóvis Cavalcanti

Message

K N Ninan
President, Indian Society for Ecological Economics

The Tenth Biennial Conference of the Indian Society for Ecological Economics (INSEE) which is co-organised and being held at the Centre for Economic and Social Studies (CESS), Hyderabad during November 6-8, 2019 will mark a milestone when INSEE completes two decades since its registration as a professional society in the year 1999.Over the past two decades INSEE has tried to fulfil its mission and mandate by furthering the cause of sustainable development by providing a forum for dialogue among scholars, practitioners, and policy analysts from various disciplines, particularly economics and ecological sciences on a range of national and international issues such as climate change, natural resources, energy, waste, ecosystem services and valuation.These two decades have witnessed several activities including the successful conduct of nine biennial conferences, several capacity building workshops and training programmes, special lectures, refresher courses for young scholars, publication of books and more recently launch of INSEE's flagship journal Ecology, Economy and Society which has published two volumes so far. Over the years INSEE has collaborated with several governmental and non-governmental agencies, national and international institutions, donor and UN agencies to organise its activities.

It is befitting that the theme of the Tenth INSEE Biennial conference is on 'Climate Change and Disasters: Challenges, Opportunities and Responses' which is of great concern to India, other developing countries and the world. The risks arising from climate change are many, such as unforeseen and extreme weather events like heat waves, typhoons and cyclones, coastal and river flooding and prolonged droughts. These can have adverse economic, social and environmental consequences and affect human well-being and the overall quality of life. The rising demand for food due to rising population and incomes coupled with declining production of staples such as wheat, rice and maize due to the adverse effects of climate change will undermine food security and affect the poor and vulnerable people.

Building resilience to address these climate risks therefore poses a challenge to governments, societies and entities. Mainstreaming 'resilience' into development plans is therefore critical to tackling poverty, inequality, ill health and poor sanitation, as well as realizing the Sustainable Development Goals (SDGs), since poor and marginalized people and poor countries that have low adaptive capacity are most vulnerable to the adverse consequences of climate change. Improving climate and disaster risk management can also lead to larger gains in development and poverty reduction. Building resilience will also be helpful in coping with the uncertainties arising from the complex and dynamic interactions between climate change and other parameters such as health.

What are the likely impacts of climate change on human and natural ecosystems? How will it affect different sectors and sections of the society? What are the alternatives and policy options to address the risks posed by climate change and extreme weather events?

To discuss the challenges, opportunities and responses for addressing the risks posed by climate change and extreme weather events from different perspectives the Tenth Biennial Conference of INSEE will provide a platform for students, researchers, practitioners and policy makers to discuss these issues.

The broad sub-themes covered in the biennial conference includes the macro perspectives on climate change; impacts, mitigation and adaptation; incentives, institutions, governance and communities; extreme weather events and disasters; climate justice and equity; and building climate resilience through nature-based solutions and other alternative approaches. The conference will have keynote addresses by several eminent experts from both India and abroad, plenary and several parallel technical sessions, panel discussions, poster sessions and other activities. The conference will also have curtain raiser events with lectures by INSEE members in other institutions in Hyderabad, as well as pre- and post-conference events. Presentation of the Inaugural Bina Agarwal Prize for Ecological Economics to Professor Joan Martinez-Alier, honouring Professor C H Hanumantha Rao for his Lifetime Achievements, and honouring and conferring the title of INSEE Fellow on Professors M N Murty, Ramprasad Sengupta and Madhu Verma are other noteworthy events during this conference. Another important event is the IPCC Outreach Event/ Dissemination Activity by the Intergovernmental Panel on Climate Change (IPCC) being organised by INSEE where selected IPCC authors will share and discuss the findings of the Special Reports of the IPCC on Global Warming of 1.5°C; Climate Change and Land; Oceans and Cryosphere in a Changing Climate, and the ongoing AR6 assessment cycle. The conference will provide an opportunity for researchers and scholars belonging to different disciplines and policy makers to have a dialogue and share their research from different perspectives, as well as help build networks both within and outside India.

We look forward to the successful conduct of the conference. We would also like to express our immense gratitude to all those who have put in several months of hard labour and work for the organisation of the conference, to the Executive Committee of INSEE, and especially to the Chairman, Director, faculty, administrative and supporting staff of CESS, Hyderabad, to the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the National Institute for Rural Development Panchayat Raj (NIRDPR), the Government of Telengana, Indian Council of Social Science Research (ICSSR), National Bank for Agriculture and Rural Development (NABARD), TATA TRUST, and the Centre for Economics, Environment and Society (CEES), Bangalore for their valuable support. We would like to profusely thank all the experts and reviewers who reviewed the papers received for the conference which helped ensure the rigour and quality of the papers accepted for the conference. We also extend our sincere thanks to all governmental agencies, national and international institutions, donor and UN agencies for extending their support for the conduct of INSEE's Biennial conferences and other activities and look forward to their continued support.

K N Ninan

Message

E. Revathi
Director, Centre for Economic and Social Studies, Hyderabad

The Centre for Economic and Social Studies is co-organising and hosting the Tenth Biennial Conference of the Indian Society for Ecological Economics (INSEE) on **"Climate Change and Disasters: Challenges, Opportunities and Responses"** during 6-8 November 2019.

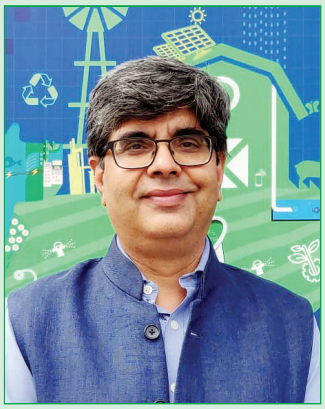
We know that threats of climate change loom large over every aspect of our lives with multiple socio, economic and political ramifications. Governments and civil society across the world are putting in earnest efforts to devise ways and methods of adaptation to the extreme events caused by changing weather. It is also equally important to understand the societal response to fine-tune/ customise the adaptation measures. In this context, it is very timely that INSEE has proposed this theme for its Tenth Biennial Conference and the Centre for Economic and Social Studies is glad to co-organise and host the conference. The conference is expected to discuss and debate various issues related to climate change and enhance our understanding of various challenges as well as the opportunities it poses.

We are also glad that CESS is hosting the Biennial Conference of INSEE for a second time and that it coincides with the 20th year of establishment of INSEE which has grown as a vibrant professional body in a short period. It is a matter of happiness to note that the former presidents of the society who were also its founding members will grace this conference. Several professionally well-equipped economists and other social scientists and natural scientists and participants from other civil society organisations are expected to participate in the intense three day Conference.

I warmly welcome all the delegates to our Centre and this conference. I wish you all a pleasant stay in Hyderabad and a productive and successful Conference.

E. Revathi

Message



Rajeev Ahal
Director, Natural Resource Management
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, India.

On behalf of GIZ, I would like to firstly congratulate INSEE on organising the 10th biennial conference this year. It is our pleasure to collaborate with INSEE as a principal partner in organising the conference.

As you may be aware, GIZ is the sole implementing agency of Technical Cooperation for the German Government and is currently present in over 120 countries worldwide. The Indo-German cooperation is 61 years young and works with the Governments and other organisations on issues of environment, Natural Resource Management, climate change, sustainable agriculture, energy, social security - to just name a few.

The prime theme for the INSEE conference this year is 'Climate Change and Disasters: Challenges, Opportunities and Responses'. This is a very relevant topic for India today, given that we currently rank sixth in the Global Climate Risk Index published in 2018.

As alerted by the Intergovernmental Panel on Climate Change, water is one of the key resources impacted by climate change. The German Federal Ministry for Economic Cooperation and Development notes that all the existing problems surrounding water, such as too much water causing floods, too little water causing droughts, or water pollution, will all be further exacerbated by climate change. The interlinkages of water to food, energy and other essential systems for sustaining life makes the issue further critical. In this changing climate scenario, climate resilient water security is therefore a prime concern.

Among our ongoing Indo-German projects on water security, the bilateral project 'Water Security and Climate Adaptation in Rural India' is commissioned by the German Federal Ministry for Economic Cooperation and Development, in cooperation with the Indian Ministry of Rural Development and the Ministry of Jal Shakti. The project is being implemented in Tamil Nadu, Rajasthan, Madhya Pradesh, Uttar Pradesh and at the national level from April 2019-March 2022. The project aims to focus on improving climate resilient water resource management, by improving convergent planning and financing

mechanisms, demonstrating innovative water management measures and strengthening cooperation with the private sector.

While this bilateral project is new, we have worked with Governments in various states on improving water conservation and management measures in our past projects. Under the Indo-German project - Environmental Benefits through MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act; April 2013 - March 2019), we have supported the Government of Andhra Pradesh in reviving more than 2000-year-old tank cascade structures in the Champavathi River Basin, contributing to drought mitigation and flood control at the same time. Along with the Government of Chhattisgarh, a 15-kilometre-long drainage line was treated in Rajnandgaon district, contributing to drought proofing, and enhancing irrigation to about 2000 hectares of agricultural land. A remote-sensing based planning approach for MGNREGA demonstrated under the Indo-German projectis now being used by 14,000 Gram Panchayats in India for preparing their annual action plans.

In the new project on Water Security and Climate Adaptation in Rural India, we look forward to continue working with the Government partners, knowledge institutions, civil society and the private sector to develop innovative solutions for improving water security and climate adaptation in rural India.

I am happy to note that I will be participating at the INSEE-2019 conference, where I would look forward to share more about our work, and learn much more from the eminent speakers, researchers and other participants. I am sure the conference will be an exciting opportunity to discuss the challenges and opportunities for addressing climate change in India, especially in the context of natural disasters.

I wish the event organisers and all the participants all the very best.

Rajeev Ahal

Message

W R Reddy, IAS
Director General,
National Institute of Rural Development and Panchayati Raj, Hyderabad

Climate change is a reality today. People who did least to cause the problem are the most affected, particularly the rural poor and indigenous communities. Research works show that small and marginal farmers around the world will be the most affected category due to land degradation and global warming. A drastic decline in fish catch and aquaculture production is also predicted due to sea-level rise. Climate change can push more people in developing countries below the poverty line. Our natural environment, sources of food, water, and infrastructure needs to be protected against extreme climate risks. Natural resource management becomes critical to improve the adaptive capacity of people living in rural areas. In India, ecosystem specific approachers are built-in rural development programmes and policies. Protection of forests and watersheds are encouraged to reduce the risk of hazards like landslides, soil erosion, etc. Agroforestries are promoted to retain soil moisture and reduced evaporation. In the coast, we have programmes to manage and restore floodplains, mangroves, and marshes. Decentralised approaches with peoples participation at the village level, and the convergence between departments, and other agencies are found to be more effective in building climate-resilient societies. Today women self-help groups at grassroots level play a significant role to improve the adaptive capacity of rural poor against climate change-induced risks.

I congratulate the Indian Society for Ecological Economics for selecting the most policy-relevant theme for the Tenth Biennial Conference. I express my sincere thanks to the organisers for inviting the National Institute of Rural Development and Panchayati Raj as a joint organiser of the conference. I wish a fruitful deliberation and success to the conference.

W R Reddy

About the Conference

Jeena T Srinivasan
Organising Secretary
of the Conference

The risks arising from climate change are many, such as unforeseen and extreme weather events like heat waves, typhoons and cyclones, coastal and river flooding, and prolonged droughts. These can have adverse economic, social and environmental consequences and affect human well-being and the overall quality of life.The rising demand for food due to rising population and incomes coupled with declining production of staples such as wheat, rice and maize due to the adverse effects of climate change will undermine food security and affect the poor and vulnerable people.

Building resilience to address these climate risks poses a challenge to governments, societies and entities. Mainstreaming 'resilience' into development plans is therefore critical to tackling poverty, inequality, ill health and poor sanitation, as well as realizing the Sustainable Development Goals (SDGs), since poor and marginalized people and poor countries that have low adaptive capacity are most vulnerable to the adverse consequences of climate change. Improving climate and disaster risk management can also lead to larger gains in development and poverty reduction.Building resilience will also be helpful in coping with uncertainties arising from the complex and dynamic interactions between climate change and other parameters such as health.

What are the likely impacts of climate change on human and natural ecosystems? How will it affect different sectors and sections of the society? What are the alternatives and policy options to address the risks posed by climate change and extreme weather events?

To discuss the challenges, opportunities and responses for addressing the risks posed by Climate Change and extreme weather events from different perspectives, INSEE invites contributions from students, researchers, practitioners and policy makers on the following broad sub-themes:

1. Climate Change: Macro Perspectives
   - 1.1 Vulnerability assessment
   - 1.2 Growth, human well-being and SDGs
2. Impacts, Mitigation and Adaptation
   - 2.1 Agriculture, fisheries, forests, mining
   - 2.2 Biodiversity and ecosystem services

2.3 Urban ecosystems

2.4 Energy and renewable energy

2.5 Water, lakes, rivers, and marine ecosystems

2.6 Health, sanitation and nutrition

3. Incentives, Institutions, Governance, Communities

3.1 Carbon prices, taxes, trading and finance

3.2 Regulatory measures

3.3 Governance, Communities and Action

4. Extreme Weather Events and Disasters

4.1 Droughts, Floods and Cyclones

4.2 Other extreme events

5. Climate Justice and Equity

5.1 Gender

5.2 Vulnerable sections and regions

6. Building Climate Resilience

6.1 Nature-based solutions

6.2 Other alternative approaches, Technology, Infrastructure

The conference announced on the 1st of January 2019 received about 215 paper abstracts and 15 proposals for panel discussions. We received abstracts from all over the country and abroad. Each Abstract received was reviewed by two members of the Scientific Advisory Committee (SAC) and based on their recommendations about 139 authors were invited to submit their Full Papers. We received 92 Full Papers and each paper was reviewed by two members of the Scientific Advisory Committee. The SAC recommended acceptance of 67 papers for oral presentation and 9 for poster presentations. Ten-panel proposals have been recommended for presentation at the conference by the SAC.

The three day event is organised into various plenary, panel and technical sessions. Besides the inaugural address and Presidential address, there are five keynote address by eminent scholars. There are also ten-panel discussions, twelve technical sessions of contributed papers and a valedictory session. It also has a special IPCC Plenary session and an award ceremony of the Bina Agarwal Prize for Ecological Economics and a Lifetime Achievements Award and INSEE Fellows felicitation function. A special session by the Springer Nature on ethical issues in writing is also there in the conference. A Curtain Raiser Event comprising of three public lectures by eminent scholars at the Administrative Staff College of India, University of Hyderabad and Arts College, Osmania University, a pre-conference workshop on Behavioural and Environmental Economics is also scheduled on 5th November 2019. There is also a post-conference workshop on Non-market Valuation Techniques organised jointly with SANDEE and CESS that is scheduled on the 9th of November 2019. About 30-35 scholars are participating in these workshops.

Jeena T Srinivasan

Scientific Advisory Committee

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K N Ninan	Chairperson, Centre for Economics, Environment and Society, Bengaluru President, INSEE (2018-20)
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Sujit Kumar Mishra	Associate Professor, Council for Social Development, Southern Regional centre, Hyderabad.
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Joyashree Roy	Professor of Economics and Coordinator, Global Change Programme,Jadavpur University.
Jyothis Sathyapalan	Professor & Head, Centre for Wage Employment, National Institute of Rural Development, Rajendranagar, Hyderabad,
Amita Shah	Honorary Fellow, Centre for Development Alternatives, Ahmedabad and former President, INSEE (2012-14)
E Somanathan	Professor of Economics, Indian Statistical Institute, New Delhi and Executive Director, SANDEE
Nandini Sundar	Professor of Sociology at the Delhi School of Economics, Delhi University
Madhu Verma	Professor, Indian Institute of Forest Management, Bhopal, India.
Arild Vatn	Professor of Environmental Sciences at the Department of International Environment and Development Studies at the Norwegian University of Life Sciences (NMBU), Norway

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V. Subash Varma	Finance Officer, Centre for Economic and Social Studies, Hyderabad

Keynote Speakers

Mr. Rajeev Ahal

Director, Natural Resource Management (NRM), GIZ

Mr Rajeev Ahal works as Director, Natural Resource Management (NRM) at GIZ India, where he leads the project 'Water Security and Climate Adaptation in Rural India' along with four other projects on issues of NRM production and marketing systems, green financing and climate risk insurance. Mr Ahal has over 30 years of experience in working with international agencies, governments and the private sector in India and African countries on issues of NRM, livelihoods, decentralisation and local governance, social protection among others. He majored in Electrical Engineering for his graduation, and also holds a Diploma in International Programme for Organisational and Systems Development from Gesalt Center for Organisational and Systems Development in Ohio.

Prof. Kirit S. Parikh

Chairman, Integrated Research and Action for Development, IRADe

He was Member, Planning Commission from 2004 to 2009. He was a Member of the Economic Advisory Council (EAC) of five Prime Ministers of India, Atal Behari Vajpayee, P.V. Narasimha Rao, Chandra Shekhar, V.P.Singh and Rajiv Gandhi.

Founder Director and Vice Chancellor of Indira Gandhi Institute of Development Research (IGIDR) and Professor of Economics since 1967 and has a Doctorate in Civil Engineering and a Master's degree in Economics from Massachusetts Institute of Technology (MIT).

As Member of Planning Commission in charge of Energy and Water, he was the principal architect of India's official Integrated Energy Policy.

He chaired the expert group on 'Low Carbon Strategy for Inclusive Growth' in 2014. The report has had significant impact on India's energy and climate change policy.

He was conferred Padma Bhushan in 2009, shared the Nobel Prize in 2007 given to IPCC authors as was a review editor of IPCC-3 and IPCC-5. Honoured as the Most Distinguished and Illustrious Alumni of the Decade from India by MIT and as Distinguished Alumnus by IIT-Kharagpur.

Prof. N.H. Ravindranath
Professor (Retd.)
Centre for Sustainable Technologies, Indian Institute of Science Bangalore, India.

Areas of Research, Developmentand Policy Advocacy include: Climate Change, Forests, Bioenergy and Ecosystem Services.

Prof. Ravindranath has focused his research, advocacy and publications on various dimensions of Climate Change -Mitigation Assessment, Greenhouse Gas Emissions Inventory in Land Use Sectors, Impact of Climate Change and Vulnerability Assessment in Forest and Agro-ecosystems, Adaptation and Climate Resilience, Forest Ecology, CDM and REDD+ Projects.He has also worked on Bioenergy, Biofuels and Biomass Production, Environmental / Ecosystem Services, and Citizen Science.

1. He is an author for several IPCC (Intergovernmental Panel on Climate Change) Assessment Reports on Climate Change - WMO and UNEP focusing on mitigation in forest sector.
2. He is an author for IPBES (Intergovernmental Platform on Bio-diversity and Eco-system Services)-Reports.
3. He is the Scientific Advisory Panel Member for Global Environmental Outlook (GEO 6)
4. He was the Science Technology Advisory Panel (STAP) member of GEF (Global Environmental Facility) for Climate Change Focal Area during 2008 - 2012.
5. He is a UNFCCC expert for GHG (Greenhouse Gas) inventory reports submitted to UN.
6. He has published 8 books (from Oxford and Cambridge Uni. Press, Kluwer, and Springer Publishers) out of which 4 are on Climate Change.
7. He has published over 150 peer reviewed research papers out of which about 60 are on Climate Change.
8. He has brought out special issues on Climate Change in Journals such as Current Science, Mitigation and Adaptation Strategies to Global Change.
9. He has worked for or advised many State governments on "Assessment of Climate Change Projections, Impacts and Vulnerability". He also has worked at national level on MGNREGA and climate change.
10. He is an expert for several World Bank, UN and other bilateral projects related to climate change.

Prof. Thomas Sterner

Professor of Environmental Economics at the University of Gothenburg

Thomas Sterner is a Professor of Environmental Economics at the University of Gothenburg in Sweden, whose work is focused on the design of policy instruments to deal with resource and environmental problems. He has built up the Unit for Environmental Economics as a leading European centre for environmental economics that gives a unique PhD program in climate economics with students from developing countries. He has been advisor to around 50 PhD students.

Sterner has published more than a dozen books and a hundred articles in refereed journals, mainly on environmental policy instruments with applications to energy, climate, industry, transport economics and resource management in developing countries. He has in particular worked on the importance of fuel taxation for climate and transport policies. He has also worked on the feasibility and income distributional aspects of environmental policies. Another body of his work is focused on intertemporal discounting.

Sterner is the recipient of the Myrdal Prize, Past President for the European Association of Environmental and Resource Economists and Associate Editor of Environmental and Resource Economics. He is also a Fellow or researcher at Resources for the Future, The Beijer Institute and Statistics Norway and an EAERE Fellow.

With Gunnar Köhlin, he has founded the Environment for Development Initiative and is a member of the research board of several developing country networks such as CEEPA (Africa) and SANDEE (in South Asia) and the Board of Academic advisors to the Center for Chinese Agricultural Policy, CCAP of the Chinese Academy of Sciences. He sits on numerous boards and is Guest Professor in Cape Town. He is a Member of the Scientific Advisory Panel on Sustainability to the Swedish Government.

During 2012 and 2013 he served as Visiting Chief Economist of the Environmental Defense Fund in New York and he remains affiliated with EDF. For the year 2015-16 he was elected as a guest professor (chaireannuelle)at the Collège de France. Sterner also served in the AR5 of the IPCC where he was Coordinating Lead Author of chapter 15 on policy instruments.

Prof. E Somananathan

Professor, Indian Statistical Institute in Delhi.

E. Somanathan is Professor in the Economics and Planning Unit of the Indian Statistical Institute in Delhi, Professor-in-Charge of the Social Sciences Division of the ISI, and Program Director of CECFEE (Centre for Research on the Economics of Climate, Food, Energy and Environment). His research is in the economics of environment and development. He received his Ph.D from Harvard and has taught at Emory, the University of Michigan, and Princeton. He has been Executive Director of SANDEE (South Asian Network for Development and Environmental Economics), a Co-ordinating Lead Author for the Fifth Assessment Report of the IPCC, and is the Editor of Environment and Development Economics, a Cambridge University Press journal.

Dr. Vinod Thomas

Former Senior Vice-President, The World Bank

Vinod Thomas is currently Special Adviser to the President and Dean of Asian Institute of Management and Visiting Professor at National University of Singapore. Previously he was Director General of Independent Evaluation at the Asian Development Bank (2011-2016).

Prior to ADB, Vinod was Director-General and Senior Vice-President of the Independent Evaluation Group at the World Bank Group (2006-2011). He was formerly Country Director for Brazil and Vice-President. He was Vice-President of the World Bank Institute. Having joined the World Bank in 1976, he was Chief Economist for the East Asia and Pacific region, Director for the World Development Report, Chief of Trade Policy and Principal Economist for Colombia, and Economist for Bangladesh.

Vinod has a PhD and MA in Economics from the University of Chicago and a BA from St. Stephen's college, Delhi. He has authored 16 books, articles, and reports on macroeconomic, social and environmental issues. His books include: The Quality of Growth, 2000, Multilateral Banks and the Development Process, (with Xubei Luo), 2012, Climate Change and Natural Disasters, 2017, and (with Namrata Chindarkar) Economic Evaluation of Sustainable Development, 2019.

He has taught at Vassar College, New York and the University of Sao Paulo, Brazil, been on several Boards and has addressed numerous fora in all regions. He has been advisor for evaluation at Global Climate Fund and at IFAD, and for Results for Development and the Emerging Market Forum.

Felicitations

Winner of the First Bina Agarwal Prize for Ecological Economics

Prof. Joan Martinez - Alier

Senior Researcher in the Environmental Science and Technology Institute of the Autonomous University of Barcelona (ICTA-UAB).

Joan Martinez-Alier is a senior researcher in the Environmental Science and Technology Institute of the Autonomous University of Barcelona (ICTA-UAB). He is also professor emeritus at FLACSO, Quito. He has edited the journal Ecología Política in Barcelona since 1990. His publications are numerous and in English include: Labourers and Landowners in Southern Spain (London, 1971), Haciendas, Plantations and Collective Farms (Cuba and Peru) (London 1977), Ecological economics: energy, environment and society (Oxford, 1987); Varieties of environmentalism: Essays North and South (London, 1997), with Ramachandra Guha and The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation (2003). In addition, he edited with Roldan Muradian a Handbook of Ecological Economics (2015). He contributed to the book Degrowth: a vocabulary for a new era (London, 2014) and co-edited the textbook Ecological Economics from the Ground Up (2013), a product of a collaborative research project, CEECEC, 2008-2010, which was followed by the EJOLT project (2011-15), Environmental Justice Organizations, Liabilities and Trade involving 23 academic and activist partners (www.ejolt.org) (www.ejatlas.org). He was President of the International Society for Ecological Economics in 2006 and 2007 and member of the scientific committee of the European Environment Agency between 2000 and 2008. His research focuses on ecological economics, political ecology, agrarian studies, environmental justice and the environmentalism of the poor and the indigenous. In 2016 he was awarded a European Research Council Advanced Grant for the project EnvJustice (A global environmental justice movement), 2016-21.

Lifetime Achievements Award

Prof. C. H. Hanumantha Rao

Past President of INSEE, Former Chairman and Honorary Professor, Centre for Economic and Social Studies, Hyderabad

Professor C.H. Hanumantha Rao holds a PhD from the Delhi School of Economics, University of Delhi (1962). He was Post-Doctoral Fellow, Department of Economics, University of Chicago (1966-67) and Fellow, Institute of Economic Growth, University of Delhi (1961-1992). He has been Hon. Professor, Centre for Economic and Social Studies, Hyderabad since 1992. His areas of interest are: Agricultural Economics, Development Planning and Policy. He has been a member of the Planning Commission, Finance Commission, on the Board of Directors of the RBI; Member, National Advisory Council; and Chancellor, University of Hyderabad. He was awarded 'Padma Bhushan' by the President of India in 2004 in the field of literature and education.

He has published twelve books, seven edited books and over 120 research papers and articles in journals and edited books in India and abroad. He has served as Member of several expert bodies including National Advisory Council, 2004-2008; Technical Advisory Committee for International Agricultural Research,1996-98;Board of Directors, Reserve Bank of India, 1994-2000; Planning Commission, G.O.I., 1982-86; and Seventh & Eighth Finance Commissions.

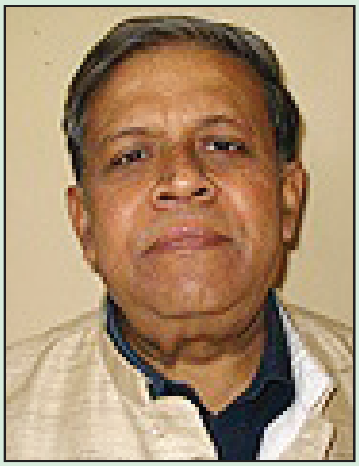
He was awarded Rafi Ahmed Kidwai Memorial Prize for 1974-75, by the Indian Council of Agricultural Research, for Outstanding Contribution in the field of Agricultural Economics; Received Financial Express Award for Lifetime Work in Economics, in 1995.

INSEE Fellows

Prof. M.N. Murty

Professor of Economics (Retired)., Institute of Economic Growth, University Enclave, Delhi

He is currently Fellow, South Asian Network for Development Economics and Environment (SANDEE).He was a Ford Foundation Fellow at University of Birmingham and Research Fellow at London School of Economics, UK, Visiting Faculty, at Institute of Developing Economies, Tokyo, Japan, and Visiting Professor at National Institute of Public Finance and Policy, and TERI University, Delhi. He was a consultant for World Bank, Asian Development Bank, International Crop Research Institute (ICRISAT) and ESCAP. He specializes in Public Economics and Environmental and Resource Economics. He taught at Delhi University, Institute of Economic Growth, Delhi, Department of Economics, University of Birmingham, U.K, Jawaharlal Nehru University, New Delhi, School of Planning and Architecture, New Delhi, Delhi School of Economics, Delhi, TERI University, Delhi, Indira Gandhi Institute of Development Research, Mumbai, Indian Statistical Institute, Kolkata, Institute for Social and Economic Change, Bangalore, Madras School of Economics, Chennai, and Jadavpur University, Kolkata. He has published 10 books including 6 books in Environment and Resource Economics, four by Oxford University Press, one each by Cambridge University Press and SAGE. He has contributed a large number of research papers to national and international journals of Economics and chapters in a good number of edited books. He has undertaken a number of research projects funded by international organizations like World Bank, IDRC, Canada, ESCAP, European Commission, ICRISAT, Planning Commission, NITI Ayog, CSO, Ministry of Environment and Forests, Ministry of Communications and ICSSR of Government of India.



Prof. Ramprasad Sengupta

Professor Emeritus in Economics at the Jawaharlal Nehru University (JNU), New Delhi

Prof. Ramprasad Sengupta is a Professor Emeritus in Economics at the Jawaharlal Nehru University (JNU), New Delhi where he was a Professor of Economics for almost four decades and has been a former Dean of its School of Social Sciences. He was Mahatma Gandhi National Fellow of the ICSSR at the Centre for Studies in Social Sciences, Calcutta during 2016 - 2018. He was also a Professor at the Indian Institute of Management Calcutta (1999 -2001) and a Visiting Professor / Scholar in a number of foreign Universities in Europe, North America and Japan. Besides his teaching stints, he was Advisor, Planning Commission, Government of India and a part time Independent Director on the Board of Steel Authority of India for several years.

Prof. Sengupta's area of interest and specialization are Energy, resource and ecological / environmental economics; Quantitative policy modelling of infrastructural sectors. He has written a number of books and large number of scholarly published papers; the latest book authored by him is Ecological Limits and Economic Development : Creating Space, OUP. (2013). His forthcoming book is "Entropy Law, Sustainability and Third Industrial Revolution" to be published by the OUP.

Prof. Madhu Verma

Professor, Area of Environment & Developmental Economics and Coordinator - Centre for Ecological Services Management, Indian Institute of Forest Management.

A biological Science graduate and MA, M.Phil & Ph.D. in Economics from Bhopal University, Bhopal. She is a Fulbright Fellow (2012), LEAD Fellow (2007) and World Bank EMCaB program's EEOFC Grant awardee (2001) for post doc research at the UCAL (Berkeley) as Visiting Scholar and at UMASS (Amherst) & as Visiting Professor (2001). She works on Economic Valuation & Green Accounting of Ecosystems & Biodiversity, Ecosystem-Economy Modelling, Tiger & Snow Leopard Habitat Valuation, Forest- Fiscal Federalism and Payment for Ecosystem Services. She has 35 years of enriched work experience with many national and international institutes, Ministries like MoEFCC, MoFinance, Forestry Commission & various Finance Commissions of India and United Nations bodies, World Bank and various international funding agencies and academic institute. She has travelled across the globe to more than 30 countries for work and has more than 40 publications in international and national journals, several books & Project Reports to her credit. Many of her research outcomes have greatly influenced the policies and decision making process of the government and have led to introduction of economic instruments in the system. She has contributed to the Millennium Ecosystem Assessment Report, TEEB and to the Global Biodiversity Assessment Report of IPBES.

She has been recognized by United Nations- REDD platform for 'Women Working in Forests", featured in a special issue of India Today in March 2018 on Madhya Pradesh under the category of Trendsetters- Anchors of New Policies for her work on valuation of forest resources to inform policy makers & nominated as a "Human Star" for the "Day out with a Star" forum based at Washington, DC on environmental careers.

IPCC Outreach Event

Intergovernmental Panel on Climate Change (IPCC) Outreach Event on IPCC's Role, Activities and Findings hosted by the Indian Society for Ecological Economics (INSEE) at the Tenth Biennial Conference of INSEE held at the Centre for Economic and Social Studies (CESS), Hyderabad on November 07th 2019

IPCC

The Intergovernmental Panel on Climate Change (IPCC) is the UN body for assessing the science related to climate change. The IPCC does not conduct its own research. It identifies where there is agreement in the scientific community and where there are differences of opinion and where further research is needed. It is a partnership between scientists and policymakers, and it is this that makes its work a credible source of information for policymakers. IPCC assessments are produced according to procedures that ensure integrity, in line with the IPCC's overarching principles of objectivity, openness and transparency. IPCC reports are policy relevant, but not policy prescriptive.

IPCC assessments provide governments, at all levels, with scientific information that they can use to develop climate policies. IPCC assessments are a key input into the international negotiations to tackle climate change. IPCC reports are drafted and reviewed in several stages, thus guaranteeing objectivity and transparency. In 2013-2014 IPCC published the Fifth Assessment Report. In 2015 and 2016, the IPCC decided to produce a Sixth Assessment Report (AR6), three Special Reports, a Methodology Report and AR6 by 2022 as follows:

- Special Report on Global Warming of 1.5°C (SR1.5) in 2018.
- Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) in 2019.
- Special Report on Climate Change and Land (SRCCL)in 2019.
- Refined 2006 IPCC Guidelines for National Greenhouse Gas Inventories will be delivered in 2019.
- AR6 Synthesis Report to be finalized in the first half of 2022.

Objective:

INSEE with the participation of the IPCC authors is organizing a Panel discussion followed by Q & A session on "Understanding Climate Change Science and Adaptation and Mitigation Options" based on the Special Reports of IPCC and AR6 assessment cycle. The objective of the event is to generate scientific understanding among various stakeholders about climate change to encourage climate actions at local levels. More specifically, it seeks (i) **To raise awareness** especially among policy makers, about the outcomes of the Special Reports of the IPCC and understanding the AR6 assessment cycle and process, and social scientists of INSEE to demonstrate how climate change impacts are closely linked to human dimensions. The event will highlight the current level of multidisciplinary scientific understanding of the climate science, potential solutions to the challenges of climate change focussing on adaption and mitigation; (ii) **To promote knowledge sharing,** especially among policy makers and the scientific community from the region about the IPCC process, priorities and scope of participation in IPCC AR6 process and assessments in future; (iii) **To encourage participation of the local social science research community** in climate research and encourage regional contributions to future assessments and climate change studies; (iv) **To foster better understanding among the news media, youth** and **the private sector** about climate science, the IPCC's role and innovative solutions for climate change; (v) **To present key findings of climate change studies and enable climate actions among** policy-makers, development practitioners, students, civil society and business sector representatives.

About the Event:

INSEE will host the event with the participation of IPCC on November 7th, 2019 at the Tenth Biennial Conference of INSEE being held at CESS, Hyderabad. Two more special events for public and policy makers are proposed to be held in Hyderabad on November 8th, 2019 in collaboration with local government and organizations. There will be sessions devoted to discussing the findings of the Special Reports of the IPCC as well as the production of the ongoing Sixth Assessment Report (AR6) and how these are being operationalized in South Asia and the potential solutions. The INSEE programme will help forge synergies with IPCC assessment. The event will have sessions for interaction with the authors and NGOs, policy makers and the local scientific community including students. In addition, INSEE will have poster sessions demonstrating various local actions.

IPCC Plenary Session on November 07th, 2019

Chair/Moderator

Professor Thomas Sterner

Professor of Environmental Economics, University of Gothenburg, Sweden and Contributing Lead Author of the Fifth Assessment Report of the IPCC (2014); and Past President of the European Association of Environmental and Resource Economists.

Speakers (IPCC Authors):

Speaker	Affiliation	Topic
Krishna Achuta Rao	Associate Professor, Centre for Atmospheric Sciences, Indian Institute of Technology, Delhi	**Climate Science and Models**
Joyashree Roy	Bangabandhu Chair Professor, Asian Institute of Technology, Thailand	**Main Messages from Special Report on Global Warming of 1.5°C in Sustainable Development Context**
Anjal Prakash	Associate Professor and Associate Dean, Business Development, TERI-SAS, Hyderabad	**Special Report on Ocean and Cryosphere in a Changing Climate**
Joyashree Roy	Bangabandhu Chair Professor, Asian Institute of Technology, Thailand	**IPCC Process and Scope for Participation in AR6**
Jagadish Krishnaswamy	Senior Fellow, Ashoka Trust for Ecology and the Environment (ATREE), Bangalore	**Special Report on Climate Change and Desertification, Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems.**

Dr. Jagdish Krishnaswamy

Dr Jagdish Krishnaswamy has a B.Tech in Civil Engineering from Indian Institute of Technology, Mumbai, India and a MS in Statistics and Decision Sciences and a Ph.D in Environmental Studies, Duke University, North Carolina, USA. His research and teaching interests include ecohydrology, landscape ecology, conservation planning, ecosystem services and applications of bayesian approaches in understanding complex changes in the environment over space and time. He has coordinated the establishment of instrumented catchments in the Western Ghats and in the Himalayas to study the impacts of land-cover and climate variability on hydrological processes. Jagdish has recently become involved in defining and assessing ecological flow requirements of rivers in the Western Ghats and the Ganga basins with a special focus on endangered species such as the gharial and river dolphin. His work on climate science and climate change includes vegetation response to climate and land-cover change in India, Central America and Africa. Over the years, his work has contributed to various policy and actions such as the declaration of the Western Ghats as a UNESCO World Heritage Site, the investment of the Critical Ecosystem Partnership Fund in the Western Ghats and a special report on Himalayan Springs to the Niti Ayog. He has designed capacity building and field hydrology training courses for aquatic ecologists and grass roots NGOs. He is a Coordinating Lead Author of the Special IPCC Report on climate change, desertification, degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.

Dr. Anjal Prakash

Dr. Anjal Prakash is Associate Professor and Associate Dean - Business Development at TERI-SAS Hyderabad Campus. Before joining TERI- SAS, Dr. Prakash worked as the Programme Coordinator of Himalayan Adaptation, Water and Resilience (HI-AWARE) Research on Glacier and Snowpack Dependent River Basins at International Center for Integrated Mountain Development (ICIMOD) based in Kathmandu, Nepal. Dr. Prakash has been selected as coordinating Lead Author for the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) and also been selected as a Lead author in the chapter on cities, settlements and key infrastructure in the IPCC's 6th Assessment Report.

Dr. Krishna Achuta Rao

Dr. Krishna Achuta Rao is currently Associate Professor, Centre for Atmospheric Sciences at Indian Institute of Technology, Delhi (IIT-Delhi). Prior to join IIT-Delhi Dr. Achuta Rao was working as a Research Scientist at Program for Climate Model Diagnosis and Intercomparison (PCMDI), Lawrence Livermore National Laboratory, Livermore CA, U.S.A. He is one of the Lead Authors in the Sixth Assessment Report of Working Group 1 (Chapter-3) of the Intergovernmental Panel on Climate Change (IPCC). His research interests span ocean heat uptake, variability of the coupled ocean-atmosphere system from ENSO to decadal and longer time-scales, climate model verification and diagnosis, regional impacts and detection & attribution of climate change.

Prof. Joyashree Roy

Prof. Joyashree Roy is currently the Bangabandhu Chair Professor at Asian Institute of Technology, Bangkok in Thailand and Professor of Economics, Jadavpur University, Kolkata (on lien). Prof. Roy is also one of the Coordinating Lead Authors of the Sixth Assessment Report of Intergovernmental Panel on Climate Change (IPCC). She is founder advisor of the Global Change Programme at Jadavpur University, which focuses on climate change research and beyond. She is interested in multidisciplinary approaches to understand development challenges. Her research interests are: Economics of Climate Change, Modeling energy demand, Water quality demand modeling, Sustainable development indicator development, Developmental and environmental issues relevant for informal sectors and Coastal ecosystem service evaluation. She has worked extensively with developing country data.

Other IPCC Outreach Events

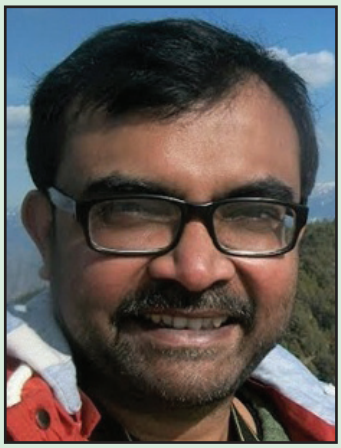
Date	Time	Venue	Chair / Moderator
7th November, 2019	14.30 - 16.00	Environment Protection Training and Research Institute, Gachibowli, Hyderabad.	**Sri B.Kalyan Chakravarthy,** IAS Director General
8th November, 2019	10.00 - 11.30	ICRISAT, Patancheru, Hyderabad.	(TBC)
	15.00 - 17.00	Centre for World Solidarity, Tarnaka, Secunderabad.	**Ms. Suryakumari** Director, Centre for Peoples' Forestry, Secunderabad

Speakers at the Curtain Raiser Events

Shreekant Gupta

Shreekant Gupta is Professor at the Delhi School of Economics, University of Delhi. He has held visiting appointments at National University of Singapore, Nazarbayev University and Jawaharlal Nehru University. Prior to joining University of Delhi, he was Fellow, National Institute of Public Finance and Policy where he headed the Environmental Policy Cell. He has also worked as an environmental economist at the World Bank at Washington DC and as an economist in the Indian government (Indian Economic Service cadre). His policy experience includes Directorship of National Institute of Urban Affairs. He has served on various national and international committees on environment, notably the Economic Options Committee of the Montreal Protocol and 3rd, 5th and 6th Assessment Reports of IPCC.

Professor Gupta has a Ph.D. in Economics from the University of Maryland and was Fulbright Fellow at Massachusetts Institute of Technology and Shastri Fellow at Queens University. He is an Associate Editor of the *Indian Economic Review* and serves on the editorial board of *Agricultural and Resource Economics* Review.



Nandan Nawn

Nandan Nawn, is an economist by disciplinary training with a doctoral degree from Jawaharlal Nehru University. He is presently at Department of Policy Studies, TERI School of Advanced Studies, New Delhi. He teaches a course on Methods of Research in Economics besides multiple courses in the interface of Environment, Development, and Economics in the MSc Economics (with a specialization in Environment and Research Economics) programme. His present research interests are in Ecological Economics, Environment and Development and Environmental-Economic Accounting. Before joining TERI SAS in 2014, he has taught in the West Bengal National University of Juridical Sciences, Kolkata since 2001. His works have been published in various journals including *Journal of Agrarian Change*, *Economic and Political Weekly*, and *Journal of Human Development and Capabilities*. He has recently co-edited *Ecology, Economy and Society: Essays in Honour of Kanchan Chopra* (2018; Springer), *Global Change, Ecosystems and Sustainability* (2017; Sage) and *Economic Challenges for the Contemporary World: Essays in Honour of Prabhat Patnaik* (2016; Sage). He was the Head of Department of Policy Studies of TERI SAS (2017-18) and Secretary of the Indian Society for Ecological Economics (INSEE; 2016-18). He has been a recipient of doctoral fellowships from University Grants Commission, Indian Council of Social Science Research, and Fulbright-Nehru International Education Administrator Seminars scholarship, besides being an Associate at the Indian Institute of Advanced Study, Shimla. He is presently the Managing Editor of *Ecology, Economy and Society—the INSEE Journal*, a guest co-editor of the "Review of Environment and Development" in *Economic and Political Weekly*, Coordinator of Internal Quality Assurance Cell (IQAC), TERI SAS and coordinator of Bioeconomy component of the pilot precursor project to National Mission on Biodiversity and Human Well-Being (2020-25), funded by Office of the Principal Scientific Adviser,

Pranab Mukhopadhyay

Pranab Mukhopadhyay is Professor of Economics at Goa University. He is a Fellow of the South Asian Network for Development & Environmental Economics (SANDEE), Kathmandu and was former President of the Indian Society for Ecological Economics, INSEE (2016-18). He graduated from Presidency College, Calcutta and did his masters and doctoral work at Jawaharlal Nehru University, New Delhi. He has co-edited *Promise, Trust and Evolution: Managing the Commons of South Asia*, (OUP, UK, 2008), *Global Change, Ecosystems, Sustainability,* (Sage Publications, New Delhi, 2017) and *Nature, Economy and Society* (Springer, New Delhi, 2016). He co-authored the book *Common Property Water Resources: Dependence and Institutions in India's Villages (*TERI Press, New Delhi, 2008). His articles have been published in *Climatic Change*, *Current Science*; *Ecology and Society; Environment and Development Economics; Economic and Political Weekly; Geojournal; and Journal of Quantitative Economics.*

Curtain Raiser Events

5th November, 2019

Sl.No	Speaker	Topic	Venue
1	Shreekant Gupta	Climate Change: Challenges and Policy Response for India	EDP Administrative Staff College of India, College Park Campus, Road No 3: Banjara Hills Time : 15.00
2	Nandan Nawn	Environment and Economic Development in India: seeing like an ecological economist	Gautam Mathur Seminar Hall Department of Economics Arts College Osmania University Time : 11.00
3	Pranab Mukhopadhyay	Environmental Challenges and Public Policy in India	CR - 2 School of Economics University of Hyderabad Time : 11.30

Program Overview

<table>
<tr><td colspan="5">INSEE – CESS International Conference
Climate Change and Disasters: Challenges, Opportunities and Responses
The Tenth INSEE Biennial conference</td></tr>
<tr><td colspan="5">DAY 1: 6th November 2019, Wednesday</td></tr>
<tr><td>08.30 - 09.15</td><td colspan="3">Registration</td><td rowspan="2">Auditorium Main Hall</td></tr>
<tr><td>09.15 - 11.30</td><td colspan="3">Inaugural Session</td></tr>
<tr><td>11.35 - 12.00</td><td colspan="3">Tea/Coffee Break</td><td>Car Parking Area</td></tr>
<tr><td rowspan="2">12.00 - 13.30</td><td colspan="4">Panel Session PS 1 (Parallel)</td></tr>
<tr><td>PS 1.1: How IWRM in India can be more Climate Resilient?
(Auditorium Seminar Hall)</td><td>PS 1.2: Climate & Disaster Resilient Urban Development
(Seminar Hall I, First Floor, Main Building)</td><td colspan="2">PS 1.3: Adapting to Climate Change in South Asian Cities (SANDEE-ACD Panel)
(Seminar Hall II, Second Floor, Main Building)</td></tr>
<tr><td>13.30 - 14.30</td><td colspan="3">Lunch</td><td>Car Parking Area</td></tr>
<tr><td rowspan="2">14.30 - 16.00</td><td colspan="4">Plenary Session 1 : Climate Resilient Growth in India: Strategies and Measures
(Auditorium Main Hall)</td></tr>
<tr><td colspan="2">Keynote Address:
Low Carbon Strategy for Inclusive Growth</td><td colspan="2">Keynote Address:
Water Security and Climate Change Adaptation: Experiences and Way Forward</td></tr>
<tr><td>16.00 - 16.30</td><td colspan="3">Tea/Coffee Break</td><td>Car Parking Area</td></tr>
<tr><td rowspan="2">16.30 - 18.00</td><td colspan="4">Technical Session (TS) 1 (Parallel)</td></tr>
<tr><td>TS 1.1: Growth, Human Wellbeing and SDGs
(Auditorium Seminar Hall)</td><td>TS 1.2: Vulnerability, Impact and Adaptation to Climate Change
(Seminar Hall I, First Floor, Main Building)</td><td>TS 1.3: Vulnerability to Floods
(Seminar Hall II, Second Floor, Main Building)</td><td>TS 1.4: Environmental and Climate Justice
(Classroom, Ground Floor, Main Building)</td></tr>
<tr><td>18.15 - 18.45</td><td colspan="2">Session by Springer</td><td colspan="2">Auditorium Main Hall</td></tr>
<tr><td>18.45 - 19.45</td><td colspan="2">INSEE General Body Meeting
(For INSEE Members Only)</td><td colspan="2">Auditorium Seminar Hall</td></tr>
<tr><td>19.30 - 20.30</td><td colspan="2">Cultural Programme</td><td colspan="2">Auditorium Main Hall</td></tr>
<tr><td>20.30 - 21.30</td><td colspan="2">Dinner</td><td colspan="2">Car Parking Area</td></tr>
</table>

DAY 2: 7th November 2019, Thursday				
09.15 - 10.15	**Plenary Session 2** **Bina Agarwal Prize - Award Ceremony** **First Recipient: Prof.Joan Martinez Alier**			Auditorium Main Hall
10.15 - 10.30	**Tea/Coffee Break**			Car Parking Area
10.30 - 12.00	**Plenary Session 3** The Work and Findings of the Intergovernmental Panel on Climate Change			Auditorium Main Hall
12.00 - 13.00	**Plenary Session 4** **Felicitations** (Auditorium Main Hall)			
	Conferring the Lifetime Achievement Award on Prof.C.H.Hanumantha Rao		**Conferring the Honour and Title of INSEE Fellows on** Prof.M.N.Murty, Prof.RamprasadSengupta and Prof.MadhuVerma	
13.00 - 14.00	**Lunch**			Car Parking Area
14.00 - 16.00	**Technical Session (TS) 2 (Parallel)**			
	TS 2.1: Climate Vulnerability: Agriculture and Food Security (Auditorium Seminar Hall)	TS 2.2: Adaptation of Agriculture to Climate Change (Seminar Hall I, First Floor, Main Building)	TS 2.3: Climate Resilient Measures in Rural India (Seminar Hall II, Second Floor, Main Building)	TS 2.4: Institutions and Sustainability (Classroom, Ground Floor, Main Building)
16.00 - 16.30	**Tea/Coffee Break**			Car Parking Area
16.30 - 18.00	**Panel Session (PS) 2 (Parallel)**			
	PS 2.1: Local Action Plan on Climate Change: Methodology and Action (Auditorium Seminar Hall)	PS 2.2: Martin Weitzman's Contributions to Environmental Economics (Seminar Hall I, First Floor, Main Building)	PS 2.3: MGNREGS Contribution to Climate Change Mitigation and Adaptation (Seminar Hall II, Second Floor, Main Building)	
19.30 - 20.30	**Dinner**			Car Parking Area

DAY 3: 8th November 2019, Friday				
9.30 - 11.00	**Plenary Session 5** **Climate: Economics and Institutions** (Auditorium Main Hall)			
	Keynote Address: Institutional Reforms for Managing the Environment in India	Keynote Address: Dealing With the Climate in an Efficient, Fair and Feasible Manner: What Can We Learn from Economics?	Keynote Address: Climate Change, Forests and Biodiversity: Impact, Vulnerability and Adaptation – Challenges and Opportunities	
11.10 - 11.30	**Tea/Coffee Break**			Car Parking Area
11.30 - 13.00	**Panel Session (PS) 3 (Parallel)**			
	PS 3.1: Climate Change and Indian Agriculture: Methodological Issues (Auditorium Seminar Hall)	PS 3.2: Climate Change, Adaptation and Mitigation – A Focus on Rainfed Agriculture (Seminar Hall I, First Floor, Main Building)	PS 3.3: Building Climate Resilience: Lessons from 'Commoning' the Commons (Seminar Hall II, Second Floor, Main Building)	PS 3.4: Climate Change Vulnerability Assessment in the Indian Himalayan Region (Class Room, Ground Floor, Main Building)
13.00 - 14.00	**Lunch**			Car Parking Area
14.00 - 16.00	**Technical Session (TS) 3 (Parallel)**			
	TS 3.1: Ecosystem Services, Resource Dependency and Disaster Recovery (Auditorium Seminar Hall)	TS 3.2: Climate Mitigation: Industry and Infrastructure (Seminar Hall I, First Floor, Main Building)	TS 3.3: Conservation, Economic Value and Climate Change Impact (Seminar Hall II, Second Floor, Main Building)	TS 3.4: Sustainability: Infrastructure Health and Water (Classroom, Ground Floor, Mair Building)
16.00 - 16.30	**Tea/Coffee Break**			Car Parking Area
16.30 - 17.30	**Valedictory Session**			Auditorium Seminar Hall

Pre-Conference Workshop

On

Behavioural and Experimental Economics for Environmental Policy

Date: 5th November 2019

Venue: Auditorium Seminar Hall, CESS, Hyderabad.

A one-day pre-conference workshop on Behavioural and Experimental Economics for Environmental Policy is scheduled at the Centre for Economic and Social Studies (CESS), Hyderabad, the venue for the Tenth INSEE Biennial Conference.

This workshop proposes to provide a theoretical background of behavioural and experimental economics, their applications in various fields with emphasis on environmental and natural resource economics. Case studies involving field experiments conducted among farmers in Bhavani river basin and among households of Coimbatore city will be demonstrated. Hands on practice session will focus on participants gaining insights into design and implementation of laboratory and field experiments as well as natural experiments. The schedule is as follows:

Time	Topic / activity	Resource person(s)
08.30 - 09.00	Registration	
09.00 - 10.15	Behavioural Economics - An introduction to principles and methods	L.Venkatachalam RBI Chair Professor, Madras Institute of Development Studies, Chennai.
10.15-10.30	Discussions	
10.30-10.45	Coffee break	
10.45-12.00	Experimental Economics - Theoretical and methodological overview	R.Balasubramanian Professor of Agricultural Economics, Tamil Nadu Agricultural University.
12.00 - 12.15	Discussions	
12.15 - 1.15	Experimental Economics - An illustrative example from field experiment	L.Venkatachalam
13.15 - 14.15	Lunch Break	
14.15 - 15.30	Experimental Economics - Experiences from the field	R.Balasubramanian
15.30-15.45	Tea Break	
15.45-17.00	Experimental Economics and Environmental Policy	R.Balasubramanian & M. Manjula, MSSRF.
17.00 - 17.30	Discussions and feedback	M.Manjula and workshop participants

There are about 30 participants in this Pre-Conference Workshop.

Post-Conference Workshop

On

Non-market Valuation of Environmental Goods and Services

Date: 9th November 2019

Venue: Auditorium Seminar Hall, CESS, Hyderabad.

Indian Society for Ecological Economics (INSEE) in collaboration with the South Asian Network for Development and Environmental Economics (SANDEE) and Centre for Economic and Social Studies (CESS), Hyderabad, has scheduled a one-day Post-Conference Workshop on Non-Market Valuation of Environmental Goods and Services on November 9th, 2019 at the Centre for Economic and Social Studies (CESS), Hyderabad, the venue for its Tenth Biennial Conference. This one-day workshop will cover fundamentals of non-market valuation of environmental goods and services, in terms of theory and empirics. The schedule is as follows:

Time	Topic / activity		Resource person(s)
09:45 - 10:00	**Introductions**		
10:00 - 11:30	Session I:	Review of the theories of the environmental valuation	Prof. Enamul Haque, East West University, Dhaka
11:30 - 12:00	**Coffee/Tea Break**		
12:00 - 13:30	Session II	Applications of environmental valuation inSouth Asia	Prof. Pranab Mukhopadhyay, Goa University, Goa
13:30 - 15:00	**Lunch break**		
15:00 - 16:30	Session III	Writing a good research proposal for valuation of environmental goods and services	Dr. Mani Nepal, Program Coordinator SANDEE & Lead Economist
16:30 - 17:00	Closing session		

There are about 35 participants in this Post-Conference Workshop.

PROGRAMME

DAY 1: 6th November 2019, Wednesday

(Venue: Auditorium)

08.30-09.30: Registration

09.15-11.30: Inaugural Session

Chair : C.H. Hanumantha Rao
(Past President of INSEE, Former Chairman and Honorary Professor, Centre for Economic and Social Studies, Hyderabad)

09.15-09.25	Introduction	**Lavanya Suresh** Member, Local Organising Committee
09.25-09.35	Welcome	**E Revathi** Director, Centre for Economic and Social Studies, Hyderabad
09.35-9.40	Inauguration	Lighting of the Lamp
09.40-10.10	Inaugural Address: *Imperatives for Confronting Climate Change and Natural Disasters*	**Vinod Thomas** Former Senior Vice President, The World Bank; Special Adviser to the President, Dean of Asian Institute of Management, Manila; Visiting Professor, National University of Singapore and Former Director General of International Evaluation, Asian Development Bank.
10.10-10.40	Address by the Guests of Honour	**V Praveen Rao** Vice Chancellor, Prof. Jayashankar Telangana State Agriculture University, Hyderabad **Rajeev Ahal** Director, Natural Resource Management, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India **W. R. Reddy**, IAS Director General, National Institute of Rural Development and Panchayati Raj, Hyderabad **Malavika Chauhan / Amitanshu Choudhary** Tata Trust, Mumbai
10.40-11.10	Presidential Address	**K N Ninan** President, Indian Society for Ecological Economics, New Delhi
11.10-11.15	About the Conference	**Jeena T Srinivasan** Organizing Secretary of the conference
11.15-11.25	Remarks by Chair	
11.25-11.30	Vote of Thanks	**Lavanya Suresh**
11.30-11.35	Group photo	Lawn in front of the auditorium
11.35-12.00	***Tea/Coffee Break***	***Car Parking Area***

12.00-13.30 (Parallel):Panel Session (PS) 1

PS 1.1: How IWRM in India can be more Climate Resilient?

(**Venue:** Auditorium Seminar Hall)

Chair/Moderator: Rajeev Ahal
(Director, Natural Resource Management, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India)

12.00-13.30

Speakers:

Jagdish Purohit
Programme Director, Society for Promotion of Wasteland and Development, New Delhi

Jyothis Sathyapalan
Professor, NIRDPR

(TBA)
Official from Environmental Protection Training and Research Institute (EPTRI)

PS 1.2: Climate & Disaster Resilient Urban Development

(**Venue:** Seminar Hall I, 1st Floor, Main Building)

Chair/Moderator: Jyoti K Parikh
(Executive Director, Integrated Research and Action for Development (IRADe), Delhi)

Rohit Magotra
(Deputy Director, Integrated Research and Action for Development (IRADe), Delhi)

12.00-13.30

Speakers:

V Srinivasa Chary
Director, Centre for Energy, Environment, Urban Governance and Infrastructure Development, Administrative Staff College of India, Hyderabad

Lipika Nanda
Vice President, Multi-sectoral Planning in Public Health, PHFI

Rajkiran Bilolikar
Associate Professor, Centre for Energy, Environment, Urban Governance and Infrastructure Development, Administrative Staff College of India, Hyderabad

PS 1.3: Adapting to Climate Change in South Asian Cities (SANDEE-ACD Panel)

(**Venue:** Seminar Hall II, 2nd Floor, Main Building)

Chair/Moderator: E. Somanathan

(Professor, Economics and Planning Unit, Indian Statistical Institute, New Delhi)

12.00-13.30		*Speakers:* **Mani Nepal** Program Coordinator SANDEE & Lead Economist, International Center for Integrated Mountain Development, Nepal **A K Enamul Haque** Professor, East-West University and Executive Director, Asian Centre for Development, Bangladesh **Muntaha Rakib** Associate Professor, Shahjalal University of Science and Technology, Sylhet, Bangladesh **Ismat Ara Pervin** Institute of Water Modelling, Bangladesh
13.30-14.30	***Lunch***	***Car Parking Area***

14.30- 16.00: Plenary Session 1

Climate Resilient Growth in India: Strategies and Measures

(**Venue:** Auditorium Main Hall)

Chair: Shreekant Gupta

(Professor, Delhi School of Economics and Vice President, Indian Society for Ecological Economics)

14.30-14.40	Introduction	**Shreekant Gupta**
14.40-15.10	Keynote address: *Low Carbon Strategy for Inclusive Growth*	**Kirit Parikh** Chairman, Integrated Research and Action for Development, (IRaDe), New Delhi.
15.10-15.40	Keynote address: *Water Security and Climate Change Adaptations: Experiences and Way Forward*	**Rajeev Ahal** Director, Natural Resource Management, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India
15.40-15.50	Discussion	
15.50-16.00	Remarks by Chair	**Shreekant Gupta**
16.00-16.30	***Tea/Coffee Break***	***Car Parking Area***

16.30-18.00 (Parallel): Technical Session (TS) 1

TS 1.1: Growth, Human Well Being and SDGs

(Auditorium Seminar Hall)

Chair: M N Murty
(Former Professor, Institute of Economic Growth, Delhi)

Co-chair: Amalendu Jyotishi
(Professor, Amrita Visawa Vidhyapeetham, Bengaluru)

16.30-16.45	*Ability-Biased Technical change, Economic Growth and the Environment*	**Saheli Das** and Meeta Keswani Mehra
16.45-17.00	*Issue of Conditional Green Convergence: A Study of Selected OECD Countries*	**Abhishek Dutta** and Maniklal Adhikary
17.00-17.15	*Depreciation of Capital due to Natural Disasters and Adjusted Net Domestic Product*	**Amarendra Das,** Dasarathi Padhan and Chinmayee Sahoo
17.15-17.30	*Gender Equality, Food Security and the Sustainable Development Goals*	**Bina Agarwal**
17.30-17.45	*Fiscal Transfers, Natural Calamities and Partisan Politics - Evidence from India*	**Anubhab Pattanayak** and K.S. Kavi Kumar
17.45-17.55	Discussion	
17.55-18.00	Remarks by Chair/Co-chair	

16.30-18.00 (Parallel): Technical Session (TS) 1

TS 1.2: Vulnerability, Impact and Adaptation to Climate Change

(Venue: Seminar Hall I, 1st Floor, Main Building)

Chair: Malavika Chauhan / Amitanshu Choudhary
(Tata Trust, Mumbai)

Co-chair: Rakesh Kumar Sharma
(Associate Professor, Himachal Institute of Public Administration, Shimla)

16.30-16.45	*Climate Change in the Agriculture Sector Across Different Agro-Ecosystems: A Micro Level Analysis from Four Southern States of India*	**Sushanta Mahapatra,** G Sridevi and Amalendu Jyotishi
16.45-17.00	*Impact of 2018 Flood on Riverine Micro Ecosystems: A Case Study in Manali River at Thrissur, Kerala*	**P. Athulya,** T.V. Sajeev and S. Rajathy
17.00-17.15	*Socio-Economic-Environmental Impacts of Climate Change Aspirational District (Haryana)*	**Susmita Mitra,** Pradeep K. Mehta and Sudipta Kumar Mishra

17.15-17.30	*Valuing the Carbon Sequestration Regulation Service by Hokersar Wetland of Kashmir Himalaya*	**Irfan Rashid,** Ishfaq Ahmad Sheergojri, Ishfaq ul Rehman and Irfan Rashid
17.30-17.45	*Impact of Environmental Shocks on Livelihood Diversification in Rural India: Evidence from Large Scale Survey Data*	**Chhavi Tiwari** and Sankalpa Bhattacharjee
17.45-17.55	General discussion	
17.55-18.00	Remarks by Chair/Co-chair	

16.30-18.00 (Parallel): Technical Session (TS) 1

TS 1.3: Vulnerability to Floods

(Venue: Seminar Hall II, 2nd Floor, Main Building)

Chair: Amita Shah

(Past President of INSEE and Former Professor and Director, Gujarat Institute for Development Research, Ahmedabad)

Co-chair: Prajna Paramita Mishra
(Assistant Professor, University of Hyderabad)

16.30-16.45	*Flood Vulnerability of Marginal Caste Communities in the Kosi Region North Bihar*	**Ranjeet Kumar Sahani,** Siddhartha Krishnan and Shrinivas Badiger
16.45-17.00	*Assessing the Determinants of Social Vulnerability to Floods in Bihar, India*	**Rupak Kumar Jha** and Haripriya Gundimeda
17.00-17.15	*India's Preparedness to Address Urban Flood Through Institutional Mechanism*	**Satarupa Rakshit** and Zareena Begum Irfan
17.15-17.30	*A Review of the Kerala Flood - Assessing Losses, Damages and Recovery Pattern*	**Harshan T. P**
17.30-17.55	Discussion	
17.55-18.00	Remarks by Chair/Co-chair	

16.30-18.00 (Parallel): Technical Session (TS) 1

TS 1.4: Environmental and Climate Justice

(Venue: Classroom, Ground Floor, Main Building)

Chair: Jayanta Bandyopadhyay
(Past President of INSEE and Former Professor, Indian Institute of Management, Kolkotta)

Co-chair: Brototi Roy
(Ph.D Student, Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain)

16.30-16.45	*Relocation from Protected Areas as Violent Process in the Recent History of Biodiversity Conservation in India*	**Eleonora Fanari**
16.45-17.00	*Change in Climate, Cropping Pattern and Food Sovereignity in Eastern Himalayan Hills*	**Deena Gurung**
17.00-17.15	*Alternative Ways of Understanding Ecological Conservation Practices to Enable Environmental Justice for All*	**Lavanya Suresh** and Anwesha Mohanty
17.15-17.30	*Climate Justice: Is a Robust Legal Framework Need of the Hour?*	**Rakesh Chandra**
17.30-17.45	*Measuring the Socio-economic Vulnerability of the Coastal Ecosystem: A Case Study of Indian Sundarbans*	**Sneha Biswas**
17.45-17.55	Discussion	
17.55-18.00	Remarks by Chair/Co-chair	

18.15-18.45: Session by Springer
(Auditorium Main Hall)

18.15-18.45	Publishing Ethically: Best and Not-so-Good Practices	**Nupur Singh, Springer Nature**

18.45-19.45 INSEE General Body Meeting
(Auditorium Seminar Hall) (For INSEE Members Only)

19.30-20.30	***Cultural Programme***	***Auditorium Main Hall***
20.30 -21.30	***Dinner***	***Car Parking Area***

DAY 2: 7th November 2019, Thursday

09.15-10.15: Plenary Session 2

Bina Agarwal Prize - Award Ceremony

(Venue: Auditorium Main Hall)

Chair: K N Ninan
(President, Indian Society for Ecological Economics)

09.15-09.20	Welcome	**K N Ninan**
09.20-09.30	About the Prize	**Bina Agarwal** Donor of the Prize
09.30-09.35	Reading of the Citation	**E Somanathan** Member, Prize Jury
09.35-09.45	Presentation of the Award and Citation	**Bina Agarwal and E Somanathan respectively**
09.45-10.10	Response by the awardee	**Joan Martinez Alier** Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain
10.10-10.15	Vote of thanks	**Jeena T Srinivasan,** Secretary, Indian Society for Ecological Economics
10.15-10.30	***Tea/Coffee Break***	***Car Parking Area***

10.30-12.00: Plenary Session 3

The Work and Findings of the Intergovernmental Panel on Climate Change

(Venue: Auditorium Main Hall)

Chair: Thomas Sterner
(Professor of Environmental Economics, University of Gothenburg, Sweden)

10.30 -11.30	*Climate Science and Models*	**Krishna Achuta Rao** Associate Professor, Centre for Atmospheric Sciences at Indian Institute of Technology, Delhi
	Main Messages from Special Report on 1.5^0 C in Sustainable Development Context	**Joyashree Roy** Bangabandhu Chair Professor at AIT, Thailand and Professor (on lien), Department of Economics, Jadavpur University

	Special Report on the Ocean and Cryosphere in a Changing Climate	**Anjal Prakash** Associate Professor and Associate Dean - Business Development at TERI-SAS Hyderabad Campus
	Special report on Climate Change and Desertification, Degradation, Sustainable Land Management, Food Security and Greenhouse Gas Fluxes in Terrestrial Ecosystems	**Jagdish Krishnaswamy** Ashoka Trust for Ecology and the Environment (ATREE), Bengaluru
	IPCC process and Scope for Participation in AR6	**Joyashree Roy** Bangabandhu Chair Professor at AIT, Thailand and Professor (on lien), Department of Economics, Jadavpur University
11.30-12.00	Discussion	

12.00 - 13.00 Plenary Session 4

Felicitations

(Venue: Auditorium Main Hall)

Chair: K N Ninan

(President, Indian Society for Ecological Economics)

Conferring the Lifetime Achievements Award on:	**C H Hanumantha Rao** Past President of INSEE and Resident of Hyderabad
Conferring the Honour and Title of INSEE Fellows on:	**M N Murty** Professor (Retired) and Senior Consultant, Institute of Economic Growth, Delhi
	Ramprasad Sengupta Professor Emeritus of Economics, Centre for Economic Studies and Planning, & Former Dean of School of Social Sciences, Jawaharlal Nehru University, New Delhi
	Madhu Verma Professor, Indian Institute of Forest Management, Bhopal
13.00-14.00 ***Lunch***	***Car Parking Area***

14.00-16.00 (Parallel): Technical Session (TS) 2

TS 2.1: Climate Vulnerability: Agriculture and Food Security

(Venue: Auditorium Seminar Hall)

Chair: Gopal Kadekodi
(Past President of INSEE and Honorary Professor, Centre for Multi-disciplinary Research, Dharward)

Co-chair: Krishan Tyagi
(Natural Resource Management Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, India.)

14.00-14.15	*District Scale Vulnerability Index to Climate Variability for Vidarbha Region, Maharashtra, India*	**Deepika Swami** and Devanathan Parthasarathy
14.15-14.30	*Climate Change and Paddy Cultivation: The Relevance of GI Tagged Pokkali Rice from Kerala*	**Soumya Vinayan** and N Lalitha
14.30-14.45	*Climate Change, Food Security and Poverty of Vulnerable Groups: A Case of Two Villages*	**G Sridevi** and Amalendu Jyotishi
14.45-15.00	*Loss and Damage from Floods in India: Influence of Human Development, Income and Inequality*	**Chandra Sekhar Bahinipati** and Unmesh Patnaik
15.00-15.15	*Studying the Climate Change Risk for Finger Millet Crop: Empirical Evidence from Karnataka*	**Pradyot Ranjan Jena** and Rajesh Kalli
15.15-15.30	*Stress Adaptation and Farmer Preferences: A Bidding Experiment on Stress Tolerant Rice Varieties (STRVs) in Eastern India*	**Lisa Mariam Varkey,** Vikram Patil and Prakashan Chellattan Veettil
15.30-15.50	Discussion	
15.50-16.00	Remarks by Chair/Co-chair	
16.00-16.30	***Tea/Coffee Break***	***Car Parking Area***

14.00-16-00 (Parallel): Technical Session (TS) 2

TS 2.2: Adaptation of Agriculture to Climate Change

(Venue: Seminar Hall I, 1st Floor, Main Building)

Chair: Bina Agarwal
(Professor, Manchester University, U.K and Former Director, Institute of Economic Growth)

Co-chair: R Balasubramanian
(Professor, Tamil Nadu Agricultural University, Coimbatore)

14.00-14.15	*Scaling - up of Climate Resilient Agricultural Practices through Sustainable Livelihood and Adaptation to Climate Change (SLACC)*	**V. Suresh Babu,** K. Krishna Reddy, Ravindra S. Gavali, Basavaraj Patil, A. Bhagawat
14.15-14.30	*Impact of short duration climate smart variety on cropping pattern of indigenous agricultural systems*	**Prabhakaran T. Raghu,** Prakashan C. Veettil and Mayank Sharma
14.30-14.45	*Crop Insurance for Adaptation to Climate Change in Odisha: Some Micro-Evidence from Bolangir District*	**Mamata Swain** and Basanti Renu Hembram
14.45-15.00	*Multi-criteria analysis and ex-ante assessment to priortise and scale up climate smart agriculture in semi-arid tropics, India*	**Shalander Kumar,** K Dakshina Murthy, Elias Khan Patan, Murali K Gumma, Arun Khatri-Chhetri and Anthony Whitbread.
15.00-15.30	Discussion	
15.30-16.00	Remarks by Chair/Co-chair	
16.00-16.30	Tea/Coffee Break	**Car Parking Area**

14.00-16-00 (Parallel): Technical Session (TS) 2

TS 2.3: Climate Resilient Measures in Rural India

(Venue: Seminar Hall II, 2nd Floor, Main Building)

Chair: M Gopinath Reddy
(Former Professor and Consultant, Centre for Economic and Social Studies, Hyderabad)

Co-chair: Meekha Hannah Paul
(Natural Resource Management, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India)

14.00-14.15	*Building A Climate Resilient Rural India: Nature-based-Solutions for Water Ecosystems in MGNREGA Programs.*	**Neeraj Mishra,** Jyothis Satyapalan and Anagha Mariya Jose

14.15-14.30	*Addressing Climate Resilience approaches through MGNREGS Assets in Telangana State*	**P. Anuradha,** K. Jayasree, V. Suresh Babu and V. Srinivasa Rao
14.30-14.45	*Assets Creation under MGNREGS and its Contribution to Adaptive Capacity of the Rural Communities in Drought Prone Districts of Rajasthan and Karnataka*	**Anagha Mariya Josea** and Anuradha Palla
14.45-15.00	*Adoption of Soil Conservation Measures: Evidence from Rain-Fed Watershed Areas of Telangana*	**Dayakar Peddi**
15.00-15.15	*Re-looking into Micro Irrigation Models in India to Adapt to Climate Change*	**Krishna Reddy Kakumanu,** Shrikant V Mukate, V Suresh Babu and Ravindra S Gavali
15.30-15.50	Discussion	
15.50-16.00	Remarks by Chair/Co-chair	
16.00-16.30	***Tea/Coffee Break***	***Car Parking Area***

14.00-16-00 (Parallel): Technical Session (TS) 2

TS 2.4: Institutions and Sustainability

(Venue: Classroom, Ground Floor, Main Building)

Chair: Madhu Verma
(Professor, Indian Institute of Forest Management, Bhopal)

Co-chair: L Venkatachalam
(Professor, Madras Institute of Development Studies, Chennai)

14.00-14.15	*How Do Water Institutions Perform? The Case of Canal Water User Association in South India*	**Durga A.R,** K. Chandran and D. Suresh Kumar
14.15-14.30	*Interventions for Sustainable Fishing in Sundarbans: A Scoping Analysis*	**Saptarsi Chakraborty**
14.30-14.45	*Framing Management Plan for the Conservation of Sacred Groves of Kachch, Gujarat, Based on Stakeholders' Analysis*	**Amit Pandey** and Kavita Sardana
14.45-15.00	*Adaption of Grid Connected Solar Rooftop Systems in the State of Jammu and Kashmir: A Stakeholder Analysis*	**Aaina Dutta Das** and Sukanya Das

15.00-15.15	*Clean Energy at the Cost of Food? Effects of Hydro-electric Projects on Local Agriculture in Sikkim*	**Bickey Sharma**
15.15-15.45	Discussion	
15.45-16.00	Remarks by Chair/Co-chair	
16.00-16.30	***Tea/Coffee Break***	***Car Parking Area***

16.30-18.00: Panel Session (PS) 2

PS 2.1: Local Action Plan on Climate Change: Methodology and Action

(Venue: Auditorium Seminar Hall)

Chair/Moderator: Joy Elamon
(Director, Kerala Institute of Local Administration, Thrissur)

16.30-18.00

Speakers:

Sunny George
Professor, Kerala Institute of Local Administration, Kerala

J B Rajan
Associate Professor, Kerala Institute of Local Administration, Kerala

K S Shibu
President, Perumbalam Grama Panchayat, Kerala

K. Sobha
Secretary, Perumbalam Grama Panchayat, Kerala

Sasidharan Nair
Resource Person, Perumbalam Grama Panchayat, Kerala

PS 2.2: Martin Weitzman's Contributions to Environmental Economics

(Venue: Seminar Hall 1, 1st Floor, Main Building)

Chair/Moderator: Thomas Sterner
(Professor of Environmental Economics, University of Gothenburg, Sweden)

Speakers:

16.30-18.00

Shreekant Gupta
Professor, Delhi School of Economics, Delhi

M N Murty
Professor (Retired), Institute of Economic Growth, Delhi

Ramprasad Sengupta
Professor Emeritus of Economics, Centre for Economic Studies and Planning, & Former Dean of School of Social Sciences, Jawaharlal Nehru University, New Delhi

PS 2.3: **MGNREGS Contribution to Climate Change Mitigation and Adaptation**
(Venue: Seminar Hall II, 2nd Floor, Main Building)

Chair/Moderator: Jyothis Sathyapalan
(Professor, CWE, National Institute of Rural Development and Panchayati Raj, Hyderabad)

16.30-18.00 *Speakers:*

N H Ravindranath
Former Professor, Indian Institute of Science, Bengaluru

A Digambar
Associate Professor, National Institute of Rural Development and Panchayati Raj, Hyderabad

Neeraj Mishra
Associate Professor, National Institute of Rural Development and Panchayati Raj, Hyderabad

P Anuradha
Assistant Professor, National Institute of Rural Development and Panchayati Raj, Hyderabad

19.30-20.30 ***Dinner*** ***Car Parking Area***

DAY 3: 8th November 2019, Friday

9.30-11.00: Plenary Session 5

Climate: Economics and Institutions
(Auditorium Main Hall,)

Chair: Kanchan Chopra
(Past President, Indian Society for Ecological Economics and Former Professor and Director, Institute of Economic Growth, Delhi)

		Speakers:
09.30-09.35	Introduction	**Kanchan Chopra**
09.35-10.00	*Keynote address:*	
	Institutional Reform for Managing the Environment in India	**E Somanathan** Professor, Economics and Planning Unit, Indian Statistical Institute, New Delhi
10.00-10.25	Keynote address:	
	Dealing With the Climate in an Efficient, Fair and Feasible Manner: What Can We Learn from Economics?	**Thomas Sterner** Professor, University of Gothenburg, Sweden
10.25-10.50	Keynote address:	
	Climate Change, Forests and Biodiversity: Impact, Vulnerability and Adaptation - Challenges and Opportunities	**N H Ravindranath** Former Professor, Indian Institute of Science, Bengaluru
10.50-11.10	Discussion and remarks by Chair	
11.10-11.30	***Tea/Coffee Break***	***Car Parking Area***

11.30-13.00 (Parallel): Panel Session (PS) 3

PS 3.1: Climate Change and Indian Agriculture: Methodological Issues

(Venue: Auditorium Seminar Hall)

Chair/Moderator: Anubhab Pattanayak
(Assistant Professor, Madras School of Economics, Chennai)

11.30-13.00		***Speakers*** **:** **Sonal Barve** Research Intern, RBI, Mumbai **Dayakar Peddi** Assistant Professor Centre for Economic and Social Studies **K S Kavi Kumar** Professor, Madras School of Economics

PS 3.2: Climate Change, Adaptation and Mitigation - A Focus on Rainfed Agriculture

(Venue: Seminar Hall I, 1st Floor, Main Building)

Chair/Moderator: E Revathi
(Director, Centre for Economic and Social Studies)

11.30-13.00

B Venkateswarlu
Former Vice-Chancellor, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra and Former Director, Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, Telangana

Ravindra Chary
Director, CRIDA, Hyderabad

Nambi Appadurai
Director (Climate Resilience Practice), World Resources Institute, Bengaluru, Karnataka

S Naresh Kumar

Professor and Principal Scientist, Centre for Environment Science and Climate Resilient Agriculture, PUSA, New Delhi

PS 3.3: Building Climate Resilience: Lessons from 'Commoning' the Commons

(Venue: Seminar Hall II, 2nd Floor, Main Building)

Chair/Moderator: Rucha Ghate
(Foundation for Ecological Security, Anand)

11.30-13.00

Speakers:

Pratiti Priyadarshini
Foundation for Ecological Security, Anand

Himani Sharma
Foundation for Ecological Security, Anand

Shiwanaya Rawat
Foundation for Ecological Security, Anand

Liya Thomas
Foundation for Ecological Security, Anand

PS 3.4: Climate Change Vulnerability Assessment in the Indian Himalayan Region

(Venue: Classroom, Ground Floor, Main Building)

Chair/Moderator: Anamika Barua
(Associate Professor, Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati)

11.30-13.00		*Speakers:* **Shyamasree Dasgupta** Assistant Professor, School of Humanities and Social Sciences, Indian Institute of Technology Mandi, Himachal Pradesh **N H Ravindranath** Former Professor, Indian Institute of Science, Bengaluru **T Brajakumar Singh** Directorate of Environment and Climate Change, Government of Manipur
13.00-14.00	***Lunch***	***Car Parking Area***

14.00-16.00 (Parallel): Technical Session 3

TS 3.1: Ecosystem Services, Resource Dependency and Disaster Recovery
(Venue: Auditorium Seminar Hall)

Chair: P S Easa
(Former Director, Kerala Institute of Forest Research, Thrissur)

Co-chair: Santadas Ghosh
(Associate Professor, Department of Economics & Politics, Visva-Bharati, Santiniketan)

14.00-14.15	*Post-disaster Recovery in Coastal Fishing Communities*	**Trupti Mishra** and Krishna Malakar
14.15-14.30	*An Economic Analysis of the Impacts of Anthropogenic Climate Change on Agriculture: A Case Study on Hyderabad Karnataka and Coastal Areas*	**Jagadeesh** and P. S Sasdhar
14.30-14.45	*Cultural Ecosystem Services and Forest Dependency- Assessment of Recreational Demand for Parambikulam Tiger Reserve, Kerala, India*	**Divya Soman and V. Anitha**

14.45-15.00	*Reducing Ecological Stress through Subsidized Rice: Findings from Sundarbans Delta*	**Sreejit Roy**
15.00-15.15	*Prediction Modelling for Land Use Land Cover (LULC) in the Urmodi River Watershed, Maharashtra*	**Wasim A. Bagwan** and Ravindra S. Gavali
15.15-15.45	Discussion	
15.45-16.00	Remarks by Chair/Co-chair	

14.00-16.00 (Parallel): Technical Session 3

TS 3.2: Climate Mitigation: Industry and Infrastructure

(Venue: Seminar Hall 1, 1st Floor, Main Building)

Chair: Pranab Mukhopadhyay
(Past President of INSEE and Professor, University of Goa, Goa)

Co-chair: Tapas Kumar Sarangi
(Assistant Director, National Institute of Labour Economics Research and Development, Delhi)

14.00-14.15	*Potential Mitigation Strategies for Road Transport Sector of India*	**Namita Singh,** Trupti Mishra and Rangan Banerjee
14.15-14.30	*Green Growth and the Right to Energy in India*	**Rohit Azad** and Shouvik Chakraborty
14.30-14.45	*Adoption of Renewable Energy: Challenges in the Household Sector*	**Smita Bhaskar**
14.45-15.00	*Carbon Mitigation and Fuel Efficiency Improvement Strategy for North Indian Brick Industry*	**Priyanka Jajal,** Trupti Mishra, Chandra Venkataraman and Alok Jhaldiyal
15.00-15.15	*Environmental Disclosure Regulation and Decarbonization of Indian Industries: Evidence from FirmLevel Data*	**Mousami Prasad**
15.15-15.35	*Estimating Shadow Price of Water Pollutants: A Case of Kanpur Leather Industry in India*	**Aparajita Singh** and Haripriya Gundimeda
15.35-15.55	Discussion	
15.55-16.00	Remarks by Chair/Co-chair	

14.00-16.00 (Parallel): Technical Session 3

TS 3.3: Conservation, Economic Value and Climate Change Impact

(Venue: Seminar Hall II, 2nd Floor, Main Building)

Chair: K S Kavi Kumar
(Professor, Madras School of Economics, Chennai)

Co-chair: Manjula Menon
(MS Swaminathan Research Foundation, Chennai)

14.00-14.15	*Conserving Mangroves in Sundarbans through Clean Cooking Fuel: Field Evidences*	**Tapas Kumar Sutradhar**
14.15-14.30	*Estimating the Economic Benefits of Universal Health Coverage for Climate-Induced Diseases in Southwest Coastal Region of Bangladesh*	**Prakash Kumar Sahoo,** Yashobanta Parida, Prarthna Agarwal Goel and Tapaswini Nayak
14.30-14.45	*Does Economic Development and Disaster Adaptation Measures Reduce the Impact of Natural Disasters? A District Level Analysis from the State of Odisha, India*	**Prakash Kumar Sahoo,** Yashobanta Parida, Prarthna Agarwal Goel and Tapaswini Nayak
14.45-15.00	*Marginal Value of Sub-Watershed Treatment on Profit and labour Demand in Darjeeling District, India*	**Chandan Singha**
15.00-15.15	*A Time Series Study of Monsoon Rainfall Behaviour in Odisha - 1871 to 2016: An inquest into Climate Change*	**Abhilas Kumar Pradhan**
15.15-15.35	*Fertilizer Use and Rainfall Shocks in Indian Agriculture*	**Kaushik Bora**
15.35-15.55	Discussion	
15.35-15.55	Remarks by Chair/Co-chair	

14.00-16.00 (Parallel): Technical Session 3

TS 3.4: Sustainability: Infrastructure, Health and Water

(Venue: Class Room, Ground Floor, Main Building)

Chair: C Ramachandraiah

(Professor, Centre for Economic and Social Studies, Hyderabad)

Co-chair: K H Anantha

(Scientist, International Crop Research Institute for Semi-arid Tropics, Hyderabad)

14.00-14.15	*Is Electric Street Car a Sustainable Public Transport System in India? A Demand Side Analysis*	**Oindrila Dey** and Debalina Chakravarty
14.15-14.30	*Sanitation Deficiency Induced Health Costs in the Slums of Lucknow, Uttar Pradesh*	**Sanatan Nayak** and Soma Samanta
14.45-15.00	*Circular Sanitation Economy in India: Evidence from Amberpet Sewage Treatment Plant, Hyderabad*	**Sourav Mohanty** and Prajna Paramita Mishra
15.00-15.15	*The Economic and Environment Benefits of System of Rice Intensification: The Case of Telangana State*	**Ramdas Dagam**
15.15-15.30	*Integrating Economic and GIS Modelling to Evaluate Watershed Interventions Under Changing Climate*	**Josily Samuel,** CA Rama Rao, BMK Raju, Pushpanjali Nagarjuna Kumar and G Ravindra Chary
15.30-15.45	Discussion	
15.45-16.00	Remarks by Chair/ Co-chair	
16.00-16.30	***Tea/Coffee Break***	***Car Parking Area***

16.30 - 17.30: Valedictory Session

(Venue: Auditorium Seminar Hall)

Chair: E Revathi, Director, CESS

16.30-16.35	Welcome	
16.35-16.45	Overview of the Conference Deliberations	**Shreekant Gupta,** Vice President, INSEE
16.45-17.00	Valedictory Address	**Gopal Kadekodi and** Past President of INSEE and Honorary Professor, Centre for Multi-disciplinary Research, Dharwad
17.00-17.15	Remarks by Chief Guest	**C Parthasarathi,** IAS Principal Secretary, Department of Agriculture, Government of Telangna
17.15-17.30	Vote of thanks	**Jeena T Srinivasan** Organising Secretary

List of Rapporteurs					
Event		Name of the Rapporteur	Date	Time	Venue
Inaugural Session		E.B. Uday Bhaskar Reddy Sourav Mohanty	6th November	09:15-11:30	Auditorium
Panel Session 1.1	How IWRM in India can be more Climate Resilient?	Gandam Thilothu Rao Anwesha Mohanty(BITS)	6th November	12:00-13:30	Auditorium Seminar Hall
Panel Session 1.2	Climate & Disaster Resilient Urban Development	Gundapu Bhanu Chander Medha.A.S	6th November	12:00-13:30	Seminar Hall I Main Building
Panel Session 1.3	Adapting to Climate Change in South Asian Cities (*SANDEE-ACD Panel)*	N. Shankar Annemalla Ramesh	6th November	12:00-13:30	Seminar Hall II Main Building
Plenary Session 1	Climate Resilient Growth in India: Strategies and Measures	Shoeb Ahmed Srija Mitra	6th November	14:30-16:00	Auditorium Main Hall
Technical Session 1.1	Growth, Human Well Being and SDGs	Gattu Ramesh Gayathri Bhonagiri (TISS)	6th November	16:30-18:00	Auditorium Seminar Hall
Technical Session 1.2	Vulnerability, Impact and Adaptation to Climate Change	D. Ramdas Arun Balaji	6th November	16:30-18:00	Seminar Hall I Main Building
Technical Session 1.3	Vulnerability to Floods	Tamatapu Rama Priya Sravani Labisetty	6th November	16:30-18:00	Seminar Hall II Main Building
Technical Session 1.4	Environmental and Climate Justice	B.Padmapriya Guguloth Jeevan	6th November	16:30-18:00	Classroom, Ground Floor, Main Building
Plenary Session 3	The Work and Findings of the Intergovernmental Panel on Climate Change	Bishaka Ghosh YS.Prakash Anil	7th November	10:30-12:00	Auditorium Main Hall
Technical Session 2.1	Climate Vulnerability: Agriculture and Food Security	Moulkar Rajeshwar Saroja Sree	7th November	14:00-16:00	Auditorium Seminar Hall
Technical Session 2.2	Adaptation of Agriculture to Climate Change	M.Ravikumar Lingaiah Meesala	7th November	14:00-16:00	Seminar Hall I Main Building
Technical Session 2.3	Climate Resilient Measures in Rural India	Rincy Simon Sourav Mohanty	7th November	14:00-16:00	Seminar Hall II Main Building

Event		Name of the Rapporteur	Date	Time	Venue
Technical Session 2.4	Institutions and Sustainability	K. Yadagiri Annemalla Ramesh	7th November	14:00-16:00	Classroom, Ground Floor Main Building
Panel Session 2.1	Local Action Plan on Climate Change: Methodology and Action	Dayakar Peddi M.Shimron Rao (TISS)	7th November	16:30-18:00	Auditorium Seminar Hall
Panel Session 2.2	Martin Weitzman's Contributions to Environmental Economics	R. Smrithi Dr. P. Usha	7th November	16:30-18:00	Seminar Hall I Main Building
Panel Session 2.3	MGNREGS Contribution to Climate Change Mitigation and Adaptation	Predeep Kamble Medha.A.S	7th November	16:30-18:00	Seminar Hall II Main Building
Plenary Session 5	Climate: Economics and Institutions	Jogindhar Naik R. Shital	8th November	09:30-11:00	Auditorium Main Hall
Panel Session 3.1	Climate Change and Indian Agriculture: Methodological Issues	Dayakar Peddi T. Devi Priya	8th November	11:30-13:00	Auditorium Seminar Hall
Panel Session 3.2	Climate Change, Adaptation and Mitigation –A Focus on Rainfed Agriculture	G. Bhanu Chander D. Veerabhadra Rao	8th November	11:30-13:00	Seminar Hall I Main Building
Panel Session 3.3	Building Climate Resilience: Lessons from 'Commoning' the Commons	Raju Cheviti Vinay Sankar (BITS)	8th November	11:30-13:00	Seminar Hall II Main Building
Panel Session 3.4	Climate Change Vulnerability Assessment in the India Himalayan Region	Bishnu Prasad Mohapatro Chetana VM	8th November	11:30-13:00	Classroom, Ground Floor Main Building
Technical Session 3.1	Ecosystem Services, Resource Dependency and Disaster Recovery	E.B. Uday Bhaskar Reddy Rituparna Bhattacharya	8th November	14:00-16:00	Auditorium Seminar Hall
Technical Session 3.2	Climate Mitigation: Industry and Infrastructure	Abhinav Deekonda Arun Balaji	8th November	14:00-16:00	Seminar Hall I Main Building
Technical Session 3.3	Conservation, Economic Value and Climate Change Impact	Shoeb Ahmed Ayushi Gupta	8th November	14:00-16:00	Seminar Hall II Main Building
Technical Session 3.4	Sustainability: Infrastructure, Health and Water	M.Rajeshwar Kopal Khare(BITS)	8th November	14:00-16:00	Classroom, Ground Floor Main Building
Valedictory Session		Chakradhar Jadhav B.Padmapriya	8th November	16:30-17:30	Auditorium Seminar Hall

Day 1: 6th November 2019

16.30-18.00 (Parallel): Technical Session (TS) 1

TS 1.1: Growth, Human Well Being and SDGs

Ability-Biased Technical Change, Economic Growth and the Environment

Saheli Das[1] and Meeta Keswani Mehra[2]

Abstract

Technical change is a major driving factor for economic growth and development of economies. During the past decades, there has been acceleration of technical change that has exhibited a skilled labour bias. At the same time, climate change due to anthropogenic activities is posing new challenges to adaptation, impacting differentially the skilled and unskilled labour force. This paper focuses on economic growth and welfare implications of simultaneous effects of ability- biased technical change and environmental quality change when the inherent ability of an individual is differentiated and she/ he responds differently to technological change as well as environmental change. We postulate an analytical continuous time endogenous growth model of differentiated human capital (in terms of ability) and endogenous technical change. The model is extended to incorporate the environmental dynamics as a by-product of final good's production. The analysis derives the trade-off between environmental degradation and economic growth on the one hand, while ability-biased technological progress improves environmental quality on the other. Accordingly, along the equilibrium path, the effects of these dynamics on consumption, production, environmental quality, inequality and aggregate economic welfare are characterized. The ability differentiation of the individuals and their decision to acquire education affects income distribution, thus generating effects on the level of wage inequality, both within-group and between-group, across distinct categories of individuals. Due to a discouragement effect, rising within-group wage inequality reduces incentives to acquire education for ordinary ability individuals, which in turn, puts a downward pressure on skill supply, and an upward pressure on both within-group and between-group wage inequalities during the period of technological progress. Thus, as economy is growing gradually, at first skill supply increases and then decreases. This non-monotonic relationship between the economic growth and skill supply generates an inverted U-shaped relationship between economic growth and environmental degradation, similar to the Environmental Kuznets Curve (EKC). As a result, economy is converging over the time from the balanced growth path. The results of the analytical model are also tested empirically, taking data for labour force and labour productivity with respect to their educational level, labour income, GDP growth as economic growth, emission of CO2, PM2.5, environmental vulnerability index as environmental degradation, gross fixed capital as physical capital investment. It is found that ability-biased technical change along with environmental quality change affects developing countries more than developed ones due to differing in constraints like, labour force structure, production of more pollution generating products etc. The empirical analysis shows that increasing between-group wage inequality decreases economic growth whereas, increasing within-group wage inequality promotes economic growth, and also the converging or diverging nature of a developing country with respect to a developed country over time due to the simultaneous effects of ability-biased technical change and environmental quality change.

Keywords: Ability-biased technical change; Endogenous growth; Environmental pollution; Within-group and between-group inequality; Income distribution; Welfare effects; Environmental Kuznets Curve; Economic convergence and divergence

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Issue of Conditional Green Convergence: A Case Study of Selected OECD Countries

Maniklal Adhikary[1] and Abhishek Dutta[2]

Abstract

GDP is not a suitable measure for sustainable economic growth because it does not consider the damages to the environment. In this paper, we adjust GDP with the real and opportunity cost of environmental resources and constructs Green GDP and test the unconditional and conditional convergence in terms of per capita Green GDP. The concepts are applied to 21 selected OECD countries for over a period of 1990-2016. The conditioning variables that proxy for the steady state of the economies are economic openness, total emissions, forest area, average years of total schooling. During the period of analysis the cross section of OECD countries exhibit divergence but unconditional and conditional convergence in per capita Green GDP.

Keywords: Green GDP; Sustainable Economic Growth; Absolute Green Convergence; Conditional Green Convergence; Absolute and Conditional Sigma Convergence.

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Depreciation of Capital due to Natural Disasters and Adjusted Net Domestic Product

Amarendra Das[1], Dasarathi Padhan[2] and Chinmayee Sahoo[3]

Abstract

In last two decades, attempts are being made to compute a better metrics to measure the national income that accounts for the environmental resources and costs. The conventional measure of GDP does not take into consideration the environmental degradations. Therefore, economists have been trying to include the depletion of natural resources as depreciation of natural capital and measure a modified Net Domestic Product. This adjusted NDP is GDP less the depreciation of physical capital and natural capital. However, this measure also does not account for the depreciation of physical capital caused by natural calamities. Some countries and states within the country face frequent natural calamities than others. Investment and physical capital are prerequisites for fast economic growth and poverty reduction. Therefore, frequent occurrence of natural disasters may deplete the physical capital base (such as public infrastructure, private enterprises etc.) and hence may reduce the capability of individuals and states to achieve fast economic growth and enhance economic wellbeing. Therefore, NDP calculation should also take into account the depreciation of physical capital caused by natural disasters.Attempts have been made in other country context to measure the full economic cost of disaster (*Rasmussen*, 2004; Gaddis *et al*., 2007; Noy 2009; Raddatz, 2009; Shabnam, 2014), and link the effects of disasters on economic growth (Hallegatte and Dumas 2009). Similarly studies (Raddatz, 2009) have attempted to differentiate the macro economic effects of climatic and other disasters. Some studies have compared the costs of disasters across geographical areas and income levels and to answer structural and policy related aspects of costs due to disasters (Noy, 2008). In Indian context, Das (2012) has attempted to understand the role of natural ecosystems and socio-economic factors in the vulnerability of coastal villages to cyclone and storm surge. To our knowledge, systematic studies on the economic accounting of loss due to natural disasters in Indian context are limited. This paper tries to account for the economic loss due to natural disasters, especially the climatic disasters, as the depreciation of capital and provide the adjusted estimate of NDP. Systematic data on economic loss due to natural disasters are limited for all Indian states. Therefore, this paper provides a methodological framework for accounting for the depreciation of the capital due to natural disasters for all Indian states and provides an approximate estimate of adjusted NDP for all Indian states. Due to availability of systematic data on the economic loss due to natural disasters, time series estimate of adjusted NDP are provided for Odisha state which experiences maximum climatic natural disasters. Calculation of adjusted NDP will be very much useful for fiscal transfer from Union to States and other economic policy making.

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Gender Equality, Food Security and the Sustainable Development Goals

Bina Agarwal[1]

Abstract

This presentation will focus on household food security as a fundamental aspect of sustainable development and examine the potential and limitations of SDG 5 in helping to achieve it. The potential is argued to lie in the attention the Goal pays to women's access to land and natural resources, which can significantly enhance women's ability to produce and procure food. Its limitations lie in a lack of attention to the production constraints that women farmers face its failure to recognise forests and fisheries as key sources of food; and its lack of clarity on which natural resources women need access to and why. Moreover, other Goals which bear on food security as important providers of nutrition, such as SDG 15 as it relates to forests and SDG 14 as it relates to fish resources, make no mention of gender equality, nor does SDG 13 (Climate action) recognise the vulnerabilities of women farmers. A bold interpretation of SDG 5 and establishing synergies with other SDGs would provide ways forward.

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Fiscal Transfers, Natural Calamities and Partisan Politics - Evidence from India

K.S. Kavi Kumar[1] and Anubhab Pattanayak[2]

Abstract

Do some sub-national governments receive higher transfers from the Central Government than others? Which channels exist for the Central Government to practice partisan politics? Taking note of the significant gap between the relief sought by the states in the context of natural calamities such as drought and the assistance given by the centre, the present study attempts to contribute to the vast literature on fiscal transfers from the Centre to different states in India with particular focus on partisan politics. The empirical analysis based on total and non-plan fiscal grants from the Centre to different states and an index of drought over the past three decades suggests that the states ruled by political party same as that at the Centre are likely to receive higher transfer from the Centre. In the absence of political alignment states not only received lower grants in a non-drought year, but if a drought of average intensity were to occur, for every unit increase in drought intensity these states also received almost 9 per cent lower grants compared to when alignment was present. The results also show that the extent of favouritism exhibited by the Centre differs across states ruled by same political party and by parties extending outside support to the Central Government. Assessment of such partisan politics over time suggests that drought as the channel through which higher grants had been provided to politically aligned states has become less important over time. Suggesting the role of partisan politics in grant allocation for drought response, the present study presents an important link in the broader literature on political economy of disaster management.

Keywords: Fiscal Federalism; Political Alignment; Natural Calamities

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16.30-18.00: (Parallel) Technical Session (TS) 1
TS 1.2: Vulnerability,Impact and Adaptation to Climate Change

Climate Change in the Agriculture Sector across Different Agro-Ecosystems: A Micro level analysis from four Southern States of India

G Sridevi[1], Amalendu Jyotishi[2] and Sushanta Mahapatra[3]

Abstract

The extreme weather condition is one of the natural factors which make the country prone to various forms of disasters. Extreme events such as drought heat waves, heavy rainfall, cyclone, flooding, etc. Natural Disasters and extreme events are the basis of the study through which we have attempted to analyze climate change vulnerability. In this context we have chosen four types of agro-ecosystem to understand the perception of the households on extreme events. Adilabad in Andhra Pradesh was for drought, Raichur in Karnataka was for flood, Nagapathannam in Tamil Nadu was for tsunami and Waynad in Kerala which is a hilly terrain for land slide. The study attempted to examine the factors that drive the adaptability of farmers. For this, we have used the binary logistic model to identify the factors influencing significantly the farm household's decision to adapt to the negative impacts of climate change and variability.

In the model, we introduced the regional dummies where Wayanad district in the state of Kerala was treated as the reference category. The estimated coefficients of all dummies are positive and significant at 1 percent level, except Adilabad dummy where the estimated coefficient was negative and significant at 1 percent level. The Nagapatanam and Raichur dummies implied that the farmers in Nagapatnam and Raichur districts of Tamil Nadu and Karnataka states were probably more perceptive to the negative agricultural impacts of climate change relative to the counterparts belonging to Wayanad district of Kerala. There has been a drastic change in the climate in the four ecologically different villages. The study has a wide scope to cover all of the aspects relating to climate change.

Keywords: Vulnerability; Agriculture; Climate Change; Andhra Pradesh; Karnataka; Kerala; Tamil Nadu; India.
JEL Classification: Q54,I 31, H84

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Impact of 2018 Flood on Riverine Microecosystems: A Case Study in Manali River at Thrissur, Kerala

P. Athulya[1], T.V. Sajeev[2] and S. Rajathy[3]

Abstract

River beds and riverine vegetations are two of the worst hit ecosystems in the 2018 floods in Kerala. Close observations on the diversity and energetic of Riverine micro ecosystem had indicated that the diversity of faunal elements in river potholes is correlated with the type of riverine vegetation, water quality and substrates. Natural vegetation enhanced diversity of organisms in the river bed while plantations denuded it. The study site was completely transformed during the flood which happened in August 2018. The site was studied again after the flood so as to decipher the precise impact of the flood on aquatic micro ecosystems. The study was done pre-flood and post-flood periods from January to November 2017 to 2018. Aquatic insects were collected once in a week from river potholes of four sampling sites selected based on river bank vegetation. Water quality parameters, substrates analysis, vegetative distribution of the study area were determined pre and post-flood periods by using standard protocol given by APHA, GIS-Software used were ArcGIS 9.3.1, QGIS, Google earth. A total of 256 individuals from 26 species, 17 families and 6 orders were reported during the pre-flood studies whereas 203 individuals belonging to 16 species,13 families and 6 orders were observed during the post-flood period. It revealed that diversity and distribution of aquatic insects in riverpotholes decreased during the post-flood periods. While river potholes adjacent to natural riverine vegetation had the highest diversity of organisms during the pre-flood period, there was an increase in the diversity observed adjacent to rubber plantations is due to the increase of dissolved oxygen concentration from 1.8mg/l to 6.8mg/l during the post-flood period. The loss of natural riverine vegetations during the floods has eroded the diversity of organisms in river potholes. However the heavy flow of water have also washed off pesticides and fertilizer deposits making the river potholes adjacent to rubber plantations to be re-colonised with a diverse array of organisms which was not recorded before the floods. Water quality parameters like water temperature, pH, dissolved oxygen, electric conductivity were changed into optimum level for the existence of the aquatic insects.

Keywords: River Potholes; Aquatic Insects; Riverine Vegetation; Insect Diversity.

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Socio-Economic-Environmental Impacts of Climate Change in Aspirational District Haryana

Susmita Mitra[1], Pradeep K. Mehta[2] and Sudipta Kumar Mishra[3]

Abstract

Unforeseen and extreme weathers are among climate change associated risks which have serious adverse consequences on human wellbeing. Poor people are more vulnerable due to their low adaptive capabilities. Global nature of the problem of climate change and local nature of the adaptive capabilities as well as practices calls for evidence-based regional studies through engagement of local communities who are impacted by the climate changes. Among 101 aspirational districts (i.e. most backward districts) in India, Nuh (Mewat) district holds the last position, despite its close proximity to the capital of the country, and stands in sharp contrast to the remaining parts of Haryana. Apart from the historical and traditional background, the impoverishment in the region is a result of contextual vulnerability to changes in the environment. The increasing groundwater salinity has become a major threat to the well-being of people in the region. This area specific, evident-based study brings out the socio-economic-environmental impacts of climate change on the most backward district of India.

Objectives: a) to capture the environmental vulnerability using trend analysis of historical data on climatic variables

b) to analyse the change in evapotranspiration rate, ground water availability and quality over the period of time and explore the socio-economic consequences of changes

c) to identify the adaptive measures taken in the context of climate change and groundwater salinity and its impact on people's wellbeing; in order to propose steps/policy prescriptions for development of the region

Methodology: The study uses both primary and secondary data, and applies both quantitative and qualitative methods. Mann-Kendall trend analysis of meteorological data of last 50 years has been used to capture environmental vulnerability. Geographical Information System (GIS) and econometric analysis is done to explore change in evapotranspiration rate,

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ground water availability and quality over the period of time, and socio-economic consequences as a result climate change. The empirical findings are complemented and validated with qualitative information collected through participatory rural appraisal method.

Findings: Increase in environmental vulnerability and occurrence of repetitive droughts in the late 1990s resulted into more groundwater extraction, given that Nuh does not have a perennial source of freshwater. Over extraction of groundwater along with the typical hydrological characteristics of terrain resulted into increased salinity of the groundwater. This led to significant decline in crop yield, reduction in crop diversification, and loss of indigenous crop varieties in the district. It also resulted into serious socio-economic repercussions. Within Nuh there is great diversity and the poorest blocks fall mostly under the saline water zone, whereas better off blocks fall under sweet water zone. Lack of knowledge, support and institutions due to the absence of institutions has prohibited planned adaptive measures to address long-term climate change phenomena. However, there are evidences of proactive adaptive measures by community but those are limited in extent in comparison to the need and urgency of the situation.

Keywords: Climate Change; Vulnerability; Groundwater Salinity.

Valuing the Carbon Sequestration Regulation Service by Hokersar Wetland of Kashmir Himalaya

Ishfaq Ahmad Sheergojri[1], Irfan Rashid[1], Irfan Rashid[2] and Ishfaqul Rehman[1]

Abstract

Wetlands are vital for human survival, as they provide provisioning (e.g., food and water), regulating (flood and disease control), cultural (e.g., spiritual, recreational), and supporting ecosystem services that maintain the conditions for life on Earth. Although, these novel ecosystems deliver countless services to mankind, but carbon sequestration and storage is regarded as the most significant of all ecosystem services with respect to the burgeoning issues of climate change. Beyond just storing carbon, these ecosystems continue to accumulate it in plants and soil over time, thus "sequestering" additional carbon each year and the sequestration rate is higher in wetlands than any other ecosystem on earth. In this study, the carbon sequestration potential of Hokersar wetland - an internationally recognized Ramsar site - was investigated to understand its ecological and economic role under the contemporary changing climate. Spatio-temporal changes in the land cover system of the wetland and its catchment were assessed and correlated using a time series of satellite, historical and field data. Plant and soil samples were collected from different locations within the wetland and the organic carbon was measured using elemental analyzer. The economic value of carbon sequestration was determined by using social cost of carbon (SCC). The results reveal that the wetland area has shrunk from 18.75 km^2 in 1969 to less than 13 km^2, and the sediment storage of organic carbon (OC) and plant biomass of the wetland is of the order of 75 Mg C ha-1and 28.28Mg C ha-1 respectively. The estimated economic value of carbon sequestration was found to be approximately USD 6.496 million for next thirty years. Detailed evaluations of other ecosystem functions and considering the importance of the local variables may provide a better monetary estimate of these regulatory services.

Keywords: LULC; Ramsar; SCC; Seqestration; Valuation; Wetland.

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Impact of Environmental Shocks on Livelihood Diversification in Rural India: Evidence from Large Scale Survey Data

Chhavi Tiwari[1] and Sankalpa Bhattacharjee[2]

Abstract

Livelihood diversification is a commonly applied strategy to cope with environmental (such as floods, droughts, etc.) and economic shocks (sudden death, illness, etc.) and is considered to be instrumental in poverty reduction. However, theories developed in this context divide livelihood diversification into distress pushed and progressive diversification. In this paper, the role played by environmental shocks with other household motivations behind livelihood diversification has been investigated for 27,579 Indian rural households using the second wave of Indian Human Development Survey (IHDS) data using Poisson regression estimates. Environmental shocks considered for the analysis are droughts, floods, earthquakes, hailstorms and tsunami which affected households during the last six years and their frequency. The study also divides livelihood strategies into employment and income diversification strategies and tests the results for both. Findings indicate that environmental shocks affect positively both the likelihood of having different household members in various occupations and having income from multiple sources. Further, the impact of diversified assets on livelihood diversification is also tested as the type of livelihood activities taken by the household is often dependent upon the wealth variables. Having a negative association with assets variables, results also implies that in Indian case livelihood diversification is mainly distress driven rather than being progressive. Findings have implications for policy-makers of India highlighting the importance of recognizing positive impacts of livelihood diversification. Policies that can create alternate income sources are suggested to be broadened including support for migration.

Keywords: Livelihood Diversification; Environmental Shocks; Poisson Regression; India.

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16.30 - 18.00 (Parallel): Technical Session (TS) 1

TS 1.3: Vulnerability to Floods

Flood Vulnerability of Marginal Caste Communities and the Women in the Kosi North Bihar

Ranjeet Kumar Sahani[1], Siddhartha Krishnan[2] and Shrinivas Badiger[3]

Abstract

There has been a significant body of work on the Kosi flood and the impact of river embankments on the communities post-independence. A number of researchers' work talk about politics of flood protection and how river embankments have created a permanent divide between riverside and countryside. There are other researchers who looked at the introduction of the embankments in Kosi floodplains and the role of expert knowledge on flood control which undermines the local and traditional flood coping mechanism used in the Kosi region. However, most of the studies on Kosi consider the communities living inside the Kosi embankments as homogenous and equally vulnerable to flood, irrespective of their caste class and geographical locations in the Kosi region. Through my current work, I am trying to iterate that communities living inside and outside of Kosi embankments are heterogeneous and that the caste-class and geographical locations of the communities affect their flood vulnerability and disproportionate distribution of flood risk in the Kosi region. From the initial reading of my results obtained from Oral History Interviews and Focus Group Discussions with the women-only group, I have found that marginality of the different caste communities renders them with resilience against the flood. However, the very marginality and the inequality created by embankments disproportionately expose them to flood risk in the Kosi flood plains.

Keywords: Kosi Region; Embankment; Flood; Vulnerability; Marginality.

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Assessing the Determinants of Social Vulnerability to Floods in Bihar, India

Rupak Kumar Jha[1] and Haripriya Gundimeda[2]

Abstract

Assessing the determinants of vulnerability is important for the risk reduction and mitigation policies. Differences in vulnerability conditions lead to differential outcomes post disasters. The objective of this study is to assess the determinants of vulnerability to floods in Bihar, an eastern state of India, which constitutes a downstream region within the Hindu Kush Himalaya (HKH). A risk-hazard framework has been adopted to assess the determinants of vulnerability for the period 1991-2013. The risk-hazard model approximates the losses as a function of both the biophysical risk factors as well as the potential for loss of an exposed population. Therefore, flood fatalities were considered as a function of (i) hazard elements represented by river flood threat, and rainfall; (ii) exposure elements represented by population density; (iii) build environment by number of houses damaged; and (iii) adaptive capacity reflected by per capita gross district domestic product. In addition to these, we incorporated mean elevation of the districts, and forest share as crucial geographical determinants. As flood fatalities are non-negative count variables, we employed zero inflated negative binomial (ZINB) regression method to overcome the problem of over dispersion. This study finds that integrated flood threat and rainfall have significant and positive effect on the mortality count across the models. High population density, built environment have a positive and significant impact on the flood fatalities, while the mean elevation reduces the flood fatalities. The findings of the study illustrate the need to enhance the adaptive capacity through effective flood and drainage management policies and through various development programs. International cooperation is required to manage the flood risk due to the sensitivity in flood control measures in the upstream region and the trans-boundary origins of flood causation.

Keywords: Trans-boundary Flood Risk; Upstream-Downstream; Vulnerability, ZINB, Bihar.

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India's Preparedness to Address Urban Flood through Institutional Mechanism in Comparison to Asian Countries

Satarupa Rakshit[1] and Zareena Begum Irfan[2]

Abstract

The climate-related disasters are increasing in urban areas, and every year millions of people are affected. Flooding in India, Nepal, and Bangladesh reportedly affected millions of people, with many living in the area identified as potentially exposed. The risk in urban centres is growing faster not only due to urban growth in hazardous locations, lacking infrastructure, vulnerability of housing and infrastructure, increasing poverty, and inequality but also due to weak disaster risk governance. Urban flooding specially is becoming very common in Indian cities. The first objective is to assess the existing institutional framework at Indian context and its approach to deal with urban flooding. Evaluate the changing role of institutional and government led policies under disaster (flood) risk reduction in Indian scenario with context to global targets. The second objective is to calculate the economic costs of floods in Indian scenario from period 1989-2017. The ultimate goal is to develop a comprehensive model for vulnerability assessment as well as risk and resilience framework to deal with urban floods. The expected results would provide valuable insights into the vulnerability of urban societies to floods and therefore lead to an enhancement of adaptation strategies in the near future to minimize the loss and damages. The conclusions and insights from this study can become a reference point for other urban centres with the similar flooding issues.

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A Review of the Kerala Flood - Assessing Losses, Damages and Recovery Pattern

Harshan T. P [1]

Abstract

The impacts of global climate change and the efforts to stabilise is a challenge faced by all the economies around the world. The United Nations Development Programme (UNDP) report in 2004 on disaster risk throws light on the fact that those countries with higher income as well as high human development index suffer less damage and losses due to a disaster; for example, the data shows that though 15 per cent of the disasters occurred in these countries, the death toll was only 1.8 per cent. Economic and human development allows countries to increase the rate of mitigation and recovery from the damages resulting from a disaster.

Kerala, one of the smallest states in India, has a prominent position in the development discourse due to the achievement of higher human development followed by an increase in the state economic growth. According to the Kerala State Action Plan on Climate change, the state is exposed to rising frequency and intensity of climate-related extreme events. In August 2018, Kerala faced a catastrophic flood, and landslides due to extreme rainfall (Sudheer et al. 2018) and the Centre for Research and Epidemiology considered this as the largest flood event of 2018. The factors that contributed to the flood include higher seasonal precipitation, multi-day extreme rainfall and extreme precipitation in the catchments upstream of the reservoirs (Mishra and Shah 2018). Over 5.4 million people were affected; 1.4 million people displaced and 433 lost their lives in the event. The total damage and losses estimated by the UN were 26718 crores (UNDP 2018). The data from the Emergency Events Database (EM-DAT) indicates that 69 per cent of the total damages and losses in India as a result of disasters in the year 2018 occurred in Kerala (CRED 2019).

The current paper is an attempt to investigate the losses and damages, public action from above and below for relief and rehabilitation as well as the recovery process of the Kerala flood. The major sources for the analysis include various sources such as Economic Review Kerala 2018, UNDP post-disaster needs assessment, and the Centre Water Commissions report on Kerala flood. The data shows that the disaster affected across all the districts (14 districts) and various villages of Kerala (1259 villages out of 1664) (UNDP 2018). Considering the extent and severity of the disaster, damages to the houses and buildings were less because 94.7 per cent of the houses in Kerala come under the category of good and liveable condition (Census 2011). State machinery (Kerala Police, Kerala Fire and Rescue Service, National Disaster Response Force, Border Security Force, Air Force, Central Reserve Police Forces), fishermen, students and voluntary organisations took part in the relief and rescue operations throughout the state. This helped in reducing the toll of human loss considering the severity of the incident. Due to the higher human development and per capita income, the recovery process was also fast. This paper shows that responsiveness of the state, civil society, higher human as well as economic developments reduce the severity of the extreme events.

Keywords: Climate Change; Disaster; Kerala; Flood; Recovery Pattern; Environmental Losses and Damages.

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16.30-18.00 (Parallel): Technical Session (TS) 1

TS 1.4: Environmental and Climate Justice

Relocation from Protected Areas as a Violent Process in the Recent History of Biodiversity Conservation in India

Eleonora Fanari[1]

Abstract

In the last two decades, conflicts due to biodiversity conservation projects have been rising all over the world. This is due to the high interest at the global level towards environmental protection which is often implemented at the expense of numerous communities living within and around important biodiversity spots. The study analyses the violent process of relocation and displacement from the protected areas of India, with the purpose of documenting the illegal relocation of indigenous communities and forest dwellers from the protected forest areas. It examines the specific laws and regulations which are legalizing the relocation of communities from their ancestral land, in contrast with the legal recognition of community's forest rights under the Forest Rights Act (FRA). This concludes how these conflicts are the results of no recognition of tenure rights, and the mirror of the contradictions embedded into the environmental protection policies not only in India but at the global level.

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Change in Climate, Cropping Pattern and Food Sovereignty in Eastern Himalayan Hills

Deena Gurung [1]

Abstract

Ensuring food security is a well recognized goal of all developmental plans. However, 'food sovereignty' is gaining a greater acceptance in recent times as a more recent concept. It requires production of own food by communities located in a region using local resources and ecological services (FAO, 2013). The early settlers in the Eastern Himalayan hills, specifically in remote rural areas in Darjeeling and Kalimpong districts, were largely food sovereign. Focus group discussions suggest that till some decades ago, these remote hill villages used to grow their own staple food, mostly rice and maize, with water from natural streams and the biomass rich topsoil.However, a look at the hill slopes presently shows abundance of fallow agricultural lands across them. The size of local agriculture, in terms of net sown area, is shrinking in last couple of decades. In addition, the cropping pattern is also changing significantly. This paper is an attempt to identify the factors leading to such phenomenon. This study is based on 200 rural households in five villages in Lower Echhey and Sakiyong Gram Panchayat area in Kalimpong district conducted during December, 2018 to February, 2019. The changes in their cropping pattern in recent years, the extent of their food sovereignty and the practice of keeping fallow land has been analysed with their economic and demographic profile. It was found that outmigration of labour have a bearing on agricultural practices and food sovereignty. It was also found that the local ecological services like water availability and man-wildlife conflict can be identified with the households' loss of food sovereignty. The study calls for government interventions in this regard to improve the agricultural condition in the region.

Keywords: Food Sovereignty; Eastern Himalayan Hills; Ecosystem Services; Cropping Pattern; Food Crops

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Alternative Ways of Understanding Ecological Conservation Practices to Enable Environmental Justice for All

Lavanya Suresh[1] and Anwesha Mohanty[2]

Abstract

The main aim of this paper is to understand the idea of justice embedded in the alternative. We situate this study within the broader context of environmental degradation and marginalization of resource dependent communities where in with declining economic margins, especially under increasingly competitive global trade regimes and unregulated markets, cost and risks are passed downwards to individual producers, who can be predicted to extract from the ecological system to balance their losses (Robbins 2012). The result is a pattern of appropriation and accumulation of natural capital, transformed into currency, at locations away from the site of production. This result in disabling of local systems of livelihood and further marginalization of those who are vulnerable (based on caste, class, gender etc.). The need is to reimagine our assumptions about ecological resources and to understand them from a political gaze that considers the operation of power at different levels. The threat of climate change has given this issue more urgency as it has brought in a new recognition of the profound interconnection between social inequities and natural systems. A focus on development without consideration for environment and biodiversity loss has led to the devastation of local economies that are dependent on resources, aggravated flooding and/or drought, harmed agricultural and water security in many regions in India. Unsustainable development projects will, as predicted by many climate change models, lead to devastation at a global scale (Rockström, et al., 2009). It is in this context that we need to look for alternatives or more sustainable ways of development. The focus here is on alternatives sustainable practices, rather than just sustainability. In this study, by alternative we mean initiatives that aim at a fundamental shift towards the core values of sustainability, equity, efficiency and democratisation. The focus of this study is on those actions and initiatives that aim at an ecologically just and sustainable future with social and economic equity. Central to this argument is also the idea of decentralisation, which provides for people having a say in making decisions about the resources in question. This would mean asking the fundamental question of - who has power and who does not? In envisioning an alternative way of being, it often means that the institutions or individual is challenging the current set of norms of being. Addressing such issues is crucial as India is an intensely hierarchal society, with inequities in all spheres of life (Kothari & Joy, 2017). Methodologically, we will be using the case study method. The case selection will be based on purposive sampling. Our study finds that actors at different scales have an impact on the conservation practices found. The everyday interaction with a resource is a product of the broader political economy of the region. The existence of an ecological resource and its management is produced by way of negotiating power structures that make the river, lake or forest itself power ladened. Hence, environmental degradation and change is not just a product of climate change, but also the ways in which power operates and how vulnerability and risk is distributed among actors.

Keywords: Climate Change Justice; Alternatives; Conservation; India; Marginalisation.

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Climate Justice: Is a Robust Legal Framework Need of the Hour?

Rakesh Chandra[1]

Abstract

The latter half of the twentieth century saw the culmination of a new and devastating phenomenon for the mankind which is now well-known as Climate Change. From melting ice caps, rampant forest fires, rising sea levels, ocean acidification, changing in agricultural growing seasons, dramatic changes in the arctic to a broad phenomenon, Global warming, Climate Change encompasses even beyond all these benchmarks. Undoubtedly, every such phenomenon is detrimental to human life on earth. This is not that the States and the NGOs are not aware of it. Under the aegis of U.N. bodies, continuous brainstorming is taking place to find solutions of this havoc, the climate change. Some agreeable doable points are also reached at among the coterie of nations. But their implementation is blocked by either the developed nations or the big multi-national corporations. The populace which is least contributing towards this menacing problem is the worst sufferer and there seems to be no light at the end of the tunnel. That is why mitigation of climate change also becomes a human rights issue. The solution to this bottleneck is fast appearing in the form of climate charge litigation which is yielding fruitful results, especially in the developed countries like America, Netherland, Norway etc. Climate change litigation is forcing the big corporate entities to toe the line. This paper explores the various aspects of climate change litigation and its role in getting the climate justice for the future sake of humanity.

Keywords: Climate Change; Climate Justice; Climate Change Litigation; Bali Principles of Climate Justice; Global Warming.

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Measuring the Socio-Economic Vulnerability of the Coastal Ecosystem: A Case Study of Indian Sundarbans

Sneha Biswas[1]

Abstract

Vulnerability is the potential for loss (Cutter, 1996). According to Adger et al. (2005) the causes of vulnerability are embedded in the political economy of resource use and the resilience of the ecosystems on which livelihoods depend. Resilience reflects how well a system can adapt to any external disturbances. Situating on the coast of Bay of Bengal and criss-crossed by many rivers, Indian Sundarbans area is highly vulnerable to environmental threats e.g. flood, cyclones, animals. While on the other hand poverty, high rate of illiteracy among adults, uncertainty of livelihood, early marriage, human trafficking are some of the socio-economic problems which the area is currently facing. The present author would like to measure the socio-economic vulnerability of people of Sundarbans based on the analytical framework of Exposure, Sensitivity and Adaptive Capacity (IPCC's framework for climate change vulnerability). The present research scholar will use both secondary and primary data to address these questions. For the primary data source, 200 household samples from 4 villages of Indian Sundarbans will be used. Variables such as demographic characteristics, water scarcity, food security, adaptation strategies will be considered for the analysis. An index scale will be used to measure the degree of vulnerability in the study area.

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DAY 2: 7th November 2019, Thursday

14.00 - 16.00 (Parallel):Technical Session (TS) 2

TS 2.1: Climate Vulnerability: Agriculture and Food Security

District Scale Vulnerability Index to Climate Variability for Vidarbha Region, Maharashtra, India

Deepika Swami[1] and Devanathan Parthasarathy[2]

Abstract

Severe impacts on agriculture has been witnessed by India during past one decade due to changing climate, manifesting in terms of increase in temperature and reduced frequency of rainfall, in particular during monsoon months, June-September. Sectors such as agriculture, fishing, infrastructure, development &planning and international trade are the most affected by changing climate. Adverse impact of climate change on agriculture is bound to affect India socio-economically as agriculture being primary contributor to Indian economy (16% contribution to GDP and 70 % population occupied in agriculture field). Considering the socio-economic importance of role of climate change in Indian agriculture, focus of the present study is to understand the impacts and adaptation measures with respect to climate variability at regional scale i.e. at district level. Present study aims to reconnoiter the impacts of climate variability, agro-ecology and socio-economic variables on agricultural yield and agriculture labour using a panel data for ten-year period (1995-2005) for Vidarbha region of Maharashtra, India. Multivariate regression was used to identify linkages between agricultural crop productivity, agriculture labor and seasonal monsoon variability. Findings revealed that districts belonging to the same agro-climate zone can show differing correlations among agriculture productivity, agriculture labor and seasonal monsoon variability, exhibiting spatio-temporal heterogeneity of climatic and other variables within the same zone. Further, districts of Western Maharashtra Scarcity zone and Central Maharashtra zone are found to be highly vulnerable due to climate, agro-ecological and socio-economic parameters; with utmost influence from parameters of climate variability. Results suggest that agricultural and climate related policies for each district should be formulated independently, without generalizing them for the entire region or state. Study specifically highlights why adaptation should become the policy priority to alleviate the majority of the problems in agriculture sector.

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Climate Change and Paddy Cultivation: The Relevance of GI tagged Pokkali Rice from Kerala

Soumya Vinayan[1] and N Lalitha[2]

Abstract

According to Inter-governmental Panel on Climate Change (IPCC), climate change affects crop production in several regions of the world, with more negative effects than positive, and developing countries are more vulnerable to such negative impacts (Lipper, *et al.* 2014). India with its larger dependency on agriculture is not an exception to this impending scenario. In the context of climate change, paddy is set to face a whole range of challenges adversely affecting its production. In this paper, we discuss the relevance of flood and salt-tolerant varieties of rice and its cultivation as prevalent in select coastal areas of India. We specifically focus on Pokkali, an indigenous rice variety which is saline tolerant and naturally organic due to cultivation practices and has medicinal properties. This paper is based on our field work among 154 Pokkali farmers in the district of Ernakulam in November 2018. The paper outlines the major processes of cultivation, the institutional mechanisms sustaining the alternate farming (through various legal and policy measures) and the challenges the farmers face in continuing the paddy cultivation.

Keywords: Climate Change; Paddy, Wetlands; Saline Tolerance; Pokkali; Geographical Indication.

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Climate Change, Food Security and Poverty of Vulnerable Groups: A Case of Two Villages

G Sridevi[1] and Amalendu Jyotishi[2]

Abstract

Impact of climate change on agriculture has received the attention of the policy makers and practitioners because of its high degree of susceptibility to climate change and its associated adverse impacts on the people, particularly the poor and marginalized sections of the society who are dependent on agriculture and its allied sectors for their livelihood. In this context, the climate change literature revealed that the dependence on erratic and unpredictable South-west monsoon, preponderance of the marginal and small farmers and more reliance on climate sensitivity activities including agriculture, forestry and fishery for livelihoods, trigger the vulnerability of Indian agriculture (Ranuzzi and Srivastava, 2012). Though there are several studies available at global, macro and meso level, literature is scanty at household level in-depth analysis on the impact of climate change on rural communities. Several questions emerge including, what characterises the social vulnerability of farmers and various social groups and its impact on nutritional security of the households. Similarly, although studies have documented various adaptation options of farmers, very few studies have looked into the factors at household level that drives the decision to undertake a particular adaptation strategy. This study is an attempt to fill the gaps by examining the social vulnerability, nutritional security and adaptation among the marginalised households in Andhra Pradesh and Telangana. The study employs a multi-stage sampling technique. In the first stage, within the state district has been selected on the basis of highest score of agricultural vulnerability index. From the selected district one village was selected each from Telangana and Andhra Pradesh. The villages were identified on the basis of two characteristics consisting high proportion of 1) Scheduled Caste Population, and 2) dependency on Agriculture. Based on this, in the State of Telangana, Odipilavancha Village Panchayat from Kataram Mandal of Karimnagar district was selected for the study. The Village has a majority of its population dependant on agriculture, with paddy and cotton being the principal crops. In the State of Andhra Pradesh, Karumanchi Village Panchayat in Tangutur Mandal of Prakasam District was selected for the study. Majority of population in Karumanchi are engaged in cultivation of paddy, green gram and tobacco. Our analysis based on primary data was to emphasize the impact of climate change on nutritional security and vulnerability among marginalised social groups. The social vulnerability of farm groups and caste groups depend principally on the dynamic interaction of demographic, economic and social factors. In our micro level study analysis two types of measures have been used to quantify the nutritional security within a household: 1.Food intake by individuals converted into nutrients, and 2. Height, weight and age measures for Anthropometric indices. Finding reveals that marginal and small farmers are more vulnerable to the impacts of climate change and variability in both the villages. Similarly, the SC and ST households are more vulnerable to climate effects than OBC and OC households in both the villages. Climate change vulnerability also reflects on nutritional security of the in terms of calorie consumption, BMI for adults, and stunting for children. Findings squarely points at the impact of climate change on different socio-economic groups. Climate change has more severe impact on socially, economically and nutritionally vulnerable groups. Therefore, improving climate resilience of these groups involves provision of social, economic and nutritional security.

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Loss and Damage from Floods in India: Influence of Human Development, Income and Inequality

Chandra Sekhar Bahinipati[1] and Unmesh Patnaik[2]

Abstract

Using a dataset on reported loss and damage from floods among the Indian states between 1980 and 2011, this paper investigates the potential role of human development, income, inequality and forest cover in reducing impact. Although the disaster specific and development based indicators are largely researched, there is a sparse in the interaction between them and the role of inequality. Employing zero-inflated negative binomial and fixed effects models, this study comes up with three major findings. First, an increasing trend is observed for the reported loss and damage indicators across the states. Second, both human development and income are mostly found as statistically insignificant, indicating that the states are not becoming flood-resilient with respect to present development. Third, there is a lack of evidence of learning effect, however, disaster risk management program mitigates risk. Therefore, the paper suggests that the ongoing development strategies must take into account climate risk and address the persistent adaptation deficit. These findings have larger policy implications as we are likely to encounter such events more frequently. This also initiated the process to draft second state action plan on climate change.

Keywords: Human Development; Income; Inequality; Forest Cover Loss and Damage; Floods; Indian States.

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Studying the Climate Change Risk for Finger Millet Crop: Empirical Evidence from Karnataka

Rajesh Kalli[1] and Pradyot Ranjan Jena[2]

Abstract

Anthropogenic greenhouse gas emissions have caused variation in climate specifically with respect to rise in temperature. These climatic shocks threaten agricultural production with frequent drought and floods. The study assesses the climate change impact on the finger millet yield, one of the drought resistant crops specifically cultivated in the subtropical zone. The proposed econometric technique applied in the article is fixed effect panel regression model to identify the causal relationship between the yield and climate variables (rainfall and temperature). A panel data of district-wise cross sections for a period of 1992-2012, with necessary inputs are used in the model. The analysis in this paper is based on the district-wise historical dataset of agriculture and updated climatic data emphasizing on kharif season. The estimates reveal a negative impact of temperature on millet yield up to 17%. Comparing the past studies on major crops like rice, maize and wheat, finger millet had been highly affected by climate change indicating the risk level faced by the farmers. The study also probed the climate change impact based on the crop phenology, where growing season is split into different growth phases. Such high negative impact raises concern especially because it has grave implications for food prices and food security. With climate expected to be uncertain in future there is a need for immediate action on adaptation to climate change.

Keywords: Climate Change Impact; Agriculture; Finger Millet; Panel Regression; Growing Degree Days; Karnataka.

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Stress Adaptation and Farmer Preferences: A Bidding Experiment on Stress Tolerant Rice Varieties (STRVs) in Eastern India

Lisa Mariam Varkey[1], VikramPatil[2] and Prakashan Chellattan Veettil[3]

Abstract

With a reduction in potential yield up to 50-70 per cent, abiotic stresses have been cited to be the primary cause of crop losses in the world. Significantly plagued by these hazards, India is no different, especially the rice growing ecosystems of Eastern India which constitute a major proportion of rain-fed paddy lands of the country. Stress Tolerant Rice Varieties (STRVs) developed following transgenic approaches have much potential to increase/provide stable rice productivity in these stress prone rice ecosystems. This paper is aimed at capturing preferences of rice farmers in these regions towards the adoption of two most popular STRVs, Swarna Sub-1 and Bina-11 ex-ante, while providing actual incentives. We employed a modified version of Becker-DeGroot-Marschak (BDM)'s approach of experimental auction, wherein farmers were engaged in a series of decision-making contexts such as bidding, pricing (initial buying) and buying (latent) decisions for the STRV seedkit. A market like cue in the form of price revelation was included to specifically trace latent buyers among the bidders. We chose doorstep delivery of the seedkit to avoid potential friction in network between buyers and sellers and to minimise transaction costs. Using combined data of 1836 households from bidding experiments conducted in 2016 and 2017 and a three stage sequential logit model approach, we find the influence of explanatory variables to be distinct and different between overall processes of initial buying and latent buying. Religion, caste, bidding year, experience of longer duration submergence and access to irrigation have significant influence on purchasing/bidding when buying is synonymous to pricing. And when it is latent buying, religion, caste (= OBC) and bidding year matter. Our results also showed that upon information revelation, 63 per cent of low price bidders decided to revise their bids to market price to acquire the seed kits offered, with education playing a significant role in price revision. The results highlighted that bidding participation increased with duration of submergence and previous STRV usage dissuaded bidders from revising their buying decision. This calls for rightful awareness creation about the significant characteristics of these varieties, especially stress tolerance capability and non-monotonic nature in order for the sustainable uptake of this technology.

Keywords: Bidding Experiment; Sequential Logit Model; STRV; Rice Farmers.

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14.00 - 16-00 (Parallel): Technical Session (TS) 2

TS 2.2: Adaptation of Agriculture to Climate Change

Scaling-up of Climate Resilient Agricultural Practices through Sustainable Livelihood and Adaptation to Climate Change (SLACC)

V. Suresh Babu[1], K. Krishna Reddy[2], Ravindra S. Gavali[3], Basavaraj Patil[4] and A. Bhagawat[5]

Abstract

The Agricultural Scientists have been spearheading agricultural research, education and extension activities for productivity enhancement and diversification of agriculture to address the accelerated climate change challenges. ICAR has initiated National Initiative of Climate Resilient Agriculture (NICRA) project in 2010-11 with technology demonstration as a key component and being implemented in collaboration with Krishi Vigyan Kendras (KVKs) and 11 ATARIs (Agricultural Technology Application Research Institutes) in 121 climatically vulnerable districts. However, its reach is very limited and certificate courses are not formulated for wider dissemination. In order to expand its reach demonstrations of appropriate practices and technological interventions have been planned through Sustainable Livelihoods and Adaptation to Climate Change (SLACC) in a farmer participatory mode to enhance their adaptive capacity and coping ability against climatic change and variability in Madhya Pradesh and Bihar. SLACC is an initiative of Ministry of Rural Development (MoRD) within the umbrella of National Rural Livelihood Mission (NRLM). The project covers drought and flood prone areas, keeping agriculture as the core sector, and combat risk management approach to livelihood planning. In this regard, NIRDPR has formulated a certified course on operational mode to build the capacities of identified National Resource Persons (NRPs). The trained NRPs has further disseminated the knowledge at gross root level by upscaling the skills of community resource persons (CRPs) to reach out the farming community. Hence, it is felt necessary to build capacities of CRPs to up-scale their skills in a cascading mode for effective dissemination of Climate Resilient Good practices across the country.

Keywords: Climate Resilient Practices; Sustainable Livelihoods Adaptation; Community Resource Person; National Resource Persons; Climate Change.

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Impact of Short Duration Climate Smart Variety on Cropping Pattern of Indigenous Agricultural Systems

Prabhakaran T. Raghu[1], Prakashan C. Veettil[1] and Mayank Sharma[2]

Abstract

Rice is a major food crop in India and it contributes nearly 20 percent of the total caloric energy and over 20 percent of the total protein per capita requirement in the country. However, rice production faces increasing challenges, further accelerated by the changing climate, to meet the demand of growing population with limited landholding. Drought is one of the major abiotic stresses, that the rainfed rice production in India is severely vulnerable. Out of nearly 20 million hectares of rainfed rice in India, about 14 million hectares are prone to drought and the value of rice production loss in drought years is estimated as high as 36 percent of the total value of rice production. Accordingly, rural poverty and food insecurity are persistent in the rainfed rice production areas. Developing drought tolerant rice varieties brings enormous values to national food security. To enhance the yield potential under drought condition, breeders in International Rice Research Institute (IRRI) have developed the drought tolerant variety 'Sahbhagidhan' in the year 2010 and distributed in Chhattisgarh for cultivation in 2013 Kharif season. Sahbhagidhan produces 4-5 t/ha under normal condition and 1-2 t/ha in drought condition, while other varieties in the state produces 2.5 t/ha under normal condition and face complete yield loss in drought condition. Sahbhagidhan needed only two irrigations and ready to harvest after 105 days, which allows farmers to utilize residue moisture more efficiently by advancing the succeeding winter crop. The present study analyses the adoption of Sahbhagidhan and its impact on change in cropping pattern over years (2013 to 2016) in the state of Chhattisgarh in India. The study was carried out in 2862 households from 228 villages of 5 districts in Chhattisgarh during April to July 2017. About, 37.7% of sampled households cultivated Sahbhagidhan at least once, but the adoption is 19.9% in the year 2016. The variety stands third largest in terms of adoption. The major reasons reported for adoption of the variety includes characteristics of drought tolerance (44.4%) and short duration (17.1%). The change in cropping pattern of different group was studied over four years (from 2013 to 2016). Here, we compare the cropping pattern of two groups, Sahbhagidhan cultivators (continuing cultivation of variety since 2013) and never adopted the variety. The rice-fallow cropping pattern was predominant in both groups in the year 2013, 63.0% of Sahbhagidhan adopters falls under category (household cultivate rice in Kharif season and kept fallow in the winter season) and it is 83.0% for non-adopters. However, in the year 2016, finding shows that fallow land is reduced by 26.0% in Sahbhagidhan adopters and 16.5% in non-adopters. The major crops occupied the fallow land includes potato, other vegetable and pulses. The area under fallow is reduced tremendously over the years. Compared to rice-fallow system, crop income increased by more than double for other cropping patterns in both the groups, however the impact is significantly higher for Sahbhagidhan adopter compared to non-adopters.

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Crop Insurance for Adaptation to Climate Change in Odisha: Some Micro-Evidence from Bolangir District

Mamata Swain[1] and Basanti Renu Hembram[2]

Abstract

Odisha is considered as the climate change hot spot of India. The state being located in the fragile ecological zone of India is extremely vulnerable to climate change because of its tropical climate, monsoon-based rainfall, long coastline, high dependence on paddy cultivation, low irrigation coverage and high incidence of chronic and mass poverty. During the last two decades, climate change has manifested itself with gradual increase in temperature, greater variability in rainfall, rise in sea level and increased frequency, intensity and duration of extreme weather events, such as drought, flood, cyclone and storm surge, which has increased production risk in agriculture substantially. Therefore, there is a great need for crop insurance as a market-based solution to provide economic support to farmers, stabilise farm income, induce them to invest in agriculture, reduce indebtedness and decrease the need for relief measures in the event of crop failure. This paper assesses the performance of the Pradhan Mantri Fasal Bima Yojana (PMFBY) in drought prone Bolangir district in western Odisha. The paper is based on primary data collected from 80 Loanee Users of PMFBY, 80 Non-Loanee Users of PMFBY and 40 Non-Users of crop insurance. The study reveals that the farmers are dissatisfied with the scheme due to delay in compensation payment, as collection of yield data based on crop-cutting experiments takes time. The adoption rate of crop insurance is very low. There is a need to create awareness among farmers about the modality and benefits of crop insurance schemes. The insurance companies may be asked to provide priority insurance services to farmers just like priority lending to agriculture sector. In the context of climate change with increasing agricultural risk, there is a need to redesign insurance products not merely as a risk transfer mechanism but as a potent device to reduce risk and crop loss by inducing desirable proactive and reactive responses in insurance users.

Keywords: Climate Change; Agricultural Risk; Adaptation; Crop Insurance; Odisha; India.

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Multi-Criteria Analysis and Ex-Ante Assessment to Prioritize and Scale up Climate Smart Agriculture in Semi-Arid Tropics, India

Shalander Kumar[1], K Dakshina Murthy[1], Elias Khan Patan[1], Murali K Gumma[1], Arun Khatri-Chhetri[2] and Anthony Whitbread[1]

Abstract

The strategies that integrate food security, adaptation and mitigation options in agriculture are of high importance to manage the increasing risk of climate change in vulnerable semi-arid regions. This paper presents a framework and evidence based designing of a strategy for scaling up Climate Smart Agriculture (CSA) in Telangana State of India. Climate risk and vulnerability mapping at disaggregate level; Identifying context specific CSA practices; multi-criteria analysis for prioritization of location specific CSA practices and identifying barriers and incentives; ex-ante impact analysis of potential adoption of CSA practices, investment and infrastructure needs and strategy for CSA integration into district level plans have been the key steps of this unified approach. Indices for climate smartness and ease of adoption for each proposed practice formed the basis of prioritizing CSA interventions. Ex-ante impact analysis of selected CSA interventions in different regions of Telangana considering cropping systems, soil types and access to irrigation helped generating geospatial mandal level maps of prioritized CSA interventions. These maps helped in identifying context specificity of CSA interventions. The ex-ante assessment considered district wise actual area and yields of major crops and rainfall level for 5 years from 2010-11 to 2014-15. The proposed unified framework helped to understand the district wise potential for promotion of CSA practices/technologies, public and private investment needs, economic impacts of the interventions to enable informed decision making for climate smart agriculture. Continuous stakeholders' engagement during this process was very important for integrating their perspective and creating ownership. Piloting of evidence based scientific framework guides investments and policy making decisions on scaling up CSA in Telangana state.

Keywords: Climate Risk; Multi-criteria Analysis; Ex-ante Assessment; Prioritization; Climate Smart Agriculture.

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14.00 - 16-00(Parallel): Technical Session (TS) 2

TS 2.3: Climate Resilient Measures in Rural India

Building a Climate Resilient Rural India: Nature-Based-Solutions for Water Ecosystems in MGNREGA Programs

Neeraj Mishra[1], Jyothis Sathyapalan[2] and Anagha Mariya Jose[3]

Abstract

All nations of the world, including India, are taking different measures to devise such policies that help in the mitigation of negative effects of climate change and strive towards the attainment of Sustainable Development Goals. India is predominantly a rural country with majority of its population living in the villages and dependent on agriculture and such livelihood activities which are highly sensitive to climate related changes. At the same time, rural areas also suffer from extreme poverty, unemployment, water scarcity, lack of infrastructural facilities, among others. To address these problems, the Government of India launched one of the largest social security and rural development programs under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in 2005. While fulfilling its basic objective of providing wage employment to the rural households for a minimum of 100 days in each year, the programs launched under this Act have brought the strategies of adaptation to climate change to the doorsteps of rural India. Most of the programs undertaken within this scheme have brought about both direct and indirect benefits to the environment and local ecosystem. Based on the review of secondary and primary literature collected from the 29 states of India, this article argues that MGNREGA has made significant contributions towards reducing the drastic effects of climate change, especially in conserving and rejuvenating the water ecosystems using 'Nature-based-Solutions. These efforts need to be further augmented and governance structure of the program needs to be strengthened for improved results.

Keywords: Nature-based-solutions; MGNREG Act, 2005, Waterworks and climate change; Adaptation; Mission water conservation

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Addressing Climate Resilience and Livelihood Opportunities through MGNREGS Assets in Telangana State

P. Anuradha[1], K. Jayasree[2], V. Suresh Babu[3] and V. Srinivasa Rao[4]

Abstract

The study attempts to capture the benefits accrued through initiatives of Telangana State Government under MGNREGS by creating assets to the small and marginal farmers in the form of perennial orchards to achieve the socio-economic sustainability and climate resilience. The field study was carried out in 29 districts of Telangana from 2014-15 to 2016-17on horticulture plantation created under MGNREGS during 2007-08 to 2013-14. The study reveals that the income levels of the small and marginal farmers have been increased by the productivity of horticulture crops. The assets created under MGNREGS at the individual and community level have contributed to building the climate resilience capacities in Telangana State. The study sample consisting of 290 farmers' benefited by horticulture plantation by cultivating fruit crops of their choice, which includes Mango (58%), Sweet orange (40%), Guava (1.9%) and lime (0.1%). The plantations raised under MGNREGS have sequestered 17,164.76 MT carbon in a period of 7 years. The works executed by Telangana state under MGNREGS helped the beneficiaries to reduce different climatic shocks, besides converting their waste lands into horticulture plantation supporting their livelihoods.

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Assets Creation under MGNREGS and its Contribution to Adaptive Capacity of the Rural Communities in Drought Prone Districts of Rajasthan and Karnataka

Anagha Mariya Jose[1] and Anuradha Palla[2]

Abstract

This study aims to explore the trends and extend of assets created under MGNREGS and its contribution to adaptive capacity of rural communities to absorb sudden shocks and unforeseen climatic risks. Both secondary and primary data has been used to estimate the trend in asset creation, and its contribution to the social resilience of vulnerable communities. The study noted that the allocation of budget for assets relating to natural resource management is significantly high in multi hazardous areas as compared to other parts of the country in certain locations, which in fact helped to improve the adaptive capacity of communities living in high risk regions by creating various ecosystem services like improved ground water, drought proofing and flood control across the country.

Keywords: Climate Resilient Assets; Adaptive Capacity; Multi-hazardous Areas.

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Adoption of Soil Conservation Measures: Evidence from Rain-Fed Watershed Areas of Telangana

Dayakar Peddi[1]

Abstract

Land degradation resulting from soil erosion is a major problem in rain-fed areas of agriculture in India. The study analyses the key determinants of the decision by the farmers to adopt on-farm soil and water conservation measures. The selected study area is rain-fed watershed areas of Siddipet district in Telangana. In these watershed areas, soil and water conservation measures have been undertaken by both the Government/NGO at the sub-watershed/community level and individual farmers on their farms. The data for this study was collected through a primary survey conducted during January-March 2018. The distinguishing features of the survey include: 1) determinants of soil and water conservation measures and explicit accounting of possible neighbourhood effects on farmer's decision; 2) exploring complementarity and substitutability between community level soil and water conservation measures and soil and water conservation practices adopted by individual farmers. The results based on logit model suggest significant positive influence of neighbourhood effects on farmer's on-farm soil and water conservation measures. Moreover, the findings also suggest significant influence of various biophysical and market access variables on farmer's decisions. Knowledge about the spatial dependency and community level practices can help the Government in designing better policies to promote the adoption of soil and water conservation practices.

Keywords: Soil and Water Conservation; Neighbourhood Effect; Sub-Watershed.

JEL Classification: C11, C13, 21, Q2

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Re-Looking into Micro Irrigation Models in India to Adopt to Climate Change

Krishna Reddy Kakumanu[1], Shrikant V Mukate[2], V Suresh Babu[3] and Ravindra S Gavali[4]

Abstract

Climate change is a global phenomenon affecting agriculture unevenly across the world. The poorest countries would be hardest hit, with reduced crop yields mostly in tropical and sub-tropical regions. Water availability is also reducing day by day due to the growing population and industrialization. The Govt. of India has formulated Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)-Per Drop More Crop in 2015 to execute micro-irrigation (MI) as an adaptation strategy. India has more than 42 million ha potential area for MI of which 18 per cent is only covered to date due to implementation challenges. In this context, present study was undertaken to evaluate the implementation models of different States, based on the adoption rate of MI. The objective of the study is to identify the factors contributing to the adoption of MI system and to develop alternative up-scaling approaches. Data was collected from Rajasthan, Madhya Pradesh, Uttar Pradesh, Telanagana and Gujarat states in India. The binary logistic regression and Garrett ranking was applied to analyse the data. The result depicts that adopted and potential/non-adopting farmers are very well aware about the benefits of MI and they need more technical guidance and training on water scheduling, fertigation and maintenance. Increase in the subsidy per cent, low/free interest rate loans for MI and integration of MI to lift irrigation schemes found to be alternatives to improve the adoption of MI. An alternative implementation model was suggested in the paper based on the successful implementations from different states. This can help the policy makers to up-scale the MI area in India.

Keywords: Climate Change; Agriculture; Micro-irrigation; PMKSY; Awareness Fertigation; Per Drop More Crop.

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How Do Water Institutions Perform? The Case of Canal Water User Associations in South India

Durga A.R[1], K. Chandran[2] and D. Suresh Kumar[3]

Abstract

The process of devolution of responsibility and control over natural resources like water from government agencies to user groups like water user associations (WUAs) shows that they can manage these natural resources in an efficient, equitable, and sustainable way. But these user groups require coordination among many farmers and are riddled with free-rider problems. Even though (WUAs) are excellent institutional arrangement, the overall performance is rather inconsistent. With this background the present paper intends to examine the method by which WUAs are constituted and assess their performance and functioning. A sample of 40 WUAs comprising 20 functioning and 20 non-functioning, were randomly selected from the project command area. Proportionate random sampling procedure was employed and thus a total sample of 273 farm households were selected and studied. Performance of WUAs in the present study was measured using three indices viz. organisational index, physical index and financial index. A composite index was constructed with these three indices which indicate the overall performance of WUAs. In line with the theoretical underpinnings a number of features based on the New Institutional Economics were taken into consideration for empirical analysis. The results indicate that most of the WUAs function with minimal activities and their financial health is less satisfactory. Even though these WUAs were created directly as a result of government activity, but the role of the government is insignificant. The rules and systems of the organisations are not rigid, no clear mechanisms and process for adapting to rules and systems of the association and no mechanism for regular overview of the rules and systems within the organisation. Conflicts to a larger extent are resolved in an informal way, using local customary rules and regulations. The study also revealed that the financial condition of the association is poor and these WUAs are unable to raise funds from the government with some of them becoming defunct. The performance was analyzed by constructing an index that was categorized into low, medium and high with the result indicating that majority of WUAs were medium performers. Introduction of cost sharing mechanism for canal maintenance and penalties for breaking rules or non-payment of dues by members would create responsibility among water management institutions and trigger the successful functioning of water user association.

Keywords: Performance; Governance; Canal WUA; South India

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Interventions for Sustainable Fishing in Sundarban: A Scoping Analysis

Saptarsi Chakraborty[1]

Abstract

It is well recognized that the fish stock in Sundarban delta is dwindling fast due to unsustainable practices and huge anthropogenic stress. Control on fishing trips and fishing locations in Sundarban is generally exercised by the Department of Forests by issuing licenses and temporary permits to fishing boats especially that enters the forest creeks. In the open rivers outside the reserve forest, there is no effective control or regulation in fishing. The boats that enter the reserve forest area are mostly oar-driven boats which operate with fishing nets of smaller mesh-size that can catch smaller fishes as well as juveniles of high value fish species. It is a bad fishing practice for the sustenance of local fish stock. On the other hand, engine-driven boats are mostly engaged in fishing in the open rivers with nets of larger mesh-size aiming for bigger and high value fish as they are prohibited in reserve forest area. This study is based on primary survey of 300 fishermen in Sundarban delta regarding their fishing practices and use of fishing gears. A regression analysis was carried out to establish the link between mesh-size and the type of boats used to cast the net. It is found that if the household are located near forests and road link, and if the education level of the household head is high, then such households tend to adopt better fishing practices. They use nets of larger mesh-size that is ecologically healthier. It was found that, controlling for other factors, an engine-driven fishing boat carries fishing nets of significantly larger mesh-size compared to an oar-driven boat. This can be contrasted with the fact that the engine-driven boats are subjected to stricter fishing rules while the oar-driven boats are exempt from it. The study suggests an alternative way to address the problem of ecological sustainability in Sundarban through provision of longer term easy credit to the poorer fishermen for converting their oar-driven boats to engine-boats.

Keywords: Sundarban Delta; Fish Stock; Sustainability; Mesh-Size; Fishing Boats; Department of Forests.

JEL Classification: Q22, Q28, Q57

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Framing Management Plan for the Conservation of Sacred Groves of Kachchh, Gujarat, Based on Stakeholder Analysis

Amit Pandey[1] and Kavita Sardana[2]

Abstract

Kachchh is pivotal for community-led conservation because of existence of two sacred groves within Gugaliyana Reserve Forest i.e. Oran Mata sacred grove and SadhayPir though, the oldest water springs with-in these sacred groves is still conserved despite drought years, purely on cultural grounds, the vegetation in these groves is severely impacted because of over grazing of cattle on the fringes of the reserve forest. This has adverse impact on the overall vegetation in the area and nearby farmland productivity. Thus, degradation of sacred groves has environmental and economic consequences. This is because management plan of sacred groves is currently non-existent in West Kachchh. This study uses Analytical Hierarchy Process (AHP) to assess stakeholder conflicts and dynamics based on ecological, environment, economic, and cultural attributes of conservation of sacred groves. Responses of 141 individuals belonging to 8 different stakeholder categories were collected using stratified random sampling. Respondents were stratified based on proximity to sacred groves. We find association between the cultural values and economic values for the farmers who grow crops in proximity of these groves. We show that the management plan that has an option with highest restriction on grazing and harvesting and that corresponds to highest cultural and economic values, receives the highest global ranking. Communities understand and value ecosystem services provided by sacred groves along with productivity benefits of proximity to sacred groves for farmland.

Keywords: Sacred Groves; West Kachchh; Ecosystem Services; Conservation; Management Plan; Analytical Hierarchy Process.

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Adoption of Grid-Connected Solar Rooftop Systems in the State of Jammu and Kashmir: A Stakeholder Analysis

Aaina Dutta[1] and Sukanya Das[2]

Abstract

Renewable energy is being seen as a transformative solution to meet energy as well as economic challenges, both globally and nationally. The Government of India has expressed its intent to achieve 100 GW of solar capacity in the country by 2020. However, one such state that lags in harnessing and achieving the solar targets is the state of Jammu and Kashmir despite having the second highest potential of solar energy. Jammu and Kashmir is a power deficit state though it has one of the best potentials in solar energy. Solar rooftop PV systems can solve most of the problems regarding power deficit, but yet people are naïve about solar rooftop PV systems. The purpose of this study is to perform stakeholder analysis to investigate the perceptions of the groups/individuals regarding grid connected solar rooftop PV systems as they have a critical impact on the result of the study as they provide fundamental data on the political, social and economic scenario of any study area. The findings from the investigation underscores that all the projects and programs related to the adoption of a solar rooftop system should concentrate on building awareness.

Keywords: Solar Rooftop; Grid-connected Systems; Stakeholder Analysis; Renewable Energy; Jammu and Kashmir; India.

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Clean Energy at the Cost of Food?
Effect of Hydro-Electric Projects on Local Agriculture in Sikkim

Bickey Sharma[1]

Abstract

Sikkim is a hilly state in North-East India with a large hydro-electric generation potential. The Sikkim government had entered into 29 MOUs with private power developers to build and operate Hydro Electric Projects (HEPs) in the state. So far, five of them are already completed and another 10 are at various stages of completion. However, the remaining 14 HEPs are terminated due to strong agitation put up by local communities against construction of dams and tunnels for HEPs. Studies on the exact nature and causes of resistance by local people in Sikkim HEPs are conspicuous by its absence in the public domain. This study was taken up to understand and measure the negative externalities of HEPs on local farming households based on a primary survey of 190 households in two HEP locations in Sikkim.

This study arrives at its finding by comparing the current agricultural performance of farming households across 'control' and 'treatment' groups. The study found that the productivity and profitability of agriculture is significantly and adversely affected by construction of headrace tunnels for these HEPs that divert the water of the local rivers. The diversion disrupts the aquifers in the hills and affects the water flows in small local streams which are the lifeline of local agriculture. The study estimates a loss of Rs.24,000 annually of an average household located in an affected village compared to its unaffected counterpart. The finding calls for government intervention for rectification of this negative environmental externality of HEPs. The finding also calls for more careful design improvements in tunnelling through hills, such that it does not affect the water flow local streams as it does with the present technology.

Keywords: Sikkim; Hydro-Electric Projects; Agriculture; Farming Households; Ecosystem Service; Resource Conflicts.

JEL Classification : Q12, Q25, Q34

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DAY 3: 8th November 2019, Thursday

14.00 - 16.00 (Parallel): Technical Session 3

TS 3.1: Ecosystem Services, Resource Dependency and Disaster Recovery

Post-Disaster Recovery in Coastal Fishing Communities

Trupti Mishra[1] and Krishna Malakar[2]

Abstract

The livelihoods and assets of coastal fishing communities are often affected by storms and cyclones. Such extreme weather events lead to disasters. Phailin was a major cyclone which affected the eastern coast of India in 2013. Odisha was one of the worst-hit states in India by the cyclone, resulting in substantial loss and damages to its population and economy. Communities need to be resilient in order to recover from the impacts of such events. This study examines the factors driving recovery from the impacts of cyclone Phailin in marine fishing communities of Odisha. The study, first, identifies the probable factors influencing recovery through an extensive review of the literature, followed by informal field visits, discussions with stakeholders and a pilot survey. Thereafter, various indicators of capitals, namely, human, economic, physical and social, are considered to be driving recovery. An extensive household survey, comprising of 300 respondents, is conducted to collect the required information. It is found that the levels and time required for recovery from the disaster differ among the fishermen. Thus, logistic regression is used to identify the significant factors linked to various levels of recovery. It is found that recovery is mostly influenced by economic capital in the form of income, assets and aid from the government. Physical capital such as having ownership of pucca house also enables recovery. Further, recovery of income can influence overall household recovery. The findings of the study may assist in designing disaster management policies for the vulnerable coastal fishing communities.

Keywords: Marine Fishing; Recovery; Cyclone; Phailin; Odisha; India.

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An Economic Analysis of the Impacts of Anthropogenic Climate Change on Agriculture: A Case Study on Hyderabad Karnataka and Coastal Areas

Jagadeesh[1] and P.S Sasdhar[2]

Abstract

Karnataka has the second largest dry zone after Rajasthan with 66% of the area under rain-fed agriculture. Changes in climate can directly affect crop growth, color, shape, size, weight, length, taste, output, yield, and occurrence of pests and diseases. Changes in yield influence on changes in the prices of output affect farmer revenues and ultimately influencing cropping patterns. The objective of this study is to explain quantify the impacts of climate change on cropping patterns after controlling for the economic factors. We estimate the composite entropy index (CEI) to measure the changes in cropping patterns. Study estimate logistic regression function using climate and agriculture data for the districts of arid regions and heavy rainfall regions spanning over seventeen years (1997-2014) to quantify the climate change effects. The results from our model indicate that climatic factors also impact crop diversification significantly. Parameter estimate on annual average temperature is positive but not statistically significant and the temperature is negative and statistically significant indicating that temperature is nonlinearly related to CEI.

Keywords: Anthropogenic Climate Change; Crop Diversification; CEI; Climate Factors; Agriculture Inputs.

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Cultural Services and Forest Dependency- Assessment of Recreational Demand for Parambikulam Tiger Reserve, Kerala, India

D. Soman[1] and V. Anitha[2]

Abstract

Tourism, one of the fastest growing sectors provides economic prosperity through its dynamic employment opportunity. The sector remains robust while the mounting number of visitors reaching their tourist destinations. The recreational value of a Protected Area aids in public policy making and decisions on the management of resources by balancing the pertinent costs and benefits. The paper addresses the strategic role of the cultural services, specifically, the recreational service in the livelihood of the primary stakeholders, i.e., the tribal communities, taking a Tiger Reserve in Kerala as a case study. The analyzed forest dependency of the forest dwellers depicted highest dependency for income and employment generation through the ecotourism activity. The Participatory Forest Management in the Reserve is a success story, whereby, the primary stakeholders generate a steady source of income. The study attempts to bring out the recreational value of the Reserve using Individual Travel Cost Method to elicit sustainable management and proper allocation of resources. A structured questionnaire survey conducted among the visitors captured the socio-demographic information, travel cost component and their perception of quality of the Reserve. The data regressed by semi log independent regression estimated the effects of socio-economic variables on the number of annual visits to the Reserve and the total recreational demand for the Reserve is worked out. Improved understanding of the recreational value of the Reserve among the various stakeholders helps in the proper maintenance of the region which attracts more environment sensitive visitors.

Keywords: Tourism; Travel Cost; Consumer Surplus; Recreational Demand; Protected Area; Tiger Reserve; Kerala.

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Reducing Ecological Stress through Subsidized Rice: Findings from Sundarban Delta

Sreejit Roy[1]

Abstract

The Sundarban mangrove delta is a Biodiversity Hotspot and a nursery ground for large number of fish species in South Asian coastal waters. Fishing in the Indian side of the delta is officially banned during 15th March to 15th June every year, as this is the hatching period of many important fish species. However, many poor fishing households regularly resorted to illegal fishing during the ban period in absence of alternative earning opportunities. A primary survey was conducted on their fishing practices and options for alternative earning. It was revealed that most of the respondents appreciate the rationale of the fishing ban and they actually want to adhere to the rule. But these poor households fail to comply as they cannot survive without food that they earn mostly by catching fish from the open waters. The study found that government policies for providing food security to the rural poor, like Rastriya Khadya Suraksha Yojna (RSKY), can also achieve an additional target of conservation. Most of these households are also recipients of 16 kg of rice per month at Rs. 2 per kg. It is a special case for this delta population apart from RKSY provisions. It was initiated as a relief measure after cyclone Aila in 2009, but is still continuing. The scheme doesn't differentiate between large and small household sizes. As a result, the proportion of food requirement by fishing household met by such highly subsidized rice, showed large variations. It opened up the scope to statistically examine its significance for compliance to the fishing ban rule. A primary survey of 317fishing households was conducted during 2017 for their awareness and willingness to comply to the fishing ban regime. The households were selected from several locations in the delta where fishing communities are concentrated. A logit regression was estimated for their revealed compliance to the ban, which was carried out using the 'proportion of rice requirement that is procured under such subsidy' as one of the regressors. It was found that a higher proportion of subsidized rice to the total rice requirement of fishing households significantly increase their willingness to comply. This paper shows that developmental interventions such as food subsidy can also have positive spillover effect on ecological sustainability and hence increases its social benefit. The paper suggests special packages of such subsidies that might be provided to the poor fishermen in Sundarban who are more dependent on local ecological resources.

Keywords: Sundarbans; Mangroves; Fishing Ban; Deltaic Ecosystem; Sustainable Fishing; Food Subsidy.

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Prediction Modeling for Land Use Land Cover (LULC) in the Urmodi River Watershed, Maharashtra

Wasim A. Bagwan[1] and Ravindra S. Gavali [2]

Abstract

In recent times, GIS and Remote Sensing (RS) are most effective and essential tools for the study of land dynamic studies. Land Use Land Cover (LULC) is also an important factor associated with land surface processes. The present study based on satellite imagery based LULC change detection and prediction of its change of Urmodi River watershed in Maharashtra. The world heritage site 'Kaas Plateau' also lies into the studied watershed. For the analysis of LULC, Landsat 8 imagery has been used to detect the change in LULC with consider to two years viz. 2013 and 2019. The analysis further extends to predict the LULC in the year 2025. Five landcovers namely agriculture, water body, barren land, settlement and forest were categorized. There occurs shrinkage in agriculture, water body and forest land. Barren land and settlement shows dramatic expansion with positive growth. The association among the land cover classes can be better studied by the modelling approach. The RS based analysis shows the quick and cost effective way of assessing the trend of land cover dynamics. The study has its implication in finding the spatio-temporal dynamics for the sustainable land use planning. The study could be beneficial to the policy maker and the stakeholders, whereby it can be utilized to avoid the risk of land deterioration activities and protection and conservation of the world heritage site.

Keywords: Geographic Information System; Remote Sensing; Land Use Land Cover; change prediction.

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14.00 - 16.00 (Parallel): Technical Session 3
TS 3.2: Climate Mitigation: Industry and Infrastructure
Potential Mitigation Strategies for Road Transport Sector of India

Namita Singh[1], Trupti Mishra[2] and Rangan Banerjee[3]

Abstract

Transport is one of the leading sources of emission in India besides biomass combustion in cooking stove and in open field, fossil fuel combustion in industries and power generation units. The uninhibited growth in transport sector due to the economic development of the country, will further lead to rampant misuse of resources and significant emission of Greenhouse Gases (GHG) and harmful pollutants. In the present study, bottom-up approach is attempted to build an on-road transport inventory for private, public, para-transit and freight transport system of India.

Emission of greenhouse gas (GHG) CO2 and air pollutants CO, NOx and PM for the year 2016 was estimated to be 261 Tg, 3117 Gg, 1881 Gg and 138 Gg respectively for the road transport sector of India. Energy consumption from the road transport sector was 3971 PJ, where major contribution was from diesel powered vehicles (2505 PJ), followed by petrol (600 PJ) and CNG (277 PJ). Therefore, need for alternate fuel and technology was analyzed in the reference year estimation. Analysis of age-wise and fuel-wise energy consumption and emission estimation of vehicles on road showed that post 2010 (0- 6 years old) vehicles have major contribution in energy consumption and vehicular emissions. Among the post 2010 vehicles, freight vehicles (trucks and lorries) have highest CO2 emission followed by private two wheelers. Whereas, in air pollutants, two wheelers (highest share on road) contribute highest concentration of CO and PM pollutants and public transport old buses contribute highest concentration of NOx. Implemented transport strategies such as Auto fuel norms, CNG diffusion and shift from 2 stroke engine to 4 stroke engines were examined to be inadequate in controlling transport emissions. Therefore, further transport strategies were suggested to achieve effective reduction in terms both GHG and air pollutant emission. The study contributes in constructing a transparent framework used for energy consumption and emission estimation, analysis of strategies in terms of emission reduction and suggesting further strategies to achieve effective reduction. Registered vehicle data of 36 years was used in developing a robust framework consisting of input variables (vehicle population, fuel efficiency, and vehicle mileage and emission factor), fuel share, and fuel mix and technology share. Impact of transport strategies on input variables was analyzed in terms of emission reduction.

Keywords: Road Transport; Vehicular Emission; Fuel Consumption; Transport Policies

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Green Growth and the Right to Energy in India

Rohit Azad[1] and Shouvik Chakraborty[2]

Abstract

Can growth in India be simultaneously made equitable and environmentally sustainable? The recent pattern of high growth in India has been inequitable even as serious questions have been raised about its ecological sustainability. In contrast to the current growth trajectory, this paper argues that an alternative growth trajectory can be developed which answers the question in the affirmative. We propose an Energy Policy with Equity (EPE), which fundamentally changes the energy mix of the Indian economy towards greener forms of energy as well as guarantees universal access to energy thus generated to the entire population, a feat that almost all the governments since independence have dreamt of but failed to deliver. This policy also fundamentally changes the energy mix of the Indian economy towards greener forms of energy as well as guarantees universal access to energy thus generated to the entire population.

This can be done by taxing carbon to control CO2 emissions. A part of the revenue thus generated can be used for a systemic overhaul of the energy mix, which to a large extent addresses the pressing problem of environmental degradation. And the other part can be used for an in-kind transfer of free electricity to the population who contribute less carbon than the economy average and universal travel passes to compensate for the rise in transport costs and to encourage the use of green public transport. The widening schism between two countries co-existing side by side, i.e. Bharat, which bears the climate impact burden, and India, which is imposing that burden because of their lifestyle choices, is justly addressed with the latter being taxed to compensate the former for the loss. The methodology employed in this paper is an Input-Output analysis which involves two steps: calculating the carbon content (IO data) and its impact on the household budget (NSS). The level of carbon tax required for this policy to come into effect is USD 60.4 per metric ton of carbon dioxide. On the one hand, a portion of these taxes mobilized is allocated for the improvement in energy efficiency and expansion of renewable energy. On the other, the free entitlement of fuel and electricity from these taxes for a household comes out to be 2268 kWh per annum or 189 kWh per month, which is 412 kWh per year multiplied by the average size of the household (i.e., 5.5). Universal travel passes with pre-loaded balance amount of USD 17.9 can be used on any mode of public transport. While the energy mix of the growth process changes in favour of clean sources through investment in green energy as well as controlling demand for fossil fuels through a carbon tax/cap, distribution of the tax revenue in the form of universal access to energy makes the process egalitarian. This policy not only curbs emissions but also delivers on providing more employment since the employment elasticity in greener forms of energy is higher than those in fossil fuel-based energy.

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Adoption of Renewable Energy: Challenges in the Household Sector

Smitha Bhaskar[1]

Abstract

Renewable energy is emerging as a solution for a sustainable, environmental friendly and long term, cost-effective source of energy for the future. Government of India has several programmes to encourage using renewable sources of energy in terms of providing subsidies, invention of technology and so on. But, their impact seems to be not so impressive. Renewable energy plays a predominant role in tackling the energy deficit in rural areas. But, wider acceptability among the households still remains a challenge. Adoption of renewable energy in the household sector not only makes the households energy self-sufficient but also brings down the pollution level thus leading to environmental sustainability. This transformation from conventional energy sources to renewable energy sources has larger implications in sustainable development. The study tries to understand the household behaviour towards adoption of renewables (like biogas, solar lighting systems to meet basic cooking and lighting purposes) and government policies and programmes in this respect. The paper is based on the empirical data collected from 500 households in selected rural and urban areas of Karnataka. The findings suggest that there is no linkage between households' attitude towards environmental awareness and adoption of renewable energy sources. The awareness about solar systems among the households is too low. The lack of marketing of solar geysers and lighting systems, non-availability of retail outlets coupled by ignorance of government rebates and subsidies among the households are the other challenges for non-adoption. Easy availability of LPG is one of the demotivating factors for biogas adoption. The study suggests for implementation of environmental awareness programme by government at the grassroots level. By providing free installations for households willing-to-adopt and, by making available technical support for maintenance works may encourage households to opt renewable sources as their main choice of fuel.

Keywords: Renewable Energy / Non-conventional Nnergy; Household Energy; Household Behaviour; Pro-environmental Behaviour; Sustainability.

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Carbon Mitigation and Fuel Efficiency Improvement Strategy for Northern Indian Brick Industry

Priyanka Jajal[1], Trupti Mishra[2], Chandra Venkataramana[3] and Alok Jhaldiyal[4]

Abstract

Brick manufacturing has been gaining attention due to large fuel requirements leading to emissions of climate pollutants. India is the second largest producer of brick in the world requires specific attention. The existing literature identifies energy efficient and emission factors for the sector; however, cost analysis for the industry has not been conducted so far along with carbon emissions. The study, hence, tries to estimate energy requirements, operation cost and carbon emissions from the selected few kilns from the northern part of India. A survey was conducted which revealed that the amount of mustard husk required for brick making is huge compared to coal due to its lower calorific values. The same leads to the increased cost of operation as well as larger emissions. It can be concluded from the study that shifting away from husk towards coal and newer technologies would result in emission reductions along with cost reduction.

Keywords: Fuel Efficiency; Carbon Emission Mitigation; Brick Industry; Survey Analysis.

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Environmental Disclosure Regulation and Decarbonization of Indian Industries: Evidence from Firm Level Data

Mousami Prasad[1]

Abstract

Climate change poses serious threats to mankind and biodiversity and the concerns have lead to efforts from all nations. India, alone is responsible for 6% of global CO2 emissions with significant contribution from energy intensive industries. While there is increasing pressure on firms to decarbonise or adopt measures for low carbon growth, the empirical evidence of such measures is very limited. This study examines what role disclosure regulation pertaining to environmental issues, plays towards decarbonisation of firms. The study includes firms from energy intensive sectors. Using economics of emission framework, it is argued that disclosure regulation can reduce the emission by increasing the marginal penalty costs for firms. Further, carbon dioxide emission inventory is built for the study sample using energy consumption details. The results suggest significant role of disclosure regulation in addressing climate change concerns at firm level. The study has implications for public policy and corporate managers.

Keywords: Disclosure Regulation; Emission Intensity; Economics of Emission; Firms.

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Estimating Shadow Price of Water Pollutants: A Case of Kanpur Leather Industry in India

Aparajita Singh[1] and Haripriya Gundimeda[2]

Abstract

This paper measures the abatement cost of pollution for the Kanpur Leather industry which is one of the most water polluting industries in India. We estimate the technical efficiency of Kanpur leather firms in reducing pollution and expanding their output. Estimates of the shadow price of Total Suspended Solids (TSS) and Chromium are obtained to reflect the marginal abatement cost of pollution on these firms under the command and control regulatory regime. The methodology used in the study is the directional output distance function which is estimated as a deterministic frontier using the linear programming approach. Our empirical analysis shows that there exists technical inefficiency in these firms and if operated efficiently, there is scope to expand the leather output by 56% while reducing TSS and chromium discharge by 55% and 50% respectively on an average. The shadow price of TSS and chromium are 281.06 and 5089.38 thousand USD/ton respectively on an average and these estimates are sensitive to the selection of directional vectors. The variations in the shadow price of the pollutants across the leather firms is explained due to the differences in degree of non-compliance of tanneries with regulations, age, size and location of the leather firms. The high variability in the shadow prices across firms indicates that command and control regulations fail to recognize the heterogeneity in the abatement potential of different leather firms. Therefore, it is recommended to use market based instruments to achieve compliance in a cost-effective manner.

Keywords: Kanpur Leather Industry; Directional Distance Function; Shadow Price; Technical Efficiency; Water Pollution; India.

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14.00 - 16.00 (Parallel): Technical Session 3

TS 3.3: Conservation, Economic Value and Climate Change Impact

Conserving Mangroves in Sundarban through Clean Cooking Fuel: Field Evidences

Tapas Kumar Sutradhar[1]

Abstract

The *Pradhan Mantri Ujjala Yojana* (PMUY) is a programme undertaken by the Government of India for providing easy and subsidized access to superior cooking fuel (LPG) for rural households. The assistance is supposed to reduce the use of fuel wood for cooking and hence improve their living conditions with reduced indoor air pollution. In the Sundarban delta, almost all the households use fuel wood as main cooking energy source and till few decades ago, most of them were sourced from mangrove forests. However, with reduction in availability and with increasing worldwide awareness for mangrove conservation, use of mangrove based fuel wood had been legally forbidden in recent years. But informal discussions with villagers reveal that a part of the fuel wood used by local villagers is often illegally sourced from mangrove forests. In formal interviews, however, few people admit this phenomenon. This paper is based on a study into the current cooking fuel usage pattern in Sundarban delta after PMUY made considerable penetration in the area. A total of 224 households, randomly selected from different landholding strata, were interviewed on their usage fuel wood and their sources. . It was found that due to high cost implication of LPG even under PMUY, the main cooking fuel of almost all the households remained fuel wood, though with reduced quantity. Interestingly, some households had admitted that their entire fuel wood need comes from nearby mangroves till now. Since most of the respondent households received LPG connection under PMUY within last one year, the survey could elicit fuel wood usage quantities before and after LPG connection, irrespective of its source. A regression analysis was carried out to explain the total quantity of monthly fuel wood consumption at household level, keeping the availability of LPG as one of the regressors. It was found that, in an average household, controlling for other characteristics, provision of LPG decreases monthly fuel wood consumption by 61 kg irrespective of its source. The result alone fails to filter out the effect of PMUY on mangrove conservation directly. However, a link was established by combining this regression result with the information from a subset of households that voluntarily revealed their source of fuel wood being mangrove forests. Together, it could be established with strong empirical evidence that PMUY is contributing to mangrove conservation in Sundarban region, apart from its direct objective of reducing indoor air pollution. The study provides a rationale to put more emphasis on implementation of PMUY in Sundarban delta, as the scheme has an additional social utility of mangrove conservation, which is considered very important for the sustainability of the delta ecology.

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Estimating the Economic Benefits of Universal Health Coverage for Climate-Induced Diseases in Southwest Coastal Region of Bangladesh

Md. Hafiz Iqbal[1] and Md. Elias Hossain[2]

Abstract

Universal Health Coverage (UHC) plays a vital role to tackle health problems with the full spectrum of services of good quality. It ensures the healthcare needs at an affordable cost. Given limited funding resources, assessment of economic efficiency of UHC is necessary. This study aims to estimate the economic benefits of UHC. Key informant interview and focus group discussions were conducted to understand climate-induced diseases properly and to select the relevant attributes of UHC. In the study, a choice experiment was applied to 716 respondents through cluster sampling technique. Five attributes - capitation, telemedicine, medicare, medicaid, and social health insurance - were identified as relevant attributes for the choice experiment. A monetary attribute - payment for UHC was also included. Random parameter and multinomial logit models were used for estimation. All the attributes included in the models were significant factors in affecting the probability of choosing an alternative scenario. The results suggest that households of the southwest coastal region of Bangladesh were more concerned about climate-induced diseases as reflected by the marginal willingness-to-pay for UHC. Household income, age, family size and years of education were found to be significant. The economic welfare from two improved scenarios makes a guarantee that investor in UHC can make more return and establish well-being.

Keywords: UHC; Choice Experiment; Behavioral Economics; Willingness to Pay; Coastal Bangladesh.

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Does Economic Development and Disaster Adaptation Measures Reduce the Impact of Natural Disasters? A District Level Analysis from the State of Odisha, India

Yashobanta Parida[1], Prarthna Goel[2], Prakash Kumar Sahoo[3] and Tapaswini Nayak[4]

Abstract

Natural disasters are a regular phenomenon in Odisha due to unique geo-climatic conditions. Frequent occurrences of natural disasters affect different aspects of human life as well as damage to private and public property. The incidences increase the fiscal pressure on the state government and adversely affect the general socio-economic conditions of the households. We examine the effect of economic development, basic disaster adaptation measures and specific disaster exposure on disaster fatality due to floods, heat wave and lightning using district-level panel data for 30 districts in Odisha over the period 1999-2011. The fixed effect Poisson estimate suggests that district with higher economic development (proxy by per capita income) experience lower disaster fatality. The results further confirm that better disaster adaptation measures such as adequate road infrastructure, higher educational attainment, village electrified, forest cover and better financial accessibility could help in mitigating disaster fatality. In addition, the results also confirm that disaster specific exposures such as incidence of flood, rainfall, high temperature and humidity lead to an increase in disaster fatality. The results conclude that different disaster adoption measures are essential to mitigate disaster fatality in the district of Odisha.

Keywords: Disaster Fatality; Temperature; Economic Development; Credit Ratio; Negative Binomial Model; Odisha

JEL Classification: O10, C54

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Marginal Value of Sub-Watershed Treatment on Profit and Labour Demand in Darrjeeling District, India

Chandan Singha[1]

Abstract

Unchecked, continued soil erosion has adverse consequences for agricultural productivity. There are many soil conservation measures, some of which are large-scale can limit soil erosion, or even restore soil cover. In Teesta River Watershed, in Darjeeling district in the Eastern Himalayas, there have been soil conservation interventions by the government at the sub-watershed level. The study assesses if farm profits and demand for farm labour are significantly different in treated sub-watersheds than in untreated sub-watersheds. We use primary survey data of Darjeeling conducted in the year 2013. We estimate a quadratic flexible form profit function jointly with labour demand, using seemingly unrelated regression, and find that profits are higher in treated sub-watersheds. However, labour demand appears to be no different between treated and untreated sub-watersheds.

Keywords: Soil Conservation; Sub-watershed; Farm Profit; Labour Demand; Seemingly Unrelated Regression.

JEL Classification: Q240, Q150, Q120

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A Time Series Study of Monsoon Rainfall Behavior in Odisha - 1871 to 2016: An inquest into Climate Change

Abhilas Kumar Pradhan[1]

Abstract

Awareness of the impact of climate change has soared since 1960s and a drive to save the 'mother-earth' and the irreplaceable life on it has gained impetus. The bounciness of the earth's ecosystems is becoming unstable due to unexpected climate change that has emerged in the form of frequent droughts, floods, wildfires and ocean acidification etc., bringing further loss of biodiversity and the planet's embryonic power for mitigation and rejuvenation. Temperature upswing, change in precipitation patterns, rise in sea level, fading of snow cover and mountain glaciers, coastal erosion, manifestation of health menaces and increasing frequencies of catastrophic events are perceived as the visible impacts of climate change. India being a stakeholder in the process of global climate change has to meet the challenge of upholding its rapid economic growth in the era of swiftly shifting global climate and weather conditions. Climate change, population explosion, diminution of ecosystems and natural resources are vital global confronts having direct sways on the livelihoods and raising fears for food security, water supply, health and energy. One of the pre-eminent ways of comprehending climate change is to examine how the variables such as temperature, rainfall, etc. have changed in the past based upon long-term observational records. Comparison of mean changes of the climatic variables and their fluctuations over time periods would corroborate the impact of anthropogenic activities on them. Further, study of climatic components especially temperature and rainfall of a region are central for sustainable development of agriculture and planning. Examination of trend and variations of rainfall and temperature are reckoned necessary as they indirectly avow the health status of environment at local, regional and global scenarios. The Inter-Governmental Panel on Climate Change (IPCC) established by United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) defines climate change as "a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity." Following the definition of IPCC, the current empirical work intends to investigate changes in the mean and/or variability and stationarity/non-stationarity of monsoon rainfall in Odisha, spanning the period 1871 to 2016. For comparative purpose, the time series data is split into two halves: 1871 to 1950 and 1951 to 2016. Data for the said periods are subject to relevant statistical tests such as Augmented Dickey Fuller (ADF) test, t-test and Variance test to ascertain changes in its properties (stationary/ non-stationary, mean and variation) or otherwise. A link is established between anthropogenic events in the state and its present climate scenario. The research work is likely to add on the existing works in the realm of climate change and may be of use for researchers, academic circles and policymakers towards adaptation strategies with special reference to agriculture which remains the back-bone of the state's economy and its people.

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Fertilizer Use and Rainfall Shocks in Indian Agriculture

Kaushik Bora[1]

Abstract

Changes in nutrient management are an important mechanism in response to climate variability. Increase or decrease in chemical fertilizer application becomes an important decision with respect to cultivation with weather uncertainties. Using district-level panel data, the paper examines how fertilizer application varies with different levels of rainfall shocks in India. The study finds significant differences in fertilizer application between rainfall excess and severally deficit years. The results suggest that the presence of irrigation and good monsoon rainfall positively contributes to the levels of fertilizer use. The present analysis does partially support the existing evidence of increasing fertilizer rate as a coping mechanism to negative rainfall shocks in some parts of the world. A negative rainfall shock is more likely to result in lower use of fertilizer at low levels of drought. However, higher intensity droughts can lead to an increase in the amount of fertilizer use at the district level. With a higher percentage of area irrigated in drought-affected areas, the likelihood of application of fertilizer relatively decreases comparatively. Overall, findings support that irrigation very well complemented the use of risk-reducing input like fertilizer since the green revolution period in India. So, basic management practice of soil nutrient and water can still play a strong role to safeguard against increasing rainfall related extreme events with the advent of climate change.

Keywords: Rainfall Shocks; Droughts; Fertilizer; Irrigation; Climate Change.

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14.00 - 16.00 (Parallel): Technical Session 3

TS 3.4: Sustainability: Infrastructure Health, and Water

Is Electric Street Car a Sustainable Public Transport System in India? A Demand Side Analysis

Oindrila Dey[1] and Debalina Chakravarty[2]

Abstract

Electric Street Car (ESC) is well acknowledged as a public transport system in urban spacewhich offers better safety, minimum pollution, conservation of fossil fuel and hence establishing as an ideal one for urban agglomeration. Yet, India embarked on an ambitious plan for going all-electric by 2030 by procuring E-buses rather than ESCs (i.e.,tramways). The crucial question is, when the government is trying to implement electric public transport system with a drive towards a low carbon emission technology then why not upgrade the existing ESC as a part of that initiative considering that the E-buses need a profound infrastructure development in India? This paper identifies the factors under which the stated preferences of the commuters to avail the ESC service are more than e-buses. Our study is based on the primary survey from randomly selected 1226 daily public transport commuters' responses from the city of Kolkata, as in the Indian sub-continent it is the only city having ESCs in operation till date. Using random utility choice model as empirical background, we identify the factors influencing the choice of tram over e-buses as public transport. The study also estimates the impact of specific performance improvements on the intention to avail the ESC services compared to the E-buses. The study helps to understand how perceptions of the individuals about ESC are aligned when the commuters are frequent or infrequent travellers of ESC. The study finds that ESC are noisy, create traffic congestions, eco friendly, safe & comfortable, cheap and good for short distance travels, yet may not be a good alternative of E-buses. On an average the stated probability to avail ESC service over electric bus service is in the range of 40%- 68 %. It is identified that higher frequency in availability of ESC service and technological upgradation are two important factors which contributes towards the switching intention of the commuters towards ESC. By promoting the ESC services over E-buses, Indian government could save substantial amount of public investment and can reach a low carbon pathway cost effectively. The findings have crucial implication both from managerial and policy perspective in transportation sector, energy sector, urban development, climate change and in public policy.

Keywords: Sustainability; Urban Development; Electric Vehicle; ESC.

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Sanitation Deficiency and Induced Health Costs in the Slums of Lucknow, Uttar Pradesh

Sanatan Nayak[1] and Soma Samanta[2]

Abstract

Using primary level data in slums of Lucknow, this paper tries to assess the effect of poor and insufficient sanitation facility and induced health costs to the dwellers of notified and non-notified slums. Multi-stage sampling method is designed to investigate the above objectives in the slums of Lucknow city (both notified and non-notified) by covering 900 slum households in 21 slums from all the six zones. Further, households are selected randomly covering socio-economy factors and health costs is measured based on cost of illness approach due to unsafe drinking water and poor or inadequate sanitation. It is observed that the existence and accessibility to basic amenities in both notified and non-notified slums Lucknow is substantially low compared other urban areas. The findings of survey reflect that nearly 50 percent of households from both types of slums do not have latrine facility and they defecate openly. Due to unsafe drinking water and open defection or lack of sanitation and hygiene, numerous water borne, and faecal-transmitted infection (FTIs) diseases viz., diarrhea, cholera, typhoid, malaria, jaundice and dysentery are identified. It is observed that total costs of acute and chronic diseases are substantial, i.e., nearly 1/5th of the annual income of the households. Therefore, the poorest section of population in the slum regions of Lucknow are pushed to further impoverishment due to acute, semi-chronic and chronic type of illness Therefore, holistic approach is needed to address for reduction of various diseases in the slum areas.

Keywords: Poor Sanitations; Faecal Transmitted Infection (FTIs); Acute and Chronic Diseases; Cost of Illness Method; Direct and Indirect Cost.

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Circular Sanitation Economy in India: Evidence from Amberpet Sewage Treatment Plant, Hyderabad

Sourav Mohanty[1] and Prajna Paramita Mishra[2]

Abstract

The Government of India launched the Swachh Bharat Mission in 2014 in order to achieve an open defecation free status by 2nd October, 2019. However, the next challenge that the country is going to face is the generation of huge volume of human waste and its management. This paves the path for sanitation economy which deals with the production, consumption and distribution of sanitation services. The sanitation economy links three distinct areas for business and societal benefits. They are the toilet economy, the smart sanitation economy and the circular sanitation economy. The circular sanitation economy (CSE) is an integrated market place of sanitation and waste management. It considers human waste as toilet resources. The value chain of circular sanitation economy involves collection, transport, treatment and reuse of these resources. Over the years there is a growing literature on circular sanitation economy. However, there is a dearth of research in India on this aspect of sanitation. To bridge this gap, the main objective of our study is to understand the prospects and implementation of CSE in India. We have taken the Amberpet Sewage Treatment Plant (STP) in Hyderabad as our case study. This STP is chosen because it is the largest STP in terms of Upflow Anaerobic Sludge Blanket (UASB) technology in Asia. Large STPs like this are associated with lower GHG emission. The biogas generated out of them can also provide net emission reduction of GHGs. A semi structured questionnaire has been used to gather information from different stake holders like the executive director, general manager, operation managers, manufacturers, retailers and farmers. An analysis of the STP shows that they derive many end products from the plant on a regular basis. These are electricity, biogas, sludge cake and treated water. The former two are used within the plant for operational purposes. The sludge cake is sold to external agencies which further processes it to obtain manure. This manure is procured by the farmers for agricultural use. Currently the treated water is released back into the river Musi. However, the concerned agency is planning to extract hydroelectric energy from it. This shows there is a potential market for all the products generated by the STP. Thus a successful implementation of circular sanitation economy requires a well-functioning market for the products. This necessitates a comprehensive understanding of existing bottlenecks in septage management in the country. Also the government has to look beyond the immediate objective of defecation free status and focus on waste treatment processes which will eventually help the society to get rid of unclean practices of hygiene and sanitation.

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The Economic and Environment Benefits of System of Rice Intensification: The Case of Telangana State

Ramdas Dagam[1]

Abstract

Paddy is a major crop cultivated under lift irrigation in Telangana. The cost of cultivation is high in paddy and there has been no significant improvement in yield (Socio-economic Outlook, Telangana 2017). This has resulted in lower incomes to the farmers and is also affecting the environment adversely. In this context, the system of rice intensification (SRI) will answer these problems. Studies show that the practice of SRI has higher environmental and economic benefits with lower inputs. It is based on four components; early establishment, reduced plant density, improved soil conditions through weeding, and reduced water application. Most of the farmers have been adopting these with slight modifications in the state. To analyze the benefits, 117 SRI and 106 Non-SRI farmers have been selected from the central region of Telangana. Data were collected on the quantities of inputs used, their costs for the kharif 2017 in July, August, and September 2018. Averages of water, organic and chemical inputs use, yields, net incomes, and efficiencies and conducted t tests have been taken for analysis. This study reveals that net incomes are higher for the SRI farmers, due to higher yields and lower cost of cultivation. Moreover, it finds that there is a decline in the use of water, and a marginal decline in the use of chemical fertilizers while the significant increase in the use of organic fertilizers in SRI has resulted in environmental benefits. Therefore, it shows that SRI practice is economically efficient. Hence, it has resulted in sustainable agriculture development.

Keywords: System of Rice Intensification; Adoption; Environment; Economic; Efficiency.

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Integrating Economic and GIS Modelling to Evaluate Watershed Interventions under Changing Climate

Josily Samuel[1], C.A. Rama Rao[1], B.M.K. Raju[1], Pushpanjali[1], R Rejani[1], Nagarjunakumar[1] and G. Ravindra Chary[1]

Abstract

In pursuit of individual goals a farmer utilizes her natural, human and economic / financial resources for maximizing various outcomes such as income, food security. A watershed is one such decision environment wherein economic outputs are maximised considering the trade-offs among the economic and ecological outcomes. Keeping this in view, this study attempts to evaluate impact of watershed interventions the change in land use land cover, productivity of major crops, cropping pattern and cropping intensity and farm incomes. Secondly the study purposes to examine the trade -off between economic and ecological objectives in bio-economic modeling framework under changing climate scenarios. The study was conducted in padmaram micro-watershed located between 77°57' 13'' to 77°59' 8'' E longitude and 17°03' 40'' to 17°06' 21''N latitude in Kondurgmandal of Mahabubnagar District in Telangana State.The soil loss from 87 per cent of the micro-watershed area was below 2.0 t ha^{-1} y^{-1} and only 7 per cent area have soil loss more than 3.0 t ha^{-1} y^{-1}. The soil loss from crop land during drought, normal and above normal years was estimated and it is 3,2, 4.0 and 3.0 t/ha/y, respectively. The soil loss was estimated for the changing climate scenarios using regional PRECIS A1B scenario data. Two different optimization models were run using the primary data on inputs and output and the soil loss to arrive at a farm plan that maximised net return and another plan that minimized soil loss under different climate scenarios. The cropping pattern and resource use under the income maximising and erosion minimising plans were studied. It is found that efforts to increase farm income were leading to more soil loss or conversely minimization of erosion would lead to reduced farm incomes.

Keywords: Watershed; Climate Change; Bio-economic Model; Soil Loss; Trade-offs.

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Abstracts of panel session

Panel Proposals for INSEE Conference, 2019

Day 1: 6th November, 2019

12:00 - 13:30 (Parallel): Panel Session (PS 1)

PS 1.1

How IWRM in India can be more climate resilient?

Chair/Moderator: Rajeev Ahal

(Director, Natural Resource Management, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India)

One of the most prominent ways in which climate change is manifesting itself is through its impact on global water resources. According to India's Composite Water Management Index (2018), 600 million people in the country (44 percent of the total population) are suffering from an acute shortage of water. A shrinking and sometimes contaminated water supply, heavy reliance on rainfall and lack of efficient irrigation systems are major problems in rural areas, where almost 70 percent of the Indian population live. India is one of the most affected countries by climate change and occupies sixth place in the Global Climate Risk Index 2018. Water is also the natural resource interlinked to food, energy and other critical and essential systems for sustaining life. In this changing climate scenario, climate resilient water security is therefore a prime concern.

Integrated Water Resource Management (IWRM) has been defined by UN Water as *'Promoting the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.'* The same has been adopted in India by the National Water Mission and other public and private entities working on water. The Indo-German bilateral project 'Water Security and Climate Adaptation in Rural Areas' (WASCA) works on improving convergent mechanisms for planning, financing and demonstrating innovative measures on climate-resilient IWRM.

This session will discuss the evolving strategies of WASCA project, as well as approaches developed and/or piloted by the Government, NGOs, research and academic institutions in India. The panel will focus on introducing the concept and setting the context to then enable a participatory brainstorming discussion on 'How IWRM in India can be more climate-resilient'. The objective is to consolidate learning, successes and challenges from policy makers, researchers and practitioners, thus bringing together various perspectives on this important issue on one platform.

[1] Climate-Resilient Water Management: An operational framework from South Asia: http://www.indiaenvironmentportal.org.in/files/file/Climate-resilient%20water%20management.pdf

Speakers
Jagdish Purohit Programme Director, Society for Promotion of Wasteland Development, New Delhi.
Jyothis Sathyapalan Professor, National Institute of Rural Development and Panchayati Raj, Hyderabad
(TBA) Official from Environmental Protection, Training and Research Institute (EPTRI).

12:00 - 13:30 (Parallel): Panel Session (PS 1)

PS 1.2

Climate & Disaster Resilient Urban Development

Chair/Moderator: Jyoti K Parikh

Executive Director, Integrated Research and Action for Development (IRADe), Delhi.

Rohit Magotra

Deputy Director, Integrated Research and Action for Development (IRADe), Delhi.

Introduction

IPCC SREX-2012 report establishes strong links between Climate Change and extreme weather events such as storms, cyclones, floods and heat waves predicting considerable increase in frequency of such events related disasters. During the last thirty years, India has been hit by 431 disasters affecting nearly 150 crore people and damage to property (DMI, 2011), highest among disaster prone displacement with nearly 0.023 crore uprooted (UNIDSR, 2017). This can be attributed to climate induced disasters and partly due to unplanned urbanization and inefficient governance.

During the last thirty years, India has been hit by 431 major disasters resulting into enormous loss to life and property. According to the Prevention Web statistics, 143,039 people were killed and about 150 crores were affected by various disasters in the country during these three decades (NIDM, 2015).Most of the Indian cities are vulnerable to climate induced natural hazards. The frequency and intensity of hazards have considerably affected cities in last decade. Cyclone Hudhud in Vishakhapatnam (2014), Srinagar Floods (2014), Chennai Floods (2015, 2018), Kerala Floods affecting its several cities (2018), cyclone Fani struck cities across Odisha & Andhra Pradesh (2019), Bengaluru Floods (2019) and Patna Floods caused huge economic losses to the cities.

Among the various disasters faced by Indian cities, some are due to sudden onset like floods, cyclones and landslides, some like sea level inundation in coastal cities and Heat Stress are *"silent disasters"*as they develop slowly. Heat waves, can adversely affect the livelihood and productivity of the people and can lead to human mortality. Under the 2-degree Celsius warming scenario of IPCC AR5, the frequency of heat waves in India is projected to increase by 30 times of the current frequency by end of the century, whereas, the duration of heat waves is expected to increase 92 to 200-folds under 1.5 and 2-degree Celsius scenarios. There have been 25,716 deaths from 1992 to 2016 due to heat waves in India (NDMA, 2017). The country recorded a 61 percent increase in heat-related mortality between 2004 and 2013 (NRCB, 2014).

Integrated Research and Action for Development (IRADe) was designated Centre of Excellence, Urban Development and Climate Change, in 2008 by the Ministry of Housing and Urban Affairs (MoHUA). IRADe has been actively working in the

areas of Climate Change, Urban Resilience, Disaster Management, Vulnerability Assessment, Smart Cities and Sustainable Urban Development. Through various projects and initiatives IRADe is furthering the agenda of integrating various urban development response to disaster & climate change and documenting best practices and policy level prescriptions that could be understood and adopted by the state and national level decision makers and local administrations to help them link climate and Disaster Risk issues with the existing programmes in urban development. We organize this session at INSEE to generate awareness and to encourage more work in this area.

Session Overview

- *Disasters and Climate Change Scenario in Indian Cities - Sudden Disaster*
- *Impact of Heat Stress (Health, Productivity & Livelihood)- Silent Creeping Disaster*

Session Objectives

The session will focus on the current status/ scenario of the disasters in Indian cities and framework to assess disaster vulnerability, prepare cities so that not all extreme evets turn into disasters. Efficient urban spaces can be created through proper management of resources, including water and energy, and better services to citizens.

Disaster Resilience can be assessed on the basis of the severity of hazards, existing urban basic infrastructure, Governance and Socio-economic conditions of the populations and vulnerable groups (HIGS Framework) and Urban Climate Vulnerability Framework. State and National stakeholders need to be sensitized on climate change and climate related vulnerability and work in close coloration with the Urban Local bodies and authorities to develop adaptation strategies for building climate resilience. A comparative analysis of thirty Indian cities will be shown.

The session will further deliberate on the Impact of Heat Stress on health, work productivity and livelihoods of vulnerable populations and the need for developing Climate Adaptive Heat Stress Action Plans for Indian cities - appropriate, innovative and affordable climate adaptation measures for improving health and livelihood resilience in the cities.

Session Questions

Disasters/ Climate Resilience

- What is the current status (infrastructure, socio-economic and administrative) of India's urban centers/ cities to be climate and disaster resilient?
- What are the available measures adopted by cities to mitigate disaster and climate change?
- What is the framework to assess Urban Vulnerability?
- What are the Policy lessons for improving climate & disaster resilience?
- What are the economic impacts and benefits of resilience?

DRAFT AGENDA

Time	Sessions
	Session : Climate & Disaster Resilient Urban Development
	- Overview on Urban Disaster & Climate Change in Indian Cities
	- Framework and Disaster Resilience in 30 Indian cities
	- Case study on Heat Stress Impact - Health, Productivity & Livelihood
	- Mapping, Mitigation and Adaptation measures
12.00- 1.30 am	Lead Speaker:
	- Prof. Jyoti Parikh, Executive Director, IRADe
	- Mr. Rohit Magotra, Deputy Director, IRADe
	Panelist:
	- Prof. V. Srinivasa Chary, Director, Centre for Energy, Environment, ASCI
	- Dr. Lipika Nanda, Vice President, Multi-sectoral Planning in Public Health, PHFI
	- Mr. Rajkiran Bilolikar, Associate Professor, Energy Area, ASCI

Heat Stress

- ✦ What are the socio-economic impacts of extreme heat events on the health, work productivity and livelihoods of vulnerable population?
- ✦ What can be done to reduce economic impact of heat stress on health and livelihoods to develop
- ✦ resilience?
- ✦ How the policy makers will be facilitated by active use of information and evidence to drive the implementation of the Heat Stress Action Plans into urban disaster strategies?

12:00 – 13:30 (Parallel): Panel Session (PS 1)

PS 1.3

Adapting to Climate Change in South Asian Cities (*SANDEE-ACD Panel)*

Chair/Moderator: E. Somanathan

Professor, Economics and Planning Unit, Indian Statistical Institute, New Delhi

Most fast-growing cities in South Asia face increased waterlogging and water contamination from improperly managed solid waste. Extreme weather events, including floods and droughts, are expected to further aggravate the operation of water supply, drainage, and sewerage infrastructure in the face of climate change. Protecting cities requires reducing waste and improving waste collection, investment in drainage, replacing riverside and wetland dumping with engineered landfills, and identifying sustainable mechanisms to finance waste management.

Amongst the many threats from climate change in South Asia, responding to flooding and extreme rain events is a priority for cities. The effects of climate-driven heavy rainfall and storm surges are exacerbated in urban centers because of inadequate drainage systems and unplanned growth of the cities. Exposed cities are at risk from immediate costs from losses on lives, assets and productivity and by the disease outbreaks from waterlogged drains and contaminated drinking water. To enable waste to be managed under circumstances of extreme or frequent flooding and heavy rainfall, cities will need to become more resilient.

In this panel, we will share and discuss the results of ongoing research in two South Asian cities - Bharatpur in Nepal and Sylhet in Bangladesh. This panel mainly focuses on:

a) Understanding city flooding and water logging under different climatic and non-climate scenarios in two cities and examining the role of hard interventions and soft interventions for mitigating the problem, including the role of solid wastes deposits on the canals and drainage system,

b) Identifying preference of the city residents for managing solid wastes better,

c) Understanding behavioral aspects of urban dwellers in properly managing the solid waste, and

d) Estimating the benefits of cleaner neighborhood in terms of residential property price.

***Co-coordinators*:**

Dr. E. Somanathan, Professor, ISI Delhi,

Dr. Mani Nepal, South Asian Network for Development and Environmental Economics –International Center for Integrated Mountain Development (SANDEE-ICIMOD), Kathmandu, Nepal.

***Panelists*:**

1. Dr. A K Enamul Haque, Professor, East-West University and Executive Director, Asian Center for Development, Bangladesh.

2. Dr. Mani Nepal, SANDEE-ICIMOD, Nepal.

3. Dr. Muntaha Rakib, Associate Professor, Shahajalal University of Science and Technology, Sylhet, Bangladesh.

4. Ms. Ismat Ara Pravin, Institute of Water Modeling, Bangladesh.

Day 2: 7th November, 2019

16:30 – 18:00 (Parallel): Panel Session (PS 2)

PS 2.1

Local Action Plan on Climate Change: Methodology and Action (KILA)

Chair: Dr. Joy Elamon

Director, Kerala Institute of Local Administration, Thrissur.

The global warming and the consequent climate change and its negative impacts are the major challenges facing the world over. In this context, United Nations (UN) has set up Intergovernmental Panel on Climate Change (IPCC) for assessing the science related to climate change. In the similar line, the State of Kerala has set up Directorate of Environment and Climate Change (DoECC), a nodal agency in the State in formulating climate change related schemes, plans, programmes and their execution. As a premise to this, DoECC has published State Action Plan on Climate Change (SAPCC). The global phenomenon of climate change requires local actions. In a state like Kerala where vibrant local governance system is in place, Local Self Government Institutions (LSGIs) can play a pivotal role in addressing the issues of climate change. It is in this context that Kerala Institute of Local Administration (KILA) has initiated action programme for facilitating the LSGIs to prepare Local Action Plan on Climate Change (LAPCC) at the local level and for undertaking activities at the local level. KILA, being the nodal institute for strengthening local governance in the state, has been deeply involved in the capacity building on climate change for LSGIs. In this process, KILA associates with other institutions like India Meteorological Department (IMD). In view of focused capacity building of LSGIs on climate change, KILA has set up a Centre for Climate Change and Local Governments.

This session will discuss the initiatives of KILA on LAPCC. The tentative programme of this session is given below.

Chair: Dr.Joy Elamon, Director, KILA, Thrissur, Kerala.

Presentations:

1.	Conceptual Framework for Local Action Plan for Climate Change	Dr.Sunny George, Professor, KILA.
2.	Methodology for Local Action Plan for Climate Change	Dr.J.B.Rajan, Associate Professor, KILA.
3.	Experience of Perumbalam Grama Panchayat on Local Action Plan for Climate Change	Mr.K.S.Shibu, President, Perumbalam Grama Panchayat, Alappuzha District, Kerala.
4.	K. Sobha, Secretary, Perumbalam Grama Panchayat.	
5.	Sasidharan Nair, Resource Persons, Perumbalam Grama Panchayat.	

16:30 – 18:00 (Parallel): Panel Session (PS 2)

PS 2.2

Martin Weitzman's contributions to Environmental Economics

Chair/Moderator: Thomas Sterner

Professor of Environmental Economics, University of Gothenberg, Sweden.

Martin Lawrence "Marty" Weitzman (April 1, 1942 – August 27, 2019) was a distinguished and influential scholar whose research spanned many areas of economics. In particular, he made seminal contributions in the field of environmental economics where his work has left a deep and lasting impression. This session focuses on Weitzman's contribution in three specific areas within environmental economics that illustrate the depth and breadth of his scholarship. While these are not the only areas of environmental economics where Weitzman left his imprint, they showcase his ability to apply rigorous analysis to real world problems and provide unique new insights into their resolution.

Shreekant Gupta will discuss Weitzman's path breaking work on climate change especially on the economics of catastrophes. Through a rigorous examination of deep structural uncertainty in climate change processes as manifested through "fat tail" probability distributions, Weitzman singlehandedly changed the economic discourse on climate change. Weitzman's so-called Dismal Theorem that was first articulated in his seminal paper "On Modeling and Interpreting the Economics of Catastrophic Climate Change" in *Review of Economics and Statistics* (2009) demonstrated why urgent and deep cuts in greenhouse gas (GHG) emissions are required. This heavily cited paper (more than 1500 times on Google Scholar) is accompanied by about a dozen other papers on this topic and also a best-selling popular book *Climate Shock*. This adds up to a body of work that has left a lasting impact on the economics of climate change.

M.N. Murty will focus on Weitzman's contribution to the choice of environmental policy instruments, namely, the choice between price instruments (such as taxes) and quantity instruments (such as tradable quotas) in the presence of uncertainty. Weitzman first analysed this issue in his classic paper "Prices vs. Quantities" in *Review of Economic Studies* (1974). While the paper was written more broadly for economic regulators, with almost 4,000 citations it is now perhaps one of the most influential papers (if not the most influential) in all of environmental economics. The paper proves the famous "Weitzman Theorem" which is now found in environmental economics textbooks. It also provides valuable insights to environmental policymakers on whether emission fees/taxes and emissions trading are equivalent and if not when should one be chosen over the other. In the context of climate change this paper has become central to the discussion on carbon taxes versus carbon trading and is yet another remarkable contribution of Weitzman to climate policy.

Ramprasad Sengupta will examine Weitzman's work on sustainable development and Green NNP as a national accounting concept that subtracts from GNP not just depreciation of capital, but also depletion of environmental assets. In an influential paper "On the Welfare Significance of Green Accounting as Taught by Parable" in *Journal of Environmental Economics and Management* (1997) Weitzman showed the consequences of technical change being absent from the standard time-autonomous model might be quite serious for the basic welfare interpretation of Green NNP. In particular, he showed a remarkable result that Green NNP would in fact have to be adjusted upwards by as much as 40 percent if technological progress were accounted for.

Speakers

Shreekant Gupta,
Professor, Delhi School of Economics, Delhi.

M N Murty,
Professor (Retired), Institute of Economic Growth, Delhi.

Ramprasad Sengupta,
Professor Emeritus of Economics, Centre for Economic Studies and Planning.
And Former Dean, School of Social Sciences, Jawaharlal Nehru University, Delhi.

16:30 – 18:00 (Parallel): Panel Session (PS 2)

PS 2.3

NIRD Panel

MGNREGS Contribution to Climate Change Mitigation and Adaptation

Chair/Moderator: Jyothis Sathyapalan, Professor and Head, Centre for Wage Employment, National Institute of Rural Development and Panchayati Raj (NIRDPR), Hydreabad.

MGNREGS aims to augment rural livelihood security by creating sustainable natural and human-made assets through public works, which is implemented in convergence with other development programmes to develop synergies in rural development. There are many examples of such synergies which not only helped to enhance rural livelihoods (social safety nets) but also promoted sustainable natural assets. It is also one of the most extensive programmes with high potential to address the adaptation needs of rural India to climate change. The MGNREGS also contributes globally by promoting large scale plantations in rural India. A study reveals that drought-proofing activities alone provide about 40% of the total carbon sequestration under MGNREGS, considering all-natural resource management works at the national level. The afforestation programme of degraded land benefited the local communities by providing material and non-material benefits.Similarly, farm ponds provide water not only for irrigation but performs other ecological functions like recharging aquafers. The proposed panel discusses many such contributions MGNREGS to climate change adaptation and mitigation at a national scale. Integrating climate solutions in the planning and execution of works under MGNREGS can strengthen environmental linkages with human livelihoods. It will also encourage the local self-governments (nodal agencies at the grassroots levels) to modify their perspective plans towards achieving the United Nations 2030 agenda of Sustainable Development Goals (SDGs), particularly on climate change.

Speakers
Dr. N.H. Ravindranath, Former Professor, Indian Institute of Science, Benguluru.
Dr. Neeraj Mishra, Associate Professor, Centre for Wage Employment, National Institute of Rural Development and Panchayati Raj (NIRDPR), Hydreabad.
Dr. A. Digambar, Associate Professor, Centre for Wage Employment, National Institute of Rural Development and Panchayati Raj (NIRDPR), Hydreabad.
Dr. P. Anuradha, Assistant Professor, Associate Professor, Centre for Wage Employment, National Institute of Rural Development and Panchayati Raj (NIRDPR), Hydreabad.

Day 3: 8th November, 2019

11:30 – 13:00 (Parallel): Panel Session (PS 3)

PS 3.1

Climate Change and Indian Agriculture: Methodological Issues

Moderator: Anubhab Pattanayak (Assistant Professor, Madras School of Economics, Chennai)

Context:

Climate change raises several issues in the context of agriculture in India. There is perhaps little disagreement within the scientific community that agriculture, being a climate sensitive sector, is likely to get adversely impacted due to climate change by the end of 21st century. However, there are aspects relating to agriculture which find little space in climate change policy in India and have taken a backseat in the broader policy discussions relating economic development in a climate constrained world. One of the foremost aspects to understand is the likely magnitude and nature of impacts on agriculture and robustness of these impact projections. A related question is pertaining to climate-induced hydro-meteorological events such as droughts and their direct impacts on agriculture. Being one of the poorest countries, where agriculture provides livelihood options for most of its employed population, any shock to agriculture is likely to have significant socio-economic-political consequences such as farmer suicides. Further, climate change is likely to influence other co-evolving physical processes (e.g., land degradation) resulting in significant system-level effects. The proposed panel will focus on these aspects through the following four papers:

- **Climate Change Impact Assessment: Methodological Review (Anubhab and Kavi Kumar)**

Sufficient evidence exists in the literature pertaining to the direct impacts of climate change on agricultural productivity. Various methodologies applied to assess climate change impacts on agriculture differ not only in terms of their scope but also in their theoretical foundations. Recent developments in the statistical methods of impact assessment, backed by more systematic availability of data, present important opportunities to examine the various issues relating to climate change and its associated effects and challenges. The role of climate econometrics which lies at the core of such analysis cannot thus be undermined. The paper (a) compares various methodologies that exists in the impact assessment literature, highlighting important methodological developments and differences in the impact assessment literature (b) discusses its implications for adaptation assessment and (c) presents their application in the context of Indian agriculture, focusing on key crops such as rice.

- **Rice Production Systems and Drought Resilience in India (Kavi Kumar, Brinda and Anubhab)**

Extending recent evidence in the literature which suggests that rice has become more resilient to drought over time in India, this paper examines the robustness of the result to alternative methodology and different definitions of drought. The paper further examines drought resilience of other crops that are important from food security perspective.

❖ **Farmer Suicides: Climate and Agricultural Productivity Linkages (Sonal, Kavi Kumar and Brinda).**

Challenges associated with climate change are likely to have manifestations in the broader socio-economic-political context. Farmer suicides are one such issue that is not only a politically charged issue but also a hard ground reality presently in India. Does climate change play any role in influencing farmer suicides? Though recent literature provided evidence in this direction, it is important to firmly establish three-way link between climate variability, agricultural distress and farmer's suicide. Therefore, a more relevant question to ask is the following: controlling for economic and other socio-political factors, does climate induced agricultural impacts influence farmer suicide? The paper explores these aspects.

❖ **Crop-sensitivity and Weather Variations: National and Regional Analysis (Anubhab, Dayakar and Kavi Kumar)**

Climate change is a gradual process and its effects will be realized over a very long time period. Land degradation is another biogeophysical process that is gradual in nature. If environment is visualized as a system, changes of any kind within the system are likely to affect the changes in other aspects of the system. This induces one to consider the role of climate in affecting the process of land degradation and vice-versa. This paper explores how temperature and precipitation changes could lead to exposure of soil to natural elements such as wind and water, resulting in enhanced soil erosion rates in Indian crop land.

While the papers in the panel cover a wide-range of issues under the broad theme of climate change impacts on Indian agriculture, they are connected by the similarity in the overall statistical approach followed for the analyses. The panel thus contributes towards the emerging field of "Climate Econometrics". The papers in the panel will be presented by the researchers from Madras School of Economics, Chennai including Dr. Anubhab Pattanayak,Dr. K.S. Kavi Kumar, Sonal Barve and Mr. Dayakar Peddi .

Speakers
Sonal Barve (Research Intern, RBI, Mumbai)
Dayakar Peddi (Assistant Professor, CESS, Hyderabad)
K.S. Kavi Kumar (Professor, MSE, Chennai)

11:30 – 13:00 (Parallel): Panel Session (PS 3)

PS 3.2

Climate Change, Adaptation and Mitigation – A Focus on Rainfed Agriculture

Chair/Moderator: Prof.E Revathi,

Director, Centre for Economic and Social Studies

The risks from climate change are arising in many ways- extreme weather events like heat waves, cyclones, river flooding and prolonged droughts. The impact of climate change is witnessed more severely in developing countries with no exception to India. Agriculture is still a predominant livelihood generating activity in these countries with majority depending on rainfed agricultural systems. Changes in the climate are already disrupting production of main crops in rainfed regions and with no concern to climate adaptation and mitigation efforts, this trend may accelerate and continue to increase.

In view of the dual challenge (adaptation and mitigation) of climate change, coupled with the need for diversified agricultural production to meet food requirements of growing population, a comprehensive approach is needed. The proposed panel attempts to address the following questions 1) What are the appropriate adaptation technologies to tackle the climate change in rainfed agriculture? 2) What are the current strategies/programmes undertaken to address this and their outcomes? 3) What are the alternative policy options to address the risks posed by climate change to rainfed agriculture? In the Telangana State, 54 percent cultivated area falls under dry land category, 63 percent of crop is rain-fed and exposed to climate change events. Therefore, a focus on the above mentioned issues in the Telangana State would be appropriate.

List of speakers:

Dr. B.Venkateswarlu	Former Vice-Chancellor, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra and Former Director, CRIDA, Hyderabad, Telangana	Adaptation of Indian agriculture to climate change, technology and policy issues.
Dr. Ravindra Chary	Director, CRIDA, Hyderabad, Telangana.	Yet to receive
Dr. Nambi Appadurai	Director (Climate Resilience Practice), WRI, Bengaluru, Karnataka.	Yet to receive
Dr.S. Naresh Kumar	Professor and Principal Scientist, Centre for Environment Science and Climate Resilient Agriculture, PUSA, New Delhi	Yet to receive

11:30 – 13:00 (Parallel): Panel Session (PS 3)

PS 3.3

Building Climate Resilience: Lessons from 'Commoning' the Commons

Panel Coordinator: Rucha Ghate

Foundation for Ecological Security (FES), Anand, Gujarat.

In India, more than 350 million small holder farmers, tribal populations and livestock keepers depend on the Commons to meet the basic needs of food, fodder, firewood, medicines and timber as well as ecosystem services in terms of water, nutrient, pollination and pest control which are critical for the viability and growth of small holder farming systems. However, in absence of secure property rights and weak governance mechanisms, these resources have been prone to elite capture, degradation and inefficient use, leading to reduced availability of water, fodder, biomass, declining soil health and biodiversity. The panel session organized by Foundation for Ecological Security (FES) draws lessons from a growing body of work on Commons-interweaving tenure, local governance and restoration to address interrelated objectives of economic opportunities, social justice and ecological health. Based on findings from action research and field studies the session aims to share insights and perspectives on:

Speakers:

Themes	Presenters
Land tenure, collective action and climate action (A system perspective for improved land use and climate action)	**Pratiti Priyadarshini**
Potential of non-forest Commons for livelihood resilience and carbon sequestration	**Himani Sharma**
Institutional architecture for commoning and climate action	**Shiwanaya Rawat**
Methods and tools (Experimental Games, Community Based System Dynamics, Mobile apps such as Composite Landscape Assessment and Restoration Tool) to trigger commoning for enhanced climate resilience	**Liya Thomas**

11:30 – 13:00 (Parallel): Panel Session (PS 3)

PS 3.4

Climate Change Vulnerability Assessment in the Indian Himalayan Region

Shyamasree Dasgupta[1] and Anamika Barua[2]

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Preamble:

Indian Himalayan Region (IHR) is one of the most sensitive regions to climate change and variability. Realizing the high vulnerability of IHR, Government of India launched the National Mission for Sustaining the Himalayan Ecosystem (NMSHE). The Department of Science and Technology (DST) is coordinating the implementation of NMSHE with support from the Swiss Agency for Development and Cooperation (SDC), under the Indian Himalayas Climate Adaptation Program (IHCAP) initiative. One of the key areas identified by NMSHE is to build capacities of the 12 IHR states for robust assessments of climate change vulnerability based on a common methodology that will adhere to IPCC 2014 framework of vulnerability. These states include Assam, Manipur, Meghalaya, Mizoram,Nagaland, Tripura, Arunachal Pradesh, Sikkim, the hilly districts of West Bengal in the eastern part of IHR, Himachal Pradesh, Uttarakhand and Jammu and Kashmir in the Western part of IHR. With this objective and with support from DST and SDC, IIT Guwahati and IIT Mandi in collaboration with IISc Bangalore worked towards capacity building of 12 IHR states. The outcome was a state level and within states, district level vulnerability maps along with potential drivers of vulnerability both at the state and district level. This panel will deal with the common methodological framework, its application and results demonstrated by the State representatives.

Panel Format:

- Moderator gives brief introduction of panelists and discussion guidelines – 10 minutes
- Panelist position presentations (15 minutes each)
- Questions & answers (20-30 minutes)

Speakers:

Panel Moderator:

Anamika Barua

Associate Professor, Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, Assam.

Topic: Climate Change, Vulnerability, Impacts and Adaptation

An Overview of evolution of vulnerability concept and framework in the context of vulnerability assessment and adaptation to climate change in the Himalayan states.

Speaker: **Prof. N. H Ravindranath**

Professor, Indian Institute of Sciences, Bangalore

Topic: Common Vulnerability Assessment Framework: An Indicator based Approach

A state level vulnerability assessment in the IHR based on the common methodological framework with detailed explanation of steps.

Speaker: **Shyamasree Dasgupta**

Assistant Professor, Indian Institute of Technology Mandi

Topic: Capacity Building in Vulnerability Assessment in 12 States in the Indian Himalayan Region

A critical evaluation of the capacity building process to carry out vulnerability assessment in the IHR states including the steps and outcomes.

Speaker: Team Leader, Indian Himalayas Climate Adaptation Programme (IHCAP), SDC

Topic: Vulnerability Assessment: A case study from the Eastern Himalayan Region

Speaker: **Shri. T. Brajakumar Singh**

Topic: Vulnerability Assessment: A case study from the Western Himalayan Region

Speaker: **State representative from one of the eastern Himalayan states**

Representatives from eastern and western Himalayan States will present their district level vulnerability assessment.

About the Organisers/Supporting Organisations

Indian Society for Ecological Economics

Indian Society for Ecological Economics (INSEE) was established in New Delhi (India) on September 24, 1998 . It was registered as a Society under the Societies Act in January 1999. It is a regional society affiliated to the International Society for Ecological Economics (ISEE). INSEE aims to further the cause of sustainable development by providing a forum for continuous dialogue among scholars, practitioners and policy analysts working at the interface of the economy, society and the ecosystem.

In that sense, the Society seeks to fulfil the felt need for a catalytic agent and a platform that would facilitate interaction between scholars from various disciplines, particularly economics and the ecological sciences, and including both natural and social sciences. It strives to promote new thinking and better understanding on a range of issues of national and international interest, such as institutions and instruments for natural resources management, energy analysis and policy, environment and trade, toxic waste management, environment and development, the valuation and accounting of ecosystem functions and services, climate change and the global commons.

INSEE works to disseminate the results of research and its policy implications to national and international bodies (governmental and non-governmental) through multiple avenues such as conferences, workshops, networking and publications

Centre for Economic and Social Studies

Centre for Economic and Social Studies was an established as an autonomous body registered under the Societies Act in the year 1980. Appreciating its role in the promotion of research and training, the Indian Council of Social Science Research (ICSSR) recognized it as a national institute in the year 1986 and included CESS in its network of institutions for annual grant. The CESS has also been approved by the Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India. The Centre has been receiving maintenance grants from the State Government and the ICSSR and projects-specific grants/consultancies from the state government, central government, World Bank, UNICEF, and other International Organisations. The main objective of the Centre is to undertake mutually supportive and interrelated research and training activities in the field of economic and social development in Telangana, Andhra Pradesh and India. It functions, thus, as a Resource Centre for the Planning machinery of the Government on various inputs needed by it on socio-economic aspects. Over a period of time, CESS has develop expertise on several themes especially on natural resources and environment , agriculture and livestock development, food security, poverty alleviation, unemployment, district planning, resettlement and rehabilitation, state finances, industrial development and economics of health and demography, urban development, trade and services, etc. The Centre also undertakes research projects sponsored by different agencies such as the State Government, Central Government, Asian Development Bank, World Bank, UNICEF, UNDP, DFID, GIZ, European Union, Volkswagan University–Germany, Ford Foundation, the International Foundation for Science, Sweden, Rockefeller Foundation-New York, ODI- the UK, Tata and other organizations in India and abroad. The Centre has collaborations with universities and research institutions abroad such as the Oxford University, the Reading University, University of East Anglia and University of Manitoba etc.

CESS has been recognized by the Telangana University for full time Ph.D and by Dr. B. R. Ambedkar Open University and the University of Hyderabad for external registration for Ph.D programs in Development Studies. The Centre is situated in the heart of Hyderabad and housed in the 5 acre campus given by Osmania University in the premises of the Nizamiah Observatory at Begumpet.

GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH)

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is a public-benefit federal enterprise owned by the German Government that provides services worldwide in the field of international cooperation for sustainable development. With a global footprint in over 120 countries, GIZ leverages its regional and technical expertise for local innovation.

In India GIZ has been working for over 60 years, jointly with partners in India for sustainable economic, ecological, and social development. The focal areas of Indo-German cooperation currently are Energy, Environment, Climate Change and Biodiversity, Sustainable Urban and Industrial Development and Sustainable Economic Development. The Indian Government has launched numerous important initiatives to address the country's economic, environmental and social challenges, and GIZ is contributing to some of the most significant ones including Smart Cities, Clean India Mission and Skill India.

The thematic area of Environment, Climate Change and Biodiversity in India supports communities, public and private institutions to improve and conserve natural resources, minimise risks from climate change and enhance rural livelihoods. The project 'Water Security and Climate Adaptation in Rural India' is one of the newest Indo-German projects launched in cooperation with the Ministry of Rural Development, and the Ministry of Jal Shakti for the period April 2019 – March 2022. The project aims to improve integrated and climate-resilient water resource management in rural areas. The project is operational at the national level and four States, namely Madhya Pradesh, Rajasthan, Uttar Pradesh and Tamil Nadu.

National Institute of Rural Development and Panchayati Raj (NIRDPR)

The National Institute of Rural Development and Panchayati Raj (NIRDPR), an autonomous organisation under the Union Ministry of Rural Development, is a premier national centre of excellence in Rural Development and Panchayati Raj. Recognized internationally as one of the UN-ESCAP Centres of Excellence, it builds capacities of rural development functionaries, elected representatives of PRIs, bankers, NGOs and other stakeholders through inter-related activities of training, research and consultancy. The Institute is located in the historic city of Hyderabad in Telangana state. The NIRD&PR celebrated its Golden Jubilee Year of establishment in 2008. In addition to the main campus at Hyderabad, this Institute has North-Eastern Regional Centre at Guwahati, Assam to meet the NE-regional needs.The vision of NIRD&PR is to focus on the policies and programmes that benefit the rural poor, strive to energise the democratic decentralization processes, improve the operation and efficiency of rural development personnel, promote transfer of technology through its social laboratories, Technology Park and create environmental awareness. As a "think-tank" for the Ministry of Rural Development, NIRD while acting as a repository of knowledge on rural development would assist the Ministry in policy formulation and choice of options in rural development to usher in the changes.

Government of Telangana

Telangana was created by passing the AP State Reorganization Bill in both houses of Parliament. The Telangana state was inaugurated formally on June 2nd 2014. Telangana is the 29th state of India and has 33 districts. The state has an area of 1,12,077 Sq. Km. and has a population of 3,50,03,674. The Government of Telangana, has been implementing many schemes to improve the wellbeing of the people. Some of the major ones are the *agriculture investment support scheme "Rythu Bandhu"* which is being implemented from the year 2018-19 to enhance agriculture productivity by meeting the initial investment needs of every farmer and generating income of the farmers besides breaking the vicious cycle of rural indebtedness.To support irrigation needs of the farmers, a flagship programme *"Mission Kakatiya"* is being implemented, aimed at restoring around 46,000 tanks in five years.Under the Telangana Drinking Water Supply Project, *"Mission Bhagiratha"*, a mammoth 1.30 lakh km stretch of pipelines would be laid to quench the thirst of Telangana towns and villages apart from providing water for the industrial needs. Another flagship programme of the government, *"Telanganaku Haritha Haram"* envisages increasing the green cover of the State from the present 25.16 to 33 percent of the total geographical area.

National Bank for Agriculture and Rural Development (NABARD)

NABARD came into existence on 12 July 1982 by transferring the agricultural credit functions of RBI and refinance functions of the then Agricultural Refinance and Development Corporation (ARDC). It was dedicated to the service of the nation by the late Prime Minister Smt. Indira Gandhi on 05 November 1982. Set up with an initial capital of Rs.100 crore, its' paid up capital stood at Rs.10,580 crore as on 31 March 2018. Consequent to the revision in the composition of share capital between Government of India and RBI, NABARD today is fully owned by Government of India. NABARD's mission is to promote sustainable and equitable agriculture and rural development through participative financial and non-financial interventions, innovations, technology and institutional development for securing prosperity.

Indian Council of Social Science Research (ICSSR)

Indian Council of Social Science Research (ICSSR) was established in the year of 1969 by the Government of India to promote research in social sciences in the country. The Council aims to review the progress of social science research and give advice to its users, sponsor social science research programmes and projects and administer grants to institutions and individuals for research in social sciences, institute and administer scholarships and fellowships for research in social sciences, indicate areas in which social science research is to be promoted and adopt special measures for development of research in neglected or new areas, give financial support to institutions, associations and journals engaged in social science research, arrange for technical training in research methodology and to provide guidance for research, co-ordinate research activities and encourage progrmmes for interdisciplinary research, develop and support centers for documentation services and supply of data, organize, sponsor, and finance seminars, workshops and study groups, undertake publication and assist publication of journals and books in social sciences, advise the Government of India on all matters pertaining to social science research as may be referred to it from time to time and take such measures generally as may be necessary from time to time to promote social science research and its utilization.

Centre for Economics, Environment and Society (CEES)

Centre for Economics, Environment and Society (CEES) is registered as a no profit organisation working in the interface of economics, environment and society. Its mission is to address the development and environmental challenges facing governments and societies, and promoting environmentally sound and socially just development, human wellbeing and sustainable development. CEES is guided in its mission and work by a distinguished panel of international and national experts and aims to to undertake research, teaching, training, outreach and other activities to address the development and environmental challenges facing governments and societies, conduct courses and training programmes to upgrade skills and knowledge of scholars, researchers, policy makers, NGOs, etc., conduct seminars, workshops, conferences, dialogue and other programmes, promote dialogue and undertake research and other activities to bridge the gap between the natural and social sciences, and between science and policy and undertake programmes and activities to promote environmentally sound and socially just development, and human wellbeing and sustainable development.

TATA Trust

Tata Trusts are amongst India's oldest, non-sectarian philanthropic organisations. Since its inception, Tata Trusts have played a pioneering role in transforming traditional ideas of charity and introducing the concept of philanthropy to make a real difference to communities. Through grant-making, direct implementation and co-partnership strategies, the Trusts support and drive innovation in the areas of healthcare and nutrition; water and sanitation; energy; education; rural livelihoods; natural resource management; urban poverty alleviation; enhancing civil society and governance; media, arts, crafts and culture; and diversified employment. The Trusts engage with competent individuals and government bodies, international agencies and like-minded private sector organisations to nurture a self-sustaining eco-system that collectively works across all these areas. In order to enhance impact and ensure that interventions are sustainable, the Trusts have adopted a cluster-based approach, supporting multiple interlinked activities in identified clusters of contiguous villages across select geographies across India. Coupled with this, is the Trusts' strict adherence to ensuring that robust financial systems are put in place with all partner organisations. Today, spread over 21 states and close to 200 districts across the country, programmes supported by the Trusts reach out to millions of households through an efficient network of 450 plus partner organisations. Additionally, the Trusts' projects and initiatives, especially in the area of educational attainment, significantly contribute to building intellectual capital in the country.

2/3rd of India's people continue to depend on rural employment for a living, while the gap between the earning capacities of the rural and the urban populations continues to increase. The need to ensure inclusion of the rural communities in the economic growth process of the country now widely reflects in the efforts of the government in the form of various development and social welfare programmes being implemented across states. Through its Rural Upliftment portfolio, the Trusts support direct field action for innovations, effective delivery systems for livelihood support services and building strong community institutions for sustained impact of programmes. For increased coverage and impact, the Trusts further focus their investments within the portfolio in line with the national strategy of fund flows. Natural resource management, agriculture, Livestock development and Community Institution Building are cross-cutting thematic areas. The projects target rural income generation

through farm and non-farm activities, water conservation and irrigation systems, fisheries, and the production, post-harvest activities and marketing of produced goods. The development, strengthening and handholding of Farmer Producer Organisations and other such institutions is a major part of this activity. The many years of experience have allowed the Trusts to identify and evolve best practices and learnings which are replicated across issues and regions, adapting to and shaping large initiatives, while integrating projects for larger and more sustainable benefits. The core of the programme remains innovation and the integration of ideas and projects with a focus on sustainability through the development of strong exit policies.

South Asian Network for Development and Environmental Economics (SANDEE)

The South Asian Network for Development and Environmental Economics (SANDEE) is an initiative of the International Centre for Integrated Mountain Development (ICIMOD) under the regional programme on Mountain Knowledge and Action Networks (MKAN), based in Kathmandu, Nepal. SANDEE brings together researchers and decision makers from South Asia and the Hindu Kush Himalaya (HKH) region to address development-environment challenges. It strengthens the capacity of individuals and institutions in South Asia and the HKH region to undertake research on the interlinkages among economic development, poverty, and environmental change and to disseminate practical information that can be applied to development policies. SANDEE's current research focuses on Economics of Natural Resource Use and Environmental Change including Ecosystems Management, Economics of Climate Change, and Policies and Programmes for Greener Development. SANDEE operates under the principle that greener growth and sustainable development are necessary in South Asia and the HKH region, and are possible with the implementation of evidence-based solutions.

Specifically, SANDEE:

- strengthens the ability of researchers to undertake multi-disciplinary research on the economics of environmental and natural resource problems by managing two annual research grant cycles
- supports the growth of rigorous policy-relevant literature on economic development, poverty reduction, and environmental change
- supports environmental and natural resource economics in teaching and research institutions by hosting a three-week Summer School , featuring leading economists from around the world as faculty
- influences policy processes through analyses, training, networking, dialogue, and dissemination of research findings

Intergovernmental Panel on Climate Change (IPCC)

The IPCC provides regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. Created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the objective of the IPCC is to provide governments at all levels with scientific information that they can use to develop climate policies. IPCC reports are also a key input into international climate change negotiations.

The IPCC is an organization of governments that are members of the United Nations or WMO. The IPCC currently has 195 members. Thousands of people from all over the world contribute to the work of the IPCC. For the assessment reports,

IPCC scientists volunteer their time to assess the thousands of scientific papers published each year to provide a comprehensive summary of what is known about the drivers of climate change, its impacts and future risks, and how adaptation and mitigation can reduce those risks.

An open and transparent review by experts and governments around the world is an essential part of the IPCC process, to ensure an objective and complete assessment and to reflect a diverse range of views and expertise. Through its assessments, the IPCC identifies the strength of scientific agreement in different areas and indicates where further research is needed. The IPCC does not conduct its own research.

The IPCC is divided into three Working Groups and a Task Force. Working Group I deals with The Physical Science Basis of Climate Change, Working Group II with Climate Change Impacts, Adaptation and Vulnerability and Working Group III with Mitigation of Climate Change. The main objective of the Task Force on National Greenhouse Gas Inventories is to develop and refine a methodology for the calculation and reporting of national greenhouse gas emissions and removals.

Alongside the Working Groups and the Task Force, other Task Groups may be established by the Panel for a set time period to consider a specific topic or question. One example is the decision at the 47th Session of the IPCC in Paris in March 2018 to establish a Task Group to improve gender balance and address gender-related issues within the IPCC. [Source: https://www.ipcc.ch/about/]

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