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FOREWORD

This souvenir provides an introduction to the International Conference on *Sustainability, Institutions and Incentives: Voices, Policies and Commitments,* organised jointly by Kerala Institute of Local Administration (KILA) and Indian Society for Ecological Economics (INSEE), during 8-10 November 2017, at KILA, Kerala. The objective of the conference is to provide a platform for a dialogue on the larger issue of sustainable development. The goal of sustainability is directly linked with human behaviour and anthropogenic pressures. Individuals and groups voice their choices through formal and informal mechanisms, and participate in decision-making.

The overall objective of the conference is divided into four sub-themes: 1. Ecosystems and Well Being: oceans, forests, mountains and wetlands, resilience, valuation and management. 2. Collective Action and Local Governance: community, institutions, transaction cost and trusts. 3. Climate Change: science of climate change, agriculture and food security, extreme events, Paris Agreement and Marrakesh Proclamation, adaptation and migration and technology. 4. Sustainable Development Goals (SDGs) and Global South: gender and ecology, inequality, environmental justice, green economy waste and recycling and energy. The present volume includes selected papers focusing on the experiences and experiments on issues related to above said themes.

It is interesting to note that these presentations are made in Kerala which is a leading state in India in democratic decentralization and participatory planning. The People's Planning in Kerala addresses the issues of sustainable development by making people involved in local level development. The recent initiative of the State under the Nava Kerala Action Programme named *"Harithakeralam"* is a strategic move towards sustainable development by means of integrating agriculture, waste management, sanitation and energy.

We are thankful to the contributors of papers, participants, and the Scientific Advisory Committee Members who scrutinised the papers. We deeply acknowledge the service of Dr. Pranab Mukhopadhyay, President, INSEE and Dr. Nandan Nawn, Secretary, INSEE for their seamless efforts in organizing this event. We are also thankful to all those who have contributed to the smooth conduct of the programme. Finally we are deeply grateful to the Government of India and Government of Kerala and agencies which made financial support to the event.

It is expected that this volume will provide a brief account of the various issues relating to sustainable development which will be a useful reference material for students, research scholars and people at large.

Dr. Joy Elamon
Director, KILA

INTRODUCTION

It gives me great pleasure to be part of the international conference being organized by the Indian Society of Ecological Economics (INSEE) and the Kerala Institute of Local Administration (KILA), Thrissur on their beautiful campus in Thrissur. This conference *Sustainability, Institutions and Incentives: Voices, Policies and Commitments* is most aptly being organised in Kerala where voices of people from the grass roots on issues of sustainability have shaped policies of the government both at the state and the national level. The commitment to long drawn campaigns, political and legal interventions have influenced institutions and the manner in which we now look at issues in development and conservation.

We are at a crucial cross-road in our developmental agenda of human kind and though much has been achieved in terms of income growth and human capital it has been at increasing cost to the environment. Despite increasing global awareness on the need for integration of the environment into the developmental framework much of the mainstream writing in development continues to pretend that ecological sustainability is a luxury. I am sure that those gathered at this conference would agree that it is exactly the opposite – we can think of development without ecological sustainability *a priori*. It is conferences like this that challenge this traditional narrowly-focused paradigms of development.

The call for papers for this conference attracted 270 plus abstracts and distinguished members of the scientific committee shortlisted about 150 abstracts for full paper requests. Then 70 of these abstracts were finally selected for presentation and another ten for poster presentations. This is the first time INSEE has introduced poster presentation during a Biennial conference.

We are grateful to the members of our Scientific Advisory Committee who devoted their time for selection the abstracts and papers for this conference. The members of the Local Advisory Committee were generous with their time and support to ensure that the curtain-raiser events preceding the conference were organized smoothly. This is also a first for INSEE to have such curtain-raiser events by senior members of the conference in order to increase awareness and an opportunity to the younger generation to interact with the doyens in this field.

This is the first time that INSEE has organized a Biennial conference in Kerala. We are very grateful to KILA, its Director, Dr Joy Elamon, and his colleagues particularly Prof. Sunny George and Shri K.K. Babu who have worked tirelessly to make this conference a success. They have been a warm and generous co-organiser and host to INSEE and we hope we can build on such partnerships. The Government of Kerala and the Government of India has facilitated various processes of the Conference. We are very grateful to our sponsors Care Earth Trust, IndusInd Bank, the South Asian Network for Development and Environmental Economics (SANDEE), the National Agricultural Bank for Rural Development (NABARD), GIZ – The Indo-German Biodiversity Programme, the Centre for Economics, Environment and Society (CEES), Central Marine Fisheries Research Institute (CMFRI) and academic partners the UNESCO-Mahatma Gandhi Institute of Education for Peace and Sustainable Development and Springer Publications.

Finally, I wish to thank my colleagues in the INSEE's Executive committee and INSEE's office for their help and support to this conference and their patience in dealing with numerous demands on their time.

We hope that this collection of abstracts will be of use to participants and readers.

Pranab Mukhopadhyay
President
Indian Society of Ecological Economics (INSEE)

Dr.K.T.JALEEL
MINISTER FOR LSGD, MINORITY WELFARE
WAKF &HAJJ
GOVERNMENT OF KERALA

Message

I am very happy to know that Kerala Institute of Local Administration (KILA) in association with Indian Society for Ecological Economics (INSEE) is organizing an International Conference on Sustainability, Institutions and Incentives: Policies and Commitments, from 8-10 November 2017, at KILA, Kerala. The conference is relevant in the overall context of the climate change and other issues directly dealing with human interventions in the ecology and environment.

I understand that Kerala has to learn many things from the experiences and experiments of other states and countries and at the same time we have a lot of experience to share. Kerala's achievement in human development is legendary. The participatory planning process of local governments ensures a minimum quality of life to all. But in the case of issues like sustainable development which relates to ecology, environment and energy, Kerala has a long way to go. It is in this context that the Government of Kerala launched the Haritha Keralam Mission under its Nava Kerala Action Programme.

I hope that the conference will provide a lively platform of dialogue and exchange of ideas. I congratulate KILA and INSEE for organizing this interesting and valuable event. I wish all success.

Dr. K.T Jaleel

Thiruvananthapuram
Date: 01.11.2017

Office: IVth Floor, Room No. 401, Secretariat Annexe
Thiruvananthapuram – 695 001
Phone-Office: 0471-2327895, 2327796 Res: 0471-2720451, 2723181
Res: 'Ganga', Cantonment House Complex

About Indian Society for Ecological Economics

INSEE was conceived at a meeting held in New Delhi in September, 1998 and within four months it was registered under the Societies Act in January 1999 as 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 dialogue among scholars, practitioners, and policy analysts from various disciplines, particularly economics and ecological sciences on a range of issues of national and international interests, such as climate change, natural resources, energy, waste, ecosystem services and valuation.

INSEE's major activities include the following:

- Biennial Conferences,
- Seminars, workshops, policy dialogues and training programmes,
- Networking nationally and internationally,
- Publication of books,
- Dissemination through web-based platforms.

Over the years INSEE has expanded its activities: in addition to its regular major activity of organising conferences since the early years, it has increasingly focused on organsing training workshops and other outreach events in more recent years. These activities have been demand-driven given the growing interest among scholars in areas of economy, ecology and the society.

Biennial Conferences are being held regularly since 1999. These conferences have typically attracted an average of 125-150 participants from young students to renowned academicians, from policymakers to practitioners. Distinguished scientists—both natural and social—have served as members of the Scientific Advisory Committee and Local Organising Committee for these events.

Besides the eight biennial conferences, the society has organised 13 Capacity Building Workshops for college teachers and researchers, 5 Research Seminars, Round tables, Symposiums, and supported 4 panels at Conferences and Workshops organised by other Societies.

Apart from 7 books published by reputed publishing houses, the society will release the early view version of the inaugural issue of its flagship journal ***Ecology, Economy, Society*** on 8th November, 2017.

INSEE is governed by an elected Executive Committee with a two year term. The INSEE members represent a wide range of social and natural scientists, environmentalists, ecologists, policy makers, administrative officials, planners, and institutions/corporate bodies interested in the interface of ecology and economics. As on October 2017, it has 499 members, including individual life members (477), corporate life members (10), ordinary members (3), and student members (9).

Executive Committee (2016-18)

***President*:**

Pranab Mukhopadhyay, Professor, Goa University.

Vice-*President:*

K N Ninan, Chairperson, Centre for Economics, Environment and Society, Bangalore.

Secretary:

Nandan Nawn, Associate Professor, TERI University, New Delhi**.**

Treasurer:

Kalyan Das, Professor, OKD Institute of Social Change and Development, Guwahati.

***Joint Secretary*:**

Jeena T Srinivasan, Associate Professor, Centre for Economic and Social Studies, Hyderabad

Bibhu Prasad Nayak, Associate Professor, Tata Institute of Social Sciences, Hyderabad.

***Members*:**

Ramachandra Bhatta, Indian Council of Agricultural Research Emeritus Scientist (Economics), College of Fisheries, Mangalore.

Saudamini Das, Professor, Institute of Economic Growth, Delhi.

Balachandra Patil, Principal Research Scientist, Indian Institute of Science, Bengaluru.

Brototi Roy, PhD student, Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain.

Bejoy K Thomas, Fellow, Ashoka Trust for Research in Ecology and Environment (ATREE), Bengaluru.

Office Manager

Sushil Kumar Sen, Academic Programme Officer, Institute of Economic Growth, Delhi

About **KERALA INSTITUTE OF LOCAL ADMINISTRATION (KILA)**

Kerala Institute of Local Administration (KILA), an autonomous institution under the Department of Local Self- Governments, Government of Kerala, is the nodal agency for Training, Research and Consultancy for Local Self-Government Institutions in Kerala. The Institute began its operation in 1990. Apart from training, consultancy and policy oriented research activities, KILA organizes seminars, workshops and discussions on various issues of local governance and development. The Government of Kerala has recognised it as a Centre of Excellence. The Ministry of Panchayati Raj, Government of India has declared KILA as the SAARC Centre of Training in Decentralization and Local Governance. KILA has provided a lead role in the capacity building and training of democratic decentralization in Kerala and now it is engaged in institutionalizing the process of decentralization and to make the local government system sustainable.

KILA is a link between people and the Government and is also a think tank for policy formulation. The feedback that have been gathered from various training programmes together with the research support facilitate in the formulation of pragmatic policies for strengthening decentralization. Indeed, in implementing these policies, KILA plays a major role by means of wider dissemination of information through training, publications, seminars, workshops and discussions.

Kerala Institute of Local Administration (KILA) has been engaged in the capacity building activities for local governments in Kerala since its establishment in 1990. The Institute is supported by the Government of Kerala, as its nodal institution for training, research and consultancy for the Local Self-Government Institutions. The Institute engages in different capacity building activities of the local governments, both rural and urban.

KILA was established in the pattern of a national institute with the main objective of training, research and consultancy in decentralised governance and administration. With a view to develop it as an institution of excellence, KILA was registered as an autonomous institution under the Travancore-Cochin Literary, Scientific and Charitable Societies Act 1955. It has five centres across the state other than the main campus in Thrissur. KILA is the only Institution in India that functions with the sole mandate of promoting decentralised governance both in urban and rural areas.

The Institute disseminates the insights of research and recommendations of its various training programmes and workshops through a number of publications. In order to meet the training needs of the participants from other Indian states and neighbouring countries, KILA has translated several documents in English and other Indian languages like Hindi, Tamil, Bengali and Kannada.

Over the years, the Institute has established its expertise in decentralized participatory Planning, local governance and administration, urban development, local level development, participatory poverty reduction, gender and development, development of marginalized social Groups, natural resource management and watershed development, training skill development of trainers, and child friendly development, and ecology, environment and sustainable development.

Governing Council (GC)

The Governing Council (GC) is the apex body of Kerala Institute of Local Administration and it deals with policy matters concerning the organization. The Honorable Minister for Local Self Government, Government of Kerala, is the President of the Governing Council and the Chief Secretary, Government of Kerala, the Vice President. The other members of the General Council are:

Members of Governing Council of KILA are:

1. Minister (LSGD) Chairperson
2. Chief Secretary Vice Chairperson
3. Principal Secretary LSGD Convenor
4. Secretary to Govt., Finance Department
5. Commissioner of Rural Development
6. Director of Panchayats
7. Director of Urban Affairs
8. Secretary to Government, Planning and Economic Affairs
9. Representative from Ministry of Rural Development & Ministry of Panchayati Raj, GOI
10. Director, KILA
11. Representative from NIRD & PR
12. Representative from Kerala Grama Panchayat Presidents Association
13. Representative from Block Panchayat Presidents Association
14. Chairman, Chamber of Municipal Chairmen
15. Member of Parliament
16. Member of Legislative Assembly

Executive Committee (EC)

The power of management and administration of KILA is with the Executive Committee (EC). The members of the EC are:

1. Principal Secretary LSGD Chairman
2. Secretary to Government, LSGD
3. Secretary to Govt., Finance Department or his nominee

4. Commissioner of Rural Development
5. Director of Panchayats
6. Director of Urban Affairs
7. Director, KILA (Convenor)

The Principal Secretary to Government (Local Self Government Department) is the Chairman of the Executive Committee. The day-today management of KILA is with the Director.

About INSEE-KILA International Conference

Sustainability, Institutions, Incentives: Voices, Policies, and Commitments

How do we as a generation sustain our "spaceship earth"? This has been a central thematic area for those working in the broad sphere of Ecological Economics and Sustainability Science. This goal of sustainability is intricately linked with human behaviour and anthropogenic pressures which are often transmitted through institutions. History shows that institutions evolve, transform or wither away due to changing incentives faced by individuals and communities. Institutions get moulded by changing societal process, technology or even extreme events (among other factors). Individuals and groups voice their choices through formal and informal mechanisms, and participate in decision-making.

When, how and where do their voices get heard? How do policies get framed and implemented? What roles do trust and power relations play in our commitment to sustainability?

INSEE proposes to provide a platform for inter-disciplinary engagement on these issues to students, researchers, practitioners and policy-makers. The following sub-themes broadly define the areas in which contributions have been invited:

Subthemes:

1. Ecosystems and Well Being
   - 1.1 Oceans, Forests, Mountains and Wetlands
   - 1.2 Resilience
   - 1.3 Valuation
   - 1.4 Management
2. Collective Action and Local Governance
   - 2.1 Community
   - 2.2 Institutions
   - 2.3 Transaction Costs
   - 2.4 Trust
3. Climate Change
   - 3.1 Science of Climate Change
   - 3.2 Agriculture & Food Security
   - 3.3 Extreme Events
   - 3.4 Paris Agreement and Marrakesh Proclamation
   - 3.5 Adaptation and Mitigation
   - 3.6 Technology
4. SDGs and Global South
   - 4.1 Gender & Ecology
   - 4.2 Inequality
   - 4.3 Environmental Justice
   - 4.4 Green Economy
   - 4.5 Waste and recycling
   - 4.6 Energy

Pre-conference workshop:

INSEE Pre-Conference Workshop titled 'Researching in Ecological Economics' on 7th November 2017, KILA, Thrissur.

This inter-disciplinary training workshop for young and mid-career researchers aims at giving an overview of doing Ecological Economics research – from collecting field data to using secondary data with multi-disciplinary teams.

Scientific Advisory Committee

Pranab Mukhopadhyay (Chairperson)
Bina Agrawal
Mahadev G Bhat
Ramachandra Bhatta
Ramesh Chand
Kanchan Chopra
Kalyan Das
Saudamini Das
Vikram Dayal
Nitin Desai
Rohan D'Souza
Anantha Duraiappah
P S Easa
Sunny George
Rucha Ghate
Nilanjan Ghosh
A Gopala Krishnan
Haripriya Gundimeda
Enamul Haque
Gopal Kadekodi
Kavi Kumar
Pushpam Kumar
Joan Martinez-Alier
M N Murty
Harini Nagendra
Nandan Nawn
Bibhu Prasad Nayak
K N Ninan
Manoj Panda
Balachandra Patil
Seema Purushothaman
Brototi Roy
Ramprasad Sengupta
Amita Shah
Satheesh C. Shenoi
Priya Shyamsundar
JeenaT Srinivasan
Nandini Sundar
Bejoy K Thomas
ArildVatn

Local Organising Committee

P P Balan (Chairperson)
Ramachandra Bhatta
B S Corrie
Shyjan Davis
P Indira Devi
P S Easa
Sunny George
K N Harilal
Nandan Nawn (Organising Secretary)
Bibhu Prasad Nayak
Balachandra Patil
Sushil Sen
Jeena T Srinivasan
Vivek Tyagi

INSEE-KILA International Conference | ***Sustainability, Institutions, Incentives: Voices, Policies and Commitments*** | **November 8-10, 2017**
Ninth Biennial Conference of Indian Society for Ecological Economics (**INSEE**) | Kerala Institute of Local Administration (**KILA**), Thrissur

Full Programme (Pre-conference, Curtain Raisers and Conference)*

November 6–10, 2017

November 6, Monday		
Registration	14:30 onwards	*Office at Aravalli Guest House*, GF (near reception)
Registration for Conference/collection of conference kit for already Registered participants		
Dinner	19:30–21:30	*Dining area*

Pre-conference workshop

November 7, Tuesday		
Breakfast	07:30–9:00	*Dining area*
Pre-conference Workshop	09:00–17:30	*Ashok Mehta Hall* (FF)
		Researching in Ecological Economics *A Pre-conference Workshop organized by INSEE*
0.1 Welcome	09:00–09:05	Welcome: **Joy Elamon**
0.2 Introduction	09:05–09:15	Introduction: **Saudamini Das**
0.3 Session 1	09:15–11:00	**Primary data from Field surveys – questionnaire designing and sampling** **Santadas Ghosh**
Tea & Snacks	11:00–11:30	*Outside Conference Room 1*
0.4 Session 2	11:30–13:00	**Primary data from Field surveys – operational challenges in survey implementation** **Santadas Ghosh**
Lunch	13:00–14:00	*Dining area*
0.5 Session 3	14:00–15:30	**Planning ecological economics research in Tropical Forests** **Susmita Dasgupta**
Tea & Snacks	15:30–15:45	*Outside Conference Room 1*
0.6 Session 4	15:45–17:15	**Executing ecological economics research in Tropical Forests** **Susmita Dasgupta**
0.7 Closing remarks	17:15–17:30	Closing Remarks: **Kalyan Das**
Dinner	20:00–21:30	*Dining area*

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

Curtain Raiser events

November 7, Tuesday	
09:00–12:00	**Organized in association with** **Department of Economics, Vimala College (Autonomous), Affiliated to University of Calicut, Thrissur** Prayer Welcome address **(Sr) Marriette A Therattil,** Principal Remarks by Chair **P S Easa**, Former Director, Kerala Forest Research Institute, Thrissur About the programme and introduction of speakers **Jeena T Srinivasan**, Joint Secretary, INSEE About KILA: The Institute for Local Governance and Development **Sunny George**, KILA ***Can conservation withstand development: Evidence and Reflections*** **Kanchan Chopra** Former Director and Professor, Institute of Economic Growth, New Delhi and Former President, INSEE About Indian Society for Ecological Economics (INSEE) **Bhibhu Prasad Nayak**, Joint Secretary, INSEE Interactions and Remarks by the Chair **P. S. Easa** Vote of thanks **Vimala M,** Head of the Department of Economics

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

10:00–12.15	**Organized in association with** **Dr. John Matthai Centre, Department of Economics, University of Calicut, Thrissur** Prayer Welcome address **K.X Joseph,** Professor and Head About Indian Society for Ecological Economics (INSEE) **Brototi Roy**, INSEE About KILA: The Institute for Local Governance and Development **Peter Raj**, KILA ***Climate Change: Economics, Environment and Public Policy with Special Reference to India*** **KN Ninan** Chairperson, Centre for Economics, Environment and Society, Bangalore, and Co-Chair, Methodological Assessment of Scenarios and Models of Biodiversity and Ecosystem Services, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), United Nations, Bonn, Germany and Vice-President, INSEE Interactions/Discussions and Remarks by the Chair Vote of thanks **Shyjan D,** Assistant Professor, Dr. John Matthai Centre

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

11:00–12:30	**Organized in association with** **Academy of Excellence in Climate Change**, Kerala Agricultural University, Vellanikkara and **Intergovernmental Panel on Climate Change** (IPCC) Welcome by Chairperson **Indira Devi**, Director of Research, KAU *General introduction by Panel Moderator on IPCC process* **Joyahsree Roy** Presentations *Climate change : Physical science basis key messages from AR5 with special relevance for South Asia* **Bala Gobindasamy** *Impacts, Adaptation and Vulnerability-Key Messages for the Region from AR5* **Purnamita Dasgupta** *International, National and Subnational Policies and Institutions in Mitigation* **E. Somanathan** *What can be done to reduce GHG emissions: Sectoral Options* **Joyashree Roy** Concluding remarks **Indira Devi** Vote of Thanks K**unjamu**, Professor and Special Officer Academy of Climate Change Education and Research ,KAU

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

13:00–15:30	**Organized in association with** **Sacred Heart College, Affiliated to University of Calicut, Chalakudy** Prayer Welcome address **(Sr) Reena Ittyachan,** Principal About the programme, introduction to INSEE and introduction of speakers **Jeena T Srinivasan**, Joint Secretary, INSEE KILA: The Institute for Local Governance and Development **J. B. Rajan**, KILA ***Why Do We Need Ecological Economics?*** **Gopal Kadekodi** Honorary Professor, Centre for Multi-disciplinary Development Research, Dharwad, Former Director, Institute for Social and Economic Change, Bangalore and Former President, INSEE Interactions Vote of thanks **V. Neetha**, Assistant Professor, Dept of Zoology

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

13:30–16:30	**Organized in association with** **St. Thomas College, Intergovernmental Panel on Climate Change** (IPCC) and **Directorate of Environment and Climate Change, Government of Kerala** *General introduction by Panel Moderator on IPCC process* **Joyahsree Roy** Presentations *Climate change : Physical science basis key messages from AR5 with special relevance for South Asia* **Bala Gobindasamy** *Impacts, Adaptation and Vulnerability-Key Messages for the Region from AR5* **Purnamita Dasgupta** *International, National and Subnational Policies and Institutions in Mitigation* **E. Somanathan** *What can be done to reduce GHG emissions: Sectoral Options* **Joyashree Roy**

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

16:00–17:30	**Organized in association with** **College of Forestry, Kerala Agricultural University, Thrissur** Welcome address **K. Vidyasagaran,** Dean, College of Forestry About the programme, introduction to INSEE and introduction of speakers **Bejoy K Thomas**, EC Member, INSEE About KILA: The Institute for Local Governance and Development **Raghavan**, KILA ***Valuing Forests: the Indian Experience and some reflections*** **Kanchan Chopra** Former Director and Professor, Institute of Economic Growth, New Delhi, Former President INSEE Interactions Vote of thanks **M. Shaji,** Assistant Professor

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

For the conference participants [other than pre-conference participants]

November 7, Tuesday		
Breakfast	07:30–09:00	*Dining area*
Registration	10:00 onwards	*Office at Aravalli Guest House,* GF (near reception)
Registration for Conference/collection of conference kit for already Registered participants		
Tea & Snacks	11:00–11:30	*Outside Ashok Mehta Hall* (FF)
Lunch	13:00–14:00	*Dining area*
Tea & Snacks	15:30–15:45	*Outside Ashok Mehta Hall* (FF)
Dinner	20:00–21:30	*Dining area*

For members of Executive Committee and General Body of INSEE

		Nattukuttam Hall (GF)
EC Meeting	17:30–18:30	**41st Meeting of Executive Committee of Indian Society for Ecological Economics**
		Mahatma Hall (SF)
GBM	18:30–20:00	**14th Meeting of General Body of Indian Society for Ecological Economics**
Dinner	20:00–21:30	*Dining area*

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

INSEE-KILA International Conference | ***Sustainability, Institutions, Incentives: Voices, Policies and Commitments*** | **November 8-10, 2017**
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November 8, Wednesday			
Breakfast	07:30–09:00	*Dining Area*	
Panel Discussions	09:00–10:30	*Gram Swaraj Hall* (GF)	*Mahatma Hall* (SF)
1.1. Parallel Panel discussions		**Citizen Science for ecology in India: experiences, opportunities, challenges** Moderator: **Pankaj Sekhsaria** Speakers: **K V Gururaja**, **Naveen Namboothri, Prabhakar Rajagopal, Pankaj Sekhsaria** and **Naveen Thayyil**	**IPCC panel: Understanding Climate Change – Science and Adaptation and Mitigation Options** Moderator**: Joyashree Roy** Speakers: **Govindasamy Bala**, **Purnamita Dasgupta** and **E Somanathan**
Tea & Snacks	10:30–11:00	*Outside Auditorium*	
Inauguration	11:00–13:00	*Swaraj Auditorium*	
1.2. Inaugural Session	11:00–11:05	Introduction: **Jeena T Srinivasan**, Joint Secretary, INSEE	
	11:05–11:15	Welcome Address: **Joy Elamon**, Director, KILA	
	11:15–11:40	Inaugural Address: **V K Ramachandran**, Vice Chairman, State Planning Board, Government of Kerala	
	11:40–11:55	Keynote Address: **K N Harilal**, Member, State Planning Board, Government of Kerala	
	11:55–12:20	Address by Chief Guest: **Pavan Sukhdev**, Founder-CEO, GIST Advisory **Writing the accounts of Society and the Corporation as if Humanity and Nature mattered**	
	12:20–12:30	Presidential Address: **Pranab Mukhopadhyay**, President, INSEE	
	12:30–12:35	Introduction to the Conference: **Nandan Nawn**, Secretary, INSEE	
	12:35–12:45	Release of Pranab Mukhopadhyay, Nandan Nawn and Kalyan Das eds. (2017) ***Global Change, Ecosystems, Sustainability: Theory, Methods, Practice***, Sage for INSEE	
	12:45–12:55	Launch of ***Ecology, Economy and Society—the INSEE Journal***: **Kanchan Chopra**, Editor, EES	
	12:55–13:00	Group Photo	
Lunch	13:00–14:00	*Dining Area*	

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

1.3. Parallel Sessions	14:00–16:00	Presentations		
Gram Swaraj Hall (GF)		*Ashok Mehta Hall* (FF)	*Gramodyaya Hall* (FF)	*Gram Sabha Hall* (FF)
Session 1.3.1: **Terrestrial and Wetland Ecosystems** Chair: **K N Ninan**		Session 1.3.2: **Impacts of Climate Change and Adaptation by farmers 1** Chair: **J B Rajan**	Session 1.3.3: **Fuelling Challenges** Chair: **Balachandra Patil**	Session 1.3.4: SDGs and Global South 1 **Urban challenges** Chair: **Bejoy K Thomas**
Modelling the economics of grassland degradation in Banni, India, using system dynamics **Mihir Mathur** and Kabir Sharma Wetland paddy ecosystems and amphibian diversity: need for compensating conservation **Manjula M,** Girigan Gopi and Vipindas Economic cost of land degradation in India **Dayakar Peddi** Analysing adoption of soil conservation measures in Darjeeling district, West Bengal, India **Chandan Singha** Conservation, poverty and livelihood: study in Similipal wildlife sanctuary **Bijayashree Satpathy**		Rainfall and agricultural productivity: empirical analysis of possible relationship **Subir Sen** Influence of climate variability on sugarcane farming in India: an application of stochastic frontier production approach **Ajay Kumar Singh**, K G S Narayanan and Pritee Sharma Climate change and its impact on agricultural production in Bangladesh: Geo-statistical Analysis of spatial and temporal variations **Md. Mahedi Hasan,** Mohammad Tauhidul Islam & Nigar Sultana Migration as adaptation strategy to cope with climate change: a study of farmers' migration in Bihar **Chandan Kumar Jha** *et al* Do we need a climate change adaptation policy in agriculture sector in Indian state of Odisha? **Narendra N Dalei**	Transport fuel elasticity estimation to understand the impacts of energy subsidy reform in India: a household study **Dhanyashree Bhuvandas** and Haripriya Gundimeda Dimension of biomass as the primary source of household energy – a study in forest fringe villages of Assam in northeast India **Kulen Chandra Das** Direct and indirect impact pathways of biofuels in developing countries: A meta-analysis of literature evidences **Prantika Das** and H Gundimeda Conflicting dilemmas of energy saving in Indian domestic sector: efficiency vs. conservation **Vandana Maurya** Distributed hybrid electricity system for energy access, livelihoods, and empowerment **Madalsa Singh** and P Balachandra	Assessment of sanitation development in India- how is the country progressing towards sustainable development goal? **Debasree Bose** and Arijita Dutta Technology choice and institutional options in urban sanitation: towards a protocol for town level sanitation planning **NC Narayanan** Urban sanitation, co-financing and the myth of co-production: the case of Indian slums **Indranil De** Waste management in the Himalayan hill city Shimla: concerns for ecology, economics and governance **Rakesh Kumar Sharma** and Vibhor Sood Enabling institutions to achieve efficient waste management **Shivani Wadehra** and Arabinda Mishra Urban food system transitions and socio-ecological resilience in Kerala **Anita Pinheiro**

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

1.4. Photo Exhibition and Tea Break	16:00–16:30	*Outside Auditorium*
		Photo Exhibition: The City and the Farms - agriculture in periurban Bengaluru Hosted by School of Development, **Azim Premji University**

Keynote Address	16:30–18:00	*Mahatma Hall*
1.5. Keynote addresses, comments, discussion	16:30–16:40	Introduction and Moderation: **Gopal Kadekodi**, Former President, INSEE
	16:40–17:10	**Estimating social time preference rate for India: declining discount rates for evaluation of climate change mitigation and other long gestation period investment projects** **M N Murty**, Former Professor, Institute of Economic Growth, New Delhi
	17:10–17:40	**Coastal zone vulnerability and climate change: visible & not-so-visible threats** **Susmita Dasgupta**, Lead Environmental Economist, The World Bank, Washington DC
	17:40–18:00	Discussion

1.6. Workshops	18:00 –19:00	*Ashok Mehta Hall* (FF)	*Gram Sabha Hall* (SF)
		Writers' Workshop **Nupoor Singh**, Springer	**Strengthening capacity in coastal and marine biodiversity management** **Neeraj Khera**, GIZ
1.7. Cultural Programme	19:00–20:30	*Swaraj Auditorium*	
Classical Dance by Kalamandalam, Thrissur			
Dinner	20:30–21:30	*Dining Area*	
		Hosted by Director, Kerala Institute of Local Administration	

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

INSEE-KILA International Conference | ***Sustainability, Institutions, Incentives: Voices, Policies and Commitments*** | **November 8-10, 2017**
Ninth Biennial Conference of Indian Society for Ecological Economics (**INSEE**) | Kerala Institute of Local Administration (**KILA**), Thrissur

<table>
<tr><th colspan="5">November 9, Thursday</th></tr>
<tr><td>Breakfast</td><td>07:30–09:00</td><td colspan="3">Dining Area</td></tr>
<tr><td>Panel Discussions</td><td>09:00–10:30</td><td>Gram Swaraj Hall (GF)</td><td colspan="2">Mahatma Hall (SF)</td></tr>
<tr><td>2.1. Parallel Panel discussions</td><td></td><td>Environment, Climate Change, Biodiversity and Local Governance
Moderator: Padma Mahanty
Speakers: Dineshan Cheruvat, Unnikrishnan Divakaran, Beena Vijayan, Asainarm, J B Rajan, S Gopikrishna Warrier and T P Kunhikannan</td><td colspan="2">Marginal Ecologies: examining Sustainability on the peripheries of Nature and Society
Moderator: Asmita Kabra
Speakers: Budhaditya Das, Arnab Mukherji, Sonam Mahalwal, Rohit Negi and Shaina Sehgal</td></tr>
<tr><td>Tea & Snacks</td><td>10:30–11:00</td><td colspan="3">Outside Seminar Hall 1</td></tr>
<tr><td>Parallel Sessions</td><td>11:00–13:00</td><td colspan="3">Presentations</td></tr>
<tr><td colspan="2">Gram Swaraj Hall (GF)</td><td>Ashok Mehta Hall (FF)</td><td>Gramodyaya Hall (FF)</td><td>Gram Sabha Hall (FF)</td></tr>
<tr><td colspan="2">Session 2.2.1: Perceptions and Behavioural responses
Chair: L Venkatachalam</td><td>Session 2.2.2: Impacts of Climate Change and adaptation by farmers 2
Chair: Indira Devi</td><td>Session 2.2.3: Conservation
Chair: Jayshree Vencatesan</td><td>Session 2.2.4: Economic-ecological systems in Kerala
Chair: Sunny George</td></tr>
<tr><td colspan="2">What affects the willingness to pay for arsenic safe drinking water? A case study in rural West Bengal
Monalisa Ghosh et al.

Economic valuation of a recreation model: challenges and way forward
Prajna Paramita Mishra

Perception of stakeholders on the maintenance of irrigation tanks in Sivagangai district of Tamil Nadu
Varadarajan Raghupathy and G Uma

Trust and life satisfaction: evidence from India
Maya K</td><td>Impact of drought on agriculture in Chittoor district of Andhra Pradesh
L Umamaheswari et al.

Climate variability and agriculture vulnerability for Vidarbha region of Maharashtra, India
Deepika Swami and Devanathan Parthasarathy

Propagating salt tolerant rice: possible adaptation strategy against climate change in coastal West Bengal
Saptarsi Chakraborty and Santadas Ghosh</td><td>Media reporting on the protected areas in Maharashtra - a thematic analysis
Trupthi Narayan and Pankaj Sekhsaria

Dual control of forests in a federal structure
Indrani Roy Chowdhury

Collective action and eco-tourism under different institutional framework-comparison of turtle nesting sites in Goa and Maharashtra
Sulochana Pednekar</td><td>Conservancies and conservation: women forest protection group in the Western Ghats of Kerala
Saji M Kadavil

Local community knowledge and revival of mangroves in two districts of Kerala: the role of collective action
Deep Jyoti Francis and Anita Pinheiro

An economic assessment of trends in land-use-land-cover data of Kuttanad wetland ecosystem, Kerala and investment measures adopted for its sustainable development
Lisa Mariam Varkey</td></tr>
</table>

* as on 05/11/2017, 02:00 hrs, programmes listed here are unlikely to change

Evidence-based sustainability reporting: condensing the integral sustainability of individual economic agents, branches and economies into the sustainability index NAX **Claudia Lemke**, Rita Bergmann and Dennis A. Ostwald		Impact of climate change and variability on rice yield in Assam Asfika Begum and **Ratul Mahanta** Climate change impacts and adaptation in sorghum production in Tamil Nadu **V Saravanakumar**	Conservation vs. livelihood: stakeholder preferences over the improved conservation of Loktak lake in Manipur, India **Binilkumar Amarayil Sreeraman** and Konthoujam Gyanendra Singh	Pilgrim tourism and ecological sustainability of Pampa river in Kerala **Anitha V** Using geotagged photos from social media to value the recreational benefits of Kerala's wetlands in India **Michael Sinclair**, Andrea Ghermandi, Sheela A. Moses, Sabu Joseph
Lunch	13:00–14:00	*Dining Area*		

Parallel Sessions	14:00–16:00	Presentations		
Gram Swaraj Hall (GF)		*Ashok Mehta Hall* (FF)	*Gramodyaya Hall* (FF)	*Gram Sabha Hall* (FF)
Session 2.3.1: **Politics, Resistance and Movements** Chair: **T P Kunhikannan**		Session 2.3.2: **Aquatic Ecosystems** Chair: **R C Bhatta**	Session 2.3.3: **Institutions for governance of 'commons'** Chair: **P S Easa**	Session 2.3.4: SDGs and Global South 3 **Pollution and Health** Chair: **Peter M. Raj**
Politics of pollution: a case of Godavari mega aqua food park in west Godavari district of Andhra Pradesh **P Omkar Nadh** Increasing water vulnerability of Indian megacity, Mumbai: interconnected web of politics and policies **Deepika Swami** and Devanathan Parthasarathy Ecology and capitalism at the crossroads: a case study of Telangana **Ramesh Dheeravath** Ecological distribution conflicts over mineral extraction in India:		Economic value of biodiversity loss: a case study of by-catch from Andhra Pradesh marine fishery **Jyothis Sathyapalan** The ecology and history of the Andaman Islands: bottom up and through the lens of fiction **Pankaj Sekhsaria** An interdisciplinary risk assessment: harmful microbes, shellfish, climate change and urbanisation in Mangalore, southwest India **Lucy M Turner** *et al*	Participatory forest management and the role of institutions in Tanzania: a survey **Anindita Roy Saha** and Grace Charles Muangirwa Role of collective action and governance in implementing sustainable fishing practices: a case study of Karnataka marine fisheries **S Gunakar** What constitutes the 'commons' in water? A case study of irrigation systems in Puducherry district	Health externality in terms of respiratory illness related sick days due to air pollution: evidence from open cast coal mining region of Odisha **Tapaswini Nayak** and Indrani Roy Chowdhury Studies on the influence of land change and land use pattern on the mosquito vector population in human dominated ecosystems at Palani, Dindigul district, Tamil Nadu **P Manikandan,** N Kamaladhasan and S Chandrasekaran Impact of air pollutant PM10 on house rent in the cities of Ghaziabad and NOIDA of NCR in India using hedonic property price model

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an overview **Arpita Bisht** and Julien-François Gerber The EJOLT project (2011-15) and the EnvJustice project (2016-21) at the ICTA UAB, Barcelona **Joan Martinez-Alier**		Choice modeling and its application to Sundarbans mangrove forest preservation **Md. Hafiz Iqbal** First-and second-order adaptation to salinity and water logging: case of coastal embankment in Satkhira district, Bangladesh **Farid Ahmed**	**S Krithi** Self governance of fishermen in Sundarban: a case study **Tapas Kumar Sutradhar** and Santadas Ghosh An agent-based Simulation of cooperation in the use of irrigation systems **Jingjing Cai** and Hang Xiong	**Gaurav Kumar** Promoting collective action to improve water security in peri-urban areas around Bangalore city using social accountability tools Arvind Lakshmisha, **Priyanka Agarwal** and Bhargavi Nagendra Effect of road transport infrastructure, energy use and economic growth on CO_2 emission in India **Namita Singh,** Trupti Mishra and Rangan Banerjee
2.4. Photo Exhibition and Tea Break	16:00–16:30	*Outside Auditorium*		

Panel Discussions	16:30–18:00	*Gram Swaraj Hall* (GF)	*Mahatma Hall* (SF)
2.5 Parallel Panel discussions		**Setting the Conservation and Development Agenda for the Western Ghats, India** Moderator: **P S Easa** Speakers: **P K Kesavan**, **N Krishnakumar** and **Hansraj Verma**	**Ecosystems and farmer well-being: PES as a tool in ensuring farmer welfare** Moderator: **Indira Devi** Speakers: **Ramachandra Bhatta**, **Lalit Kumar**, **D Suresh Kumar** and **Manjula M**
2.6. Learning game and Discussion Session	18:00 –19:00	*Swaraj Auditorium*	*Ashok Mehta Hall* (FF)
		Operationalising IWI for policy-making through a learning game **Bharath Palavalli** and **Anantha Duraiappah**, MGIEP	**Green Finance in India: Challenges and Research Requirement** Moderator: **Saudamini Das** Speakers: **Atin Prakash** and **Baiju N Kurup**
2.7. Cultural Programme	19:00–20:00	*Swaraj Auditorium*	
Bamboo Symphony			
Dinner	20:00–22:00	*Dining Area*	
Hosted by Care Earth Trust			

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<table>
<tr><th colspan="5">November 10, Friday</th></tr>
<tr><td>Breakfast</td><td>07:30–09:00</td><td colspan="3">Dining Area</td></tr>
<tr><td>Keynote Address</td><td>9:30–11:00</td><td colspan="3">Mahatma Hall</td></tr>
<tr><td rowspan="4">3.1. Keynote addresses comments, discussion</td><td>9:30–9:35</td><td colspan="3">Introduction and Moderation: Kanchan Chopra, Founder President, INSEE</td></tr>
<tr><td>9:35–10:05</td><td colspan="3">Voting in the UN and the Inclusive Wealth Index: some thoughts
Anantha Duraiappah, Director, UNESCO-MGIEP, New Delhi</td></tr>
<tr><td>10:05–10:35</td><td colspan="3">Institutions, the Environment and Development
E Somanathan, Professor, Indian Statistical Institute, Delhi</td></tr>
<tr><td>10:35–11:00</td><td colspan="3">Discussion</td></tr>
<tr><td>Tea & Snacks</td><td>11:00–11:30</td><td colspan="3">Outside Mahatma Hall</td></tr>
<tr><td>Parallel Sessions</td><td>11:30–13:30</td><td colspan="3">Session 4: Presentations</td></tr>
<tr><td colspan="2">Gram Swaraj Hall (GF)</td><td>Ashok Mehta Hall (FF)</td><td>Gramodyaya Hall (FF)</td><td>Gram Sabha Hall (FF)</td></tr>
<tr><td colspan="2">Session 3.2.1: Livelihood
Chair: Amita Shah</td><td>Session 3.2.2: Valuations, evaluations and viabilities
Chair: M N Sudhakaran</td><td>Session 3.2.3: Governing and Managing Climate Change
Chair: Bibhu Prasad Nayak</td><td>Session 3.2.4: SDGs and Global South 4
Inequality, inclusion, access
Chair: Shyjan Davis</td></tr>
<tr><td colspan="2">Ecosystem services and agricultural livelihoods: an analysis of trade-offs in peri-urban Bangalore
Dhanya B et al.

Can third party certification programs improve livelihoods and reduce food insecurity: an empirical study from southern India
Pradyot Ranjan Jena and Bibhu Prasad Nayak

Role and movement pattern of women entrepreneurs in the fish value chain: a micro level study in India
Sneha G and Gopakumar</td><td>Do consumers really care about green practices? A case study of GHMC star hotels
Arakhita Behera

Assessing the economic viability of alternative option for water management: a case study of Coimbatore district, Tamil Nadu
Sukanya Das, Karthick Radhakrishnan and Bouzit Madjid

Improving evaluation knowledge for better regulation in the forest policies
Megha Nath et al.</td><td>What lies ahead for global climate governance? A discussion on key approaches and the experience so far
Udayakrishnan Azhakath

What would a socio-economic and energy technology system be like if we limit climate change to Paris agreement? A hybrid modelling system approach
K. Dhavala et al

Climate change induced migration: challenges and opportunities under international law: a case study of India and Bangladesh</td><td>Factors influencing corporate social responsibility expenditure of Indian mining firms: implications for ecology and social inclusion
Saswat Kishore Mishra (TBC), Pulak Mishra and Srijit Mishra

Perspectives on gender equality in the context of environmental sustainability
Lavanya Suresh

Distributional impact of common property forest incomes on rural income inequality: case study from Odisha
Abhilas Kumar Pradhan</td></tr>
</table>

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		Viswanathan and Amalendu Jyotishi Drivers of adaptation decisions in marine fishing community of Mumbai, India **Krishna Malakar**, Trupti Mishra and Anand Patwardhan Agricultural production and income in a disaster year: findings from the study of Melanjippattu village affected by cyclone Thane **Harshan Tee Pee**	Economic valuation of coastal and marine ecosystem goods and services in India **Abhijit Sharan** *et al.*	**Akanksha Jumde** and Nishant Kumar Integrating space technologies into river basin management: an Indian scenario **Ramnath Reghunadhan** Role of voluntary compliance in managing climate change at firm level in India **Mousami Prasad**, Trupti Mishra and Varadraj Bapat	Can increasing human development and income reduce impact from natural disasters? empirical evidence for floods in India **Chandra Sekhar Bahinipati** and Unmesh Patnaik Inequality in access to quality housing in Kolkata- a micro level spatial analysis using geographically weighted regression **Ismail Haque**
Lunch	13:30–14:30	*Dining Area*			

Panel Discussions	14:30–16:00	*Gram Swaraj Hall* (GF)	*Mahatma Hall* (SF)
3.3. Parallel Panel discussions		**Is there a global Environmental Justice movement?** Moderator: **Brototi Roy** Speakers: **Sofía Ávila-Calero**, **Arpita Bisht**, **Deepak Malghan** and **Joan Martinez-Alier**	**Marine Fisheries resources and Technology: some Sustainability and Equity issues** Moderator: **Ramachandra Bhatta** Speakers: **John Kurien, Lynda Rodwell, T V Sathianandan**, and **Aarthi Sridhar**
3.4. Photo Exhibition and Tea Break	16:00–16:30	*Outside Auditorium*	
Valedictory Function	16:30–17:30	*Swaraj Auditorium*	
3.5. Valedictory Session	16:30–16:40	Chair: **Joy Elamon**, Director, KILA	
	16:40–17:00	Valedictory Address: **K T Jaleel**, Minister for Local Self Government, Government of Kerala	
	17:00–17:15	Concluding Remarks: **K N Ninan**, Vice President, INSEE	
	17:15–17:20	Group Photo	
	17:20–17:30	Vote of Thanks: **Kalyan Das**, Treasurer, INSEE	
High Tea	17:30–18:00	*Outside Auditorium*	
Dinner	20:00–21:30	*Dining Area*	

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November 11, Saturday		
Departures	Check out by 12:00 noon	*Front Lobby*, Aravalli Guest House, GF
Departures of Conference Participants		

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Parallel Panel Discussions 09:00–10:30

Citizen Science for ecology in India: experiences, opportunities, challenges

Moderator: **Pankaj Sekhsaria**

Speakers: **K V Gururaja**, **Naveen Namboothri, Prabhakar Rajagopal, Pankaj Sekhsaria** and **Naveen Thayyil**

One of the important new directions in science & technology (S&T) research as also understanding the impact and relevance of S&T today is the involvement of the 'citizen'. Social studies of S&T have effectively shown that the citizen is not merely a passive recipient of knowledge in the case of science or products in the case of technology, but that s/he actively participates in the shaping of technological products and often of scientific knowledge itself – what scholars have referred to in different ways as the 'co-production of knowledge', 'Mode 2 Knowledge production' and the 'Social Construction of Technology'. Science policy studies have also engaged deeply with the role of the citizen and various insights are now available on the mutual shaping of society and technology; evidence has been provided convincingly that the arrow of influence does not move from S&T to society but moves equally effectively and mutually in the opposite direction as well.

The call being heard now is a more normative one – for the citizen to be actively included in the larger S&T enterprise – in doing the science, in assessing S&T, in evaluating relevance and impact. New forms of Technology Assessment (TA) are seeking a more upstream involvement of the citizen in frames that are more democratic and participatory. And there is now the new science of 'Citizen Science' where the division between the 'expert' scientist and the 'ordinary' citizen is sought to be blurred even further. Here the citizen also does the science, the expert and the ordinary are both scientists, and the knowledge that is generated is generated by them jointly.

One area of scientific research in which Citizen Science has taken off in the Indian context is that of field ecology, where a number of projects have been initiated by scientists and researchers in active collaboration with citizens. What we seek to do in this panel at INSEE is to create a platform for engagement with and discussion on 'Citizen Science' initiatives in ecology in India - to understand the various dynamics involved, to see how data and knowledge is created, to see the interface between the traditional categories of the expert and the ordinary, to understand the motivations of the scientific community in initiating these projects and of the citizens in participating/contributing/collaborating, to see what these means for settled categories of knowledge and knowledge creation and also to see what, if any, policy and on-field impacts does this participation by citizens results in.

The idea, as the sub-title of the panel suggests, is to explore the experiences, opportunities and challenges of doing citizen science in India in environmental and ecological studies!

THE PANEL

MODERATORS: **Pankaj Sekhsaria** and **Naveen Thayyil**, DST-Centre for Policy Research, Dept of Humanities and Social Science, IIT- Delhi. Email: psekhsaria@gmail.com

PANELISTS:

1) **Prabhakar Rajagopal,**
Project: India Biodiversity Portal. (http://www.indiabiodiversity.org/)
Email: prabha.prabhakar@gmail.com

Abstract: Although seemingly ubiquitous, and well studied, access to information on India's biodiversity is restricted to and isolated within privileged academia and establishments. With 7-8% of the world's biodiversity, India has a long way to go before it has documented its biodiversity and liberated it under open access.

The India Biodiversity Portal (IBP) is an effort aimed towards building an open, reliable biodiversity information aggregation system. Through convincing establishments to liberate historical data, motivating common citizens and enthusiasts to document biodiversity around them and encouraging taxonomists to interact with and validate content, the portal has made significant steps to lay the foundations for what can be a reliable, open access information system for the biodiversity of India.

The task of building a good and reliable biodiversity information system has to be done in a collaborative environment with the collaboration of researchers and amateurs; experts and enthusiasts. We need to understand the profile of participant contributors, their motivation and the nature of participation on the portal.

The presentation will touch upon the above mentioned points both to describe what has been attempted and achieved thus far by the IBP and what are the challenges and opportunities going forward.

2) **KV Gururaja**, Srishti Institute of Art, Design and Technology,
Project: Frogwatch
Email: gururaja.kv@srishti.ac.in

Abstract: Citizen science is a rapidly growing practice of involving public in a scientific pursuit. Citizen science in its current form is viewed as a process of data gathering through citizens (as volunteers). Perhaps this view needs to change so as to make it more inclusive, i.e., citizens not only help in collecting data, they are also part of the knowledge dissemination process (peer publications; symposium and seminar presentations; popular articles and so on). Conceptually such inclusiveness leads to
1. Improved public knowledge and
2. Pushing scientists to think or step up beyond available public knowledge.

The description of two new frog species in 2016 is proof of what this inclusive citizen science initiatives can achieve.

Amphibians are one of the rapidly declining vertebrate groups that require immediate conservation efforts. Nearly 440 species occur in India with almost 170 species of these being discovered in the last 17 years. For over half the frog species in India, little information is available on their ecological status. Frog watch was initiated in

2014 as a citizen science project under India Biodiversity portal in 2014 to deal with this gap of knowledge. Till today, there are 2441 observations through this program and are certainly helping us to understand amphibian distribution in India. This will also pave way for better conservation management programs.

3) **Naveen Namboothri**, Dakshin
Project: Community based fisheries monitoring in the Lakshadweep islands
Email: naveen.namboo@gmail.com

Abstract:
Title: Public engagement in ecological sciences: from citizen science to 'citizen's science'

The roles of volunteers in Citizen Science (CS) projects are often limited to that of field data collectors. Having originated in the social-economic-cultural backdrop of the developed western countries, CS is gaining popularity in the urban and semi-urban societies of India. The challenge before CS initiatives is to ensure they are not exclusionary and do not exacerbate existing inequities. Prerequisite literacy levels, language barriers (particularly in comprehending the language of 'science'), lack of access/inability to use technology, inability to comprehend a preservationist view of the natural resources are some of the many factors that may lead to social, cultural and literacy-based exclusion of these already marglinalised communities.

Furthermore, despite having a nuanced understanding of the local ecology and direct stakes maintaining the health of local ecosystems, communities often have no part to play in such popular 'citizen science programmes'.

Initiatives that are co-created with communities and empower them with the scientific data/knowledge necessary to make informed management decisions rarely receive the attention, visibility and consequently support that they deserve. Using the case study of an ongoing fisheries monitoring programme in the Lakshadweep, we intend to highlight how community-based natural resource monitoring can go beyond the realms of simple data collection and scientific enquiry to address real world conservation and resource management challenges. It demonstrates how resource monitoring can be made truly participatory (rather than lip-service), empower communities to contribute to resource management while fostering a sense of ownership of the monitoring initiative, making it truly a 'citizen's science' initiative.

4) Pankaj Sekhsaria & Naveen Thayyil,
DST-Centre for Policy Research, Dept of Humanities and Social Science, IIT-Delhi
Email: psekhsaria@gmail.com

Abstract:
Title: Citizen science in ecology in India – An initial mapping
The presentation will put forward the very initial findings of an ongoing project to map, investigate and analyse citizen science projects in India in the field of ecology. Based on interviews and literature studies of four prominent and active such projects, this presentation brings forth some of the key questions and analysis points that emerge. These are related, for instance, to:

a) Definitional issues: How is citizen science defined? What are the markers of a project to called citizen science. The idea of altruism/ voluntary participation for instance emerges as an important rubric
b) Different kinds of citizen science: data based/ field observation based; rural/urban; no stakes involved/ voluntary etc.
c) The role of scientists/scientific institutions in fostering citizen science.
d) Normative ideas of science, scientific process, the citizen and of the nature of the citizen's participation.

IPCC panel: Understanding Climate Change – Science and Adaptation and Mitigation Options

Welcome by Chairperson: M N Murty

General introduction to IPCC process : Joyashree Roy, JU, Kolkata.

Bala Gobindasamy: (AR5 WGI Author): Climate change : Physical science basis key messages from AR5 with special relevance for South Asia, IISC, Bangalore.

Purnamita Dasgupta (AR5 WGII Author): Impacts,Adaptation and Vulnerability-Key Messages for the Region from AR5, IEG, New Delhi.

E. Somanathan (AR5 WGIII Author): International, National and Subnational Policies and Institutions in Mitigation, ISI, New Delhi.

Joyashree Roy (AR5 WGIII Author): What can be done to reduce GHG emissions: Sectoral Options, JU, New Delhi.

Q&A and Concluding remarks: Chairperson, INSEE representative (TBC)

Parallel Session I

(14:00 – 16:00)

Session 1.3.1: **Terrestrial and Wetland Ecosystems**

Chair: **K N Ninan**

Modeling the Economics of Grassland Degradation in Banni, India, using System Dynamics

Mihir Mathur and Kabir Sharma

The Energy and Resources Institute

Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi – 110 003, INDIA Tel. (+91 11) 2468 2100 and 41504900 Fax (+91 11) 2468 2144 and 2468 2145

Research Funded by Ministry of Environment, Forest and Climate Change, Government of India

ABSTRACT

This is a study on the interactions between the grassland, livestock, the invasive species Prosopis juliflora and the economy of the Banni grasslands, located in the district of Kachchh, Gujarat, India. The study focuses on modeling grassland degradation of Banni from 1992-2015 and simulates future scenarios up to 2030 using system dynamics modeling. An economic valuation of Banni's economy is done by discounting the future earnings of the pastoral economy (milk, 2 | livestock sale, dung manure) and charcoal economy under two scenarios 1) Base case (Business as Usual), i.e. keeping things as they stand today and 2) Prosopis Removal Policy (PRP) i.e. where a decision is implemented to remove Prosopis from Banni. Under the BAU scenario, modeling results indicate that the Banni grassland is headed for severe fodder scarcity due to shrinking area under grassland. If PRP is implemented then Banni would be able to revive its grasslands and more than double the Present Value of future earnings, up to 2030. If the policy decision to remove Prosopis is delayed by 5 years then it results into a 30% reduction in earnings indicating the policy's time sensitivity. The model serves as a test bed to evaluate management policies of Banni grasslands.

Keywords: Grasslands, Livestock, System Dynamics, Economics, Land Degradation

Wetland Paddy Ecosystems and Amphibian Diversity: Need for Compensating Conservation

Manjula. M

MSSRF, Chennai

Girigan Gopi

Vipindas

ABSTRACT

The state of Kerala recognizes paddy lands as important ecological systems and has passed an Act in the year 2008 to protect its conversion to alternate land uses. The State also extends subsidies to paddy farmers to encourage them to continue in paddy. But the State's effort at conserving paddy lands through land use regulations and subsidies have been unsuccessful in preventing paddy land conversions. The opportunity cost of conservation of paddy lands are considerably higher than the compensation that is available in the form of subsidies and support price from Government. The proposal to further extend ecological incentive to paddy farmers is yet to be incorporated in the State policies governing paddy lands. Given this background, the M.S. Swaminathan Research Foundation launched a study to examine the ecological rationale for the regulation on paddy land conversion. The study examined the capacity of paddy lands to provide ecosystem services like carbon sequestration and support to faunal diversity vis-à-vis its competing land use, namely banana and arecanut. It emerges from the study that conversion of paddy lands does result in ecological losses. This paper presents the result of analysis of one of the key ecosystem services from paddy lands and in the light of the results, the paper emphasizes the need for payment of ecological incentive to paddy farmers for their role in conservation of paddy lands for provision of ecosystem services for the larger societal benefit.

Keywords: ecosystem services, ecological incentives, amphibian diversity, paddy wetlands

Economic Cost of Land Degradation in India

P. Dayakar

Research Scholar, Madras School of Economics

ABSTRACT

This study attempts to make two main contributions to economic and ecological literature in the Indian context. The first one is to compute the economic cost of land degradation in India. The second one is to develop a systematic database on the valuation of terrestrial ecosystem services industry on India-specific studies in referred as well as gray literature. To develop the database on the valuation of land ecosystem services, the extensive literature survey was conducted using standard search protocol. The survey outcome was segregated into 3 categories, namely forestland, grassland, and croplands. The survey outcome units are arranged systematically and standardized into monetary 2012 US Dollar values. These values enable to provide the direct and indirect value of economic costs of land ecosystem biome. The Total Economic Value (TEV) estimated for cropland, grassland, and forestland based on standardized respective ecosystem service values. The meta-analysis shows that the average TEV values ($/ha/y 2012 prices) are 6072, 6118 and 4517 for the forest, grass, and cropland terrestrial ecosystem biomes respectively. Regulatory service values are higher than other ecosystem values in the terrestrial land biome. The study also analyzes the economic cost of land degradation using the physical data from the Desertification and Land Degradation Atlas of India for the periods 2003-05 and 2011-13. The cost of land degradation is differ from those available in the literature (for example Reddy, 2003; Mythili, 2015) due to couple of reasons including use of TEV concept for valuation of ecosystem services lost due to land degradation, and systematic development of valuation database using India specific studies.

Keywords: Land Use Cover Change; Land Ecosystem Services; Land Degradation; Total Economic Value

Analysing Adoption of Soil Conservation Measures in Darjeeling District, India

Chandan Singha

Hindu College, University of Delhi, India

ABSTRACT

The study attempts to assess the key determinants of the decision to adopt soil conservation by the farmer with a special focus on whether there is a spatial dimension to adoption decisions. The study area is Teesta River Watershed, in Darjeeling District in the Eastern Himalayas. In this watershed, there have been soil conservation interventions both by the individual farmers on their own farm and by the government at the sub-watershed level. This study considers neighbourhood effects to be crucial in the decision to adopt, given that soil conservation is location-specific, where "location" extends beyond an individual farm. Accounting for the role of spatial dependence is important for two reasons. First, soil conservation in one farm can assist or constrain it in adjacent farms, due to strategic interaction. Second, many unobserved factors, like local amenities, contribute to adoption. The presence of the first factor results in spatial dependency in conservation practices, and of the second factor in spatial dependency in error. We apply a model of spatial lag probit model (following Anselin (2002); LeSage and Pace (2009); and others) that allows us to capture neighbours' influence on outcome (i.e., the adoption decision). The model choice is motivated by the fact that—once we allow for spatial dependence in outcome—the spatial dependence in error is no longer significant. We defined neighbours as geographic neighbours, both within the village and up to a distance of three ndustrial. We used the Bayesian formulation of a standard probit model in conjunction with the Markov Chain Monte Carlo to estimate the parameters. We also compare the estimators of spatial and non-spatial probit. The data for this study was collected through a primary survey conducted during 2013. The findings suggest strong and positive evidence of spatial impact on farmers in making soil conservation decisions. We also examine if adoption decisions differ between farmers residing in treated and untreated sub-watershed and conclude that they do not.

Knowledge about the magnitude and extent of spatial dependency can help the Government in designing better policies to promote the adoption of soil conservation measures at a lower cost.

Keywords: Soil conservation measure, neighbourhood effect, spatial dependence, sub-watershed

Conservation, Poverty and Livelihood: Study in Similipal Wildlife Sanctuary

Bijayashree Satpathy

Research Scholar, Tata Institute of Social Sciences

ABSTRACT

Local communities have been customarily depending on the locally available natural resources for their sustenance. But the „fines and fences approach" enforced with the creation of protected areas (PAs) through various conservation legislations, led to alter their forest dependency and thereby their livelihood. There have been labyrinth of relation between rural livelihood, poverty and forest resources. Numbers of studies across India put forth that there has been considerable dependence of rural poor on forest resources for food, fodder and fuelwood. Often poverty is seen as a cause of loss of forest resources and vice versa. This two way relationship is attempted to explore through this study, conducted in Similipal Wildlife Sanctuary. The focus of this study to explore the dependency of communities inhabiting around the Similipal Tiger Reserves on the forest resources, by analysing their livelihood in the pre- and post- PAs creation. The study followed mixed method approach. The extreme variations in livelihood of the local communities within a PA captured by studying multiple cases. It has been found that there is a noticeable change in livelihood sources, which not only a response to the economic crisis, but also to fulfil the aspirations of the local communities.

Keywords: Conservation, Poverty, Livelihood, Protected Areas, Welfare Programs

Session 1.3.2: **Impacts of Climate Change and Adaptation by farmers 1**

Chair: **J B Rajan**

Rainfall and Agricultural Productivity: *Empirical analysis of possible relationship*

Subir Sen

Assistant Professor, Department of Humanities and Social Sciences,

Indian Institute of Technology Roorkee

ABSTRACT

India accounts for about 2.4 percent of the world's geographical area but it needs to support approximately 14 percent of the global population. The agricultural sector contributes significantly to production, employment and demand generation through various backward and forward linkages (GOI, 2016). For example, according to Census 2011, percentage share of agricultural workers to total workers was reported to be 54.6 percent. As an emerging economy, land demand is high for industrial and residential purposes that directly impact the growth of the sector. The annual growth of area under food grains decreased from 0.29 percent during the 10th Five Year Plan (FYP) (2002-03 to 2006-07) to 0.19 percent in the 11th FYP (2007-08 to 2011-12). The share of agriculture in GDP (at current prices) has decreased from 18.8 percent in 2002-03 to 10.9 percent in 2014-15[1]. This is despite the fact that record foodgrains production was recorded in the year 2013-14 estimated at 265.04 million ndus.

Agricultural Census 2010-11 indicated that small and marginal land holdings of less than 2 hectares accounted for 85 percent of the total operational holding and 44 percent of the total operated area. Furthermore, weather related events impact land use and production especially with higher temperature affecting water availability, seasonal droughts, etc. The year 2014-15 was hit by a bad monsoon which directly impacted kharif crops. The Indian Council of Agricultural Research has further predicted impact of land degradation on production losses[2].

The 12th FYP (2012-13 to 2017-18) has kept at target of 4 percent growth in the sector although much of it would be possible through increase in yields. Although yield, measured as production per hectare of land, improved for all major crops, studies have analysed the contributing factors for improvements in yield and whether or not it was due to technical efficiency or some other factors, say a favourable public policy. The focus of this study is to analyse the foodgrains productivity in selected states using the non-parametric Data Envelopment Analysis (DEA) method. In Figure 1, we have presented the trends in foodgrains production for the 19 states selected for this study and the total foodgrains production at the all India level for the period 1980-81 to 2014-15. Similarly, in Figure 2, we have the trends for foodgrains yield for the period 1990-91 to 2014-15. The trends do corroborate with observations made by Chand et al. (2011)

[1] The figure for agriculture and allied sectors (including forestry & logging and fishing) stands at 21 percent and 17.4 percent in 2002-03 and 2014-15 respectively.

[2] ICAR (2010)

that rather than total production, the instability in foodgrains production in most state is due to yield instability. Although, they analysed data only up to 2006 and opined that variations in access to irrigation and to a lesser extent variations in rainfall may have contributed to inter-state variations in instability in area, production and yield of foodgrains but a DEA based analysis would help ndustria the main sources of variations in productivity (not yield) through the decomposition of the total factor productivity index. Following which, the states are classified to be either high or low productive and analyse the factors responsible for either a progress or a regress in total factor productivity. The primary objective of the study is to understand the relationship of nondiscretionary factors (in this case, rainfall) with foodgrains productivity.

Thiam et al. (2001) reviewed 35 technical efficiency studies related to the agricultural sector. Twelve studies analysed technical efficiency for India and majority of them concentrated on ndustria productivity of *rice*. The review highlights that contrary to the general belief that the efficiency estimates of non-parametric studies are higher and that they may be biased, the non-parametric studies and parametric studies generated similar information regarding technical efficiency. This possibly explains the reason why there are a large number of applied studies on agricultural efficiency using the non-parametric approach, which is easier to apply compared to a restrictive parametric analysis. A brief review of literature on some of the earlier studies estimating agricultural productivity in the Indian context is presented in the next section following which a brief discussion on the DEA methodology and the theoretical background to Malmquist Productivity Index is presented. The discussion on the data and especially the selection of inputs and output is followed by a detailed results section. The conclusions and the limitations of this study are presented in the last section.

Influence of Climate Variability on Sugarcane Farming and Sugar Industries in India: An Application of Stochastic Frontier Production Function Approach

Dr. Ajay Kumar Singh (Corresponding Author)

Post-Doctorate Fellow, EDII Ahmedabad, Gujarat

Dr. KGS Narayanan

Associate Professor, Zantye College Research Centre,

N. Zantye College of Commerce, Bicholim, Goa

Dr. Pritee Sharma

Associate Professor, School of Humanities and Social Sciences,

Indian Institute of Technology Indore, Madhya Pradesh

ABSTRACT

Extensive research studies have estimated the influence of climate change on sugarcane yield in India. Most studies centered their investigation only on one state or groups of few states of the nation. Few studies assessed the impact of climatic factors on sugarcane production and yield at national level. No study measure the technical efficiency(TE) and impact of climatic and non-climatic factors on sugarcane farming across Indian states. Therefore, the present study estimates the influence of climate variability on sugarcane yield and sugarcane production using state-wise panel data during 1971-2014through stochastic frontier production function approach through log-linear regression model. Climatic factors (i.e., maximum temperature, minimum temperature and precipitation) were segregated for summer, spring, autumn and winter seasons to assess the climate change impact on sugarcane crop growth during aforesaid seasons. It implies that climatic factors in different weather seasons have negative and statistically significant impact on sugarcane production and yield. Most states (except Tamil Nadu) were technically inefficient to produce sugarcane production. There is high variation in TE of sugarcane production across Indian states which have potential opportunity to increase TE in sugarcane farming. Finally, it provides several policy suggestions to mitigate the adverse effects of climate variability in sugarcane farming.

Keywords: Climate change; Sugarcane production and yield; India; Technical efficiency; Regression model; SFPFA; Cobb-Douglas production function model.

Climate Change and Its Impact on Agricultural Production in Bangladesh: Geo-statistical Analysis of Spatial and Temporal Variation

Md. Mahedi Hasan

Lecturer in Statistics, Department of BBA-General, Bangladesh University of Professionals

Mohammad Tauhidul Islam

Associate Professor, Department of Peace and Conflict Management, BUP

Nigar Sultana

Assistant Professor, Department of Management Studies, Bangladesh University of Professionals

ABSTRACT

The economy of Bangladesh is dominated by the contribution of agricultural sector and the productions of many of the agricultural products are sensitive to the climatic variables as well as to the geospatial locations where these are cultivated. Agriculture accounts for almost 25 percent of gross domestic product (GDP) in Bangladesh and almost 66 percent of the labor force depends on agriculture for employment (GOB 2010). It is already evident that due to climate change many climate induced hazards, like, extreme events, creeping drought etc. are common in Bangladesh and the agricultural productions are affected by these. It is also proved that the pattern and impact of climate change is not same in all parts of the country. Assessing the region specific impacts of climate change on agriculture is also vital to take the efficacious adaptive and precautionary measures in order to mitigate the adverse effect of climate change. In that regard, this study has aimed to measure the spatiotemporal effect of climate change on the agricultural production in Bangladesh by geospatial analysis. Data on the production of the selected agricultural products, viz. rice, wheat, potato, jute, and maize has been collected for all 64 district of Bangladesh. Three different types of models have been imparted; firstly, the "time series model", to estimate the general trend of the production and climatic variables, secondly, "spatial model" to estimate the spatial effect on the production, and finally, the "spatiotemporal model" to estimate the interaction between spatial coverage and time in the presence of the climatic variables. Spatial model has been developed and the outcome of the analysis shown in a spatial map where the colors are depicting the variation and magnitude of the production in 64 districts in Bangladesh. The map has shown that the variations are eminent both with the passage of time and with the spatial disparities. Based on the suitability map of production the recommendations have been given to identify the suitable locations for cultivating the particular agricultural product.

Keywords: Climate Change, Agricultural Production, Spatial Analysis, Geo-statistical Analysis

Migration as Adaptation Strategy to Cope with Climate Change: a study of Farmers' Migration in Bihar

Chandan Kumar Jha

Research Scholar, National Institute of Industrial Engineering, Mumbai, India

Vijaya Gupta, Utpal Chattopadhyay and A.S. Binil kumar

National Institute of Industrial Engineering, Mumbai, India

ABSTRACT

This study evaluates the agriculture linkage between climate/weather changes and farmer's migration as adaptation in Bihar state of India. The study tries to identify the different cognitive conditions under which farmers decide to migrate. This study attempts to analyze how climate related stress in home region determines farmer's migration decisions also tries to evaluate the socio-economic characteristics of farm households who have adopted or not adopted migration as an adaptation strategy. The focus area of the study is to evaluate the role of migration in access to climate and agriculture extension services and further assess the contribution of migration in enhancing farmers' coping capacity. This study is based on primary survey of farm households selected from seven different districts of Bihar, India. For analyzing farmer's perception on climate change the study uses mental map technique was adopted. Further, binary logistic regression model was used to evaluate the role of socio-economic characteristics of farm households in migration. For analyzing the role of migration in access to extension services and farmers' and the differences in adaptive capacity of migrating and non-migrating farm households, the study uses descriptive statistics analysis. The study finds that climate induced livelihood risk factor is the major driver for farmer's migration in Bihar as most of them perceive changes in climate conditions. Further, socio- economic characteristics of farm households like age, education, proportion of male in house, farm size, proportion of female and children, land ownership pattern are significant factors in determining migration decisions of farm households.

The study also finds that migrating farmers have higher adaptive capacity than non-migrating farmers as they choose higher number of adaptation strategies.This study gives a micro-evidence of the contribution of migration in farmer's adaptive capacity and access to climate and agriculture extension. The study can be beneficial for analyzing climate induced migration for other developing countries with higher agricultural dependence. The study delivers valuable insights on policy requirements for reducing farmer's vulnerability to climate change by developing harmony between risk reduction, development, and capacity building in host regions.

Key Words- Climate Change, Farm Household, Regional Migration, Information and Knowledge, Agricultural extension services, Adaptation Strategies

JEL CODE- Q54, Q12, Q15, R23, D83, Q17

Do We need a Climate Change Adaptation Policy in Agriculture Sector in Indian State of Odisha?

Narendra N. Dalei

Department of Economics

University of Petroleum and Energy Studies, Kandoli Campus, Dehradun-248007 (India)

ABSTRACT

The frequencies of extreme weather events are rising and every times the post cyclone period is followed by draught in the Indian state of Odisha. Since 1965, Orissa has experienced floods for 17 years, droughts for 19 years, and cyclone for seven years. Last 10 to 20-year observation in Odisha reveled that Global climate change is affecting the local weather condition, which is again affecting the agricultural activities in Odisha. Thus, the objectives of this paper are to study the impact of global climate change on local weather condition and how the local weather is impacting agriculture in Odisha. Collecting data from Department of agriculture, Govt. of Odisha; National Aeronautics Space Administration (NASA) and NASA Goddard Institute for Space Studies and using regression analysis we found that the responsiveness of rice production to actual rainfall is inelastic in Odisha. Agriculture is being significantly affected by climate change. This study suggests introducing climate change adaptation policy in agriculture sector in Odisha.

Key words: Climate change, Agriculture, Rainfall, Regression analysis, extreme weather, paddy

Session 1.3.3: **Fuelling Challenges**

Chair: **Balachandra Patil**

Transport Fuel Elasticity Estimation to understand the impacts of Energy Subsidy Reform in India: A Household Study

Dhanyashree Bhuvandas

Research Scholar, Department of Humanities &Social Sciences, IIT Bombay, India

Haripriya Gundimeda

Professor, Department of Humanities &Social Sciences, IIT Bombay

ABSTRACT

Rapid economic and social development with a growing middle class population in India is seen to have considerable impacts on the living standards and lifestyle needs of the people, one being an ever-rising demand for transportation. However, most of the studies on residential energy choice and consumption in India focuses on cooking and lighting fuels. There are very few studies which focus on transportation aspect of energy consumption. Existing research studies on transport fuel studies are primarily based on aggregate level data at state level or country level. This paper contributes by ndustria the demand for transport fuels among the Indian households based on a micro data set, which is derived from the Indian Household Consumer Expenditure Survey conducted by the National Sample Survey Organisation (NSSO). Understanding the response of consumers to a fuel price increase is important in framing energy and environmental policies to reduce the carbon emissions associated with climate change. A two-stage Linear Approximated – AIDS (LA-AIDS) model is used to compute coefficients and calculate the demand elasticities. The results of the stage 1 estimates gives the Engel elasticity which is found to be less than 1 indicating that fuels are a necessary good. In the 2^{nd} stage, the probit regression coefficients are estimated to correct for the selection bias. The results imply that income, household size and employment status are the major socio-economic factors influencing the choice of consumption of transport fuels.

These results will further be used to obtain the uncompensated and compensated price and cross-price elasticities. The results can be used for energy demand forecasts and understanding the impacts of energy policies, especially fuel subsidy reforms which are essential to aid Sustainable Development Goals (SDGs), on household welfare. The welfare of the households can be obtained through the compensating variation method. These welfare estimates are important towards having a sustainable and inclusive growth through mitigating the negative impacts of such policies on the vulnerable groups.

Keywords: Demand elasticity; Households; LA-AIDS; Transportation fuels; Welfare

DIMENSION OF BIOMASS AS THE PRIMARY SOURCE OF HOUSEHOLD ENERGY – A STUDY IN FOREST FRINGE VILLAGES OF ASSAM IN NORTHEAST INDIA

Kulen Chandra Das

Research Scholar, Department of Humanities and Social Sciences, IIT Guwahati

An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit. Humans are an integral part of ecosystems. At the beginning of the human civilisation people tried to manage nature's service more directly through husbandry and agriculture to increase the productivity. Thus, humans have always recognized the importance of what we now call ecosystem services. The people residing by a forest derive diverse eco system services from it which is both tangible and intangible. The present paper tries to delve into extraction of some of the important tangible goods, i.e., energy in the form of fuel wood by the people living in the fringe of a protected area.

At a time when most of the developed countries of the world have shifted to clean and superior sources of energy the people of rural areas of developing and underdeveloped countries are still largely dependent on wood fuel as the prime source of energy. It is estimated that for nearly two billion people in developing countries the search for energy is a daily grind. Households need energy for a variety of reasons like cooking, house and space heating, cattle food preparation, wine brewing and use combined sources of energy starting from biomass to more clean and superior sources like LPG and electricity. Having said this the present study aims at investigating into the sources of energy of the fringe villages of two of the most important protected areas (PA) of Assam, i.e., Laokhowa and Burhachapori WLSs, once rich in biodiversity and abode to the world famous one horned Rhinoceros, turning now into a degraded landscape. The area is dominantly settled by the immigrant Muslim population apart from a few Bengali Hindu and Bihari (migrants of Bihar state of India) and of course the indigenous tribal people (who resides the forest and taungya villages). The degradation of both the protected areas started long back in 1983. Taking advantage of the political unrest that broke out in the late seventies of the last century 35 Rhinos were poached in a single year inside the PA and the remaining rhinos fled. Massive anthropogenic pressure in the form of hunting, indiscriminate felling of valuable timbers, illegal collection of NTFPs, fishing, widespread cattle grazing, etc. sets in motion quickly after that further degrading the rich forest eco-system. The poor people in the fringe villages indulge into massive fuelwood collection from the PAsin order to meet the growing demand arising out of their high population growth exacerbating further the already degraded landscape and the eco-systems of the PAs. Lack of alternative livelihood, low income and close vicinity to the forested areas are some of the pulling factors which still drives the people to collect fuelwood in large scale to meet their daily energy needs.

On the backdrop of this the paper aims at analysing quantitatively the household energy consumption in the fringe villages and its causal relationship with the PAs that may help formulate policies for sustaining the forest ecosystem as well as for sustainable energy use. Moreover, it will also look into the possibility of an energy shift up into the energy ladder for reduction in both the drudgery and pressure on both the Wildlife Sanctuaries.

Key words: Taungya, anthropogenic, energy shift.

Direct and indirect impact pathways of biofuels in Developing Countries: A meta-analysis of literature evidences

Prantika Das

Ph.D Scholar, Department of Humanities and Social Sciences, IIT Bombay

Haripriya Gundimeda

Professor, Department of Humanities and Social Sciences, IIT Bombay

ABSTRACT

Biofuels is presently being considered as the future of sustainable fuel as it delivers multidimensional opportunities like energy security, rural and economic development, and climate change mitigation. The rapid expansion of biofuel production continues to come from large economies like US, EU, and Brazil while many other developed and developing countries like Canada, New Zealand, Argentina, Indonesia, Malaysia, Thailand, India, and China are joining the global biofuel market. Government interventions and support; in form fossil fuel taxes and renewable fuel subsidies, blending mandates and budgetary allocations for R&D on advanced biofuels and feedstock production have fueled the bioeconomy enormously in recent years. Biofuel policies with first generation feedstock have proven to be costly and have strong distortionary impact (Sorda et al., 2010) on global commodity prices and limited impact on GHG emissions. The uncertainty underlying the estimated impacts of biofuels has necessitated comprehensive analysis of current bioenergy landscape, technologies, and critical review of their impacts. The year 2008 has proven to be a pivotal time for biofuel science and economics as unintended consequences of biofuels i.e. food security concerns due to global food price rise and indirect land use consequences was globally documented.

Literature on economic impact assessment of biofuels is geographically biased with US and EU biofuel policies in the focus area, although few studies have assessed Brazil biofuel policies. Assessment of biofuel impact pathways for developing countries has so far been limited. The role and importance of developing countries in global biofuel development cannot be ignored as indirect impacts like food price rise and land use displacement from agriculture, forestry and pastureland can affect the livelihood of poor and vulnerable population in the developing countries. Therefore, this study reviews impact literature on developing countries and tries to identify the direct and indirect impact pathways for developing countries. Through review of impact literature this study tries to assess whether developing countries face advantage or disadvantage in biofuel promotion both in domestic country and in international market. The

study finds that biofuels can be beneficial for developing countries provided that policies are well formulated. Biofuels in developed economies does affect developing countries agriculture and land transformation. Impact depends on global energy prices and substitution elasticity of biofuels and fossil fuels and also the trade relations which developing countries share with developed countries.

Conflicting dilemmas of energy saving in Indian Domestic Sector: Efficiency Vs. Conservation

Vandana Maurya

Research Scholar, Jawaharlal Nehru University, New Delhi

ABSTRACT

What is more favorable for energy saving: Use less light for less number of hours or Using LED for required hours? This is a dilemma we often face in our lives in the quest to reduce energy bills. Energy conservation is absolute reduction in demand whereas efficiency is improvement in service with a lower consumption of energy.

Energy demand in India is increasing tremendously in all sectors i.e. Industrial, Residential, Agricultural, Transport and Commercial sector. Industrial sector dominated the energy consumption followed by residential sector. Various factors identified for this increase are income, lifestyle, improved technology, increased accessibility, increased electrification, energy price, population growth and rapid urbanization. This consumption is expected to increase in future along with growth in economy.

This paper tries to critically analyse energy conservation and efficiency as different mechanisms to reduce the energy consumption in Indian Domestic sector. Research shows that improving efficiency behaviors have higher potential of energy saving than curtailment behavior (Abrahamese et al., 2007) because at times consumer takes energy conservation process as an intrusion to their freedom (Tashchian et al., 1984). In this study, questionnaire were sent to 135 respondents and were asked to grade the given ways of saving electricity in their households on the scale of highly important to least important. This study found that people are more inclined towards efficiency behavior rather than conservation behavior. This can be due to the fact that people don't want to compromise with their day-to-day work or their life style in order to save electricity. Further this paper, compares polices related to energy conservation and energy efficiency in domestic sector and proposes recommendation for achieving Sustainable Development Goal-7.

Keywords: energy conservation, energy efficiency, domestic sector and energy policy

Distributed hybrid electricity system for energy access, livelihoods, and empowerment

Madalsa Singh

P. Balachandra

Department of Management Studies, Indian Institute of Science, Bangalore - 560012, India

ABSTRACT

Ensuring reliable and affordable access to modern energy services, especially, for poorer and deprived section of population is a basic requisite for sustainable development. Building on energy access intervention, implementing productive energy services can influence next stages of development through livelihood activities, micro-enterprises, lifestyle energy services, value added activities, survival irrigation, etc. Social benefits of access to healthcare, education and longer productive hours have equally important impact on sustainable development. In India, still 365 million people lack electricity access. While grid extension in India is on rise through various government programmes, specific rural problems of low energy demand, poor rural economy, inaccessible terrain, and low purchasing power can render grid extension costly and inefficient. Micro-grid electricity systems, with hybrid renewable energy resources, can be good alternatives for addressing above challenges. India enjoys high solar intensity, and the predominantly agrarian rural society has enough biomass resources. A solar-biomass hybrid electricity system can solve the problem of solar intermittency. Such a system is being implemented in a remote un-electrified village in Karnataka for electricity access, livelihoods and economic empowerment. In this paper, we report the feasibility and sustainability analysis of this hybrid system. The system consists 30 kW Solar PV and 20 kW biomass gasifier modules. Both energy demand and resource availability has been estimated keeping daily and seasonal variations in end uses, availability and productive hours. The techno-economic feasibility is assessed using HOMER software.

Further, opportunities for development of micro-enterprises and their expansion through a sustainable revenue model are explored. Key words: Electricity access; Hybrid electricity system; Rural energy; Rural livelihoods; Sustainable development; Micro-grids

Session 1.3.4: SDGs and Global South 1 **Urban challenges**

Chair: **Bejoy K Thomas**

Assessment of Sanitation Development in India- How is the country progressing towards sustainable development goal?

Ms. Debasree Bose,
Ph.D Research Scholar, JRF, Department of Economics, University of Calcutta
Prof. Arijita Dutta,
Professor, Department of Economics, University of Calcutta

ABSTRACT

Introduction: India disproportionately bears the burden of open defecation in spite of growing allocation of fund and several institutional efforts including Swachh Bharat Mission, which has created public rhetoric nationally as well as internationally. A large share of households in rural India still lack basic sanitation facilities and hence the members are forced to practice open defecation.

Objective: The study endeavours to examine the existing anomaly between ndust sanitation productivity and enhanced resource allocation in rural sanitation in India. The study attempts to develop an instrument to monitor the regional performances (state and district wise) across India.

Methodology: The paper applied data exploratory method that fetches out existence of spatial inequality and economic inequity across the nation. The extent of inequality and inequity are measured through appropriate measure of dispersions, including Gini index. Moreover, inconsistency between the social expenditure and sanitation output calls for efficiency analysis. To quantity the level of efficiency of the districts in translating social spending in to sanitation coverage and usage, non-parametric data envelopment technique (DEA) has been applied to identify best-in-class performers. Finally, the main thrust of the paper is to construct a regional sanitation performance index that premises on three dimensions of performance: efficiency, equity and equality.The paper utilizes a decentralized approach to investigate on existing inequity and inequality issues in sanitation access within and across regions of the country.

Findings: Efficiency analysis reveals huge potential of India to attain a far higher sanitation access and usage with the given flow of social spending. The study unfolds the fact that India is suffering from dual burden of spatial inequality and economic inequity. While the regional divergence in sanitation access escalates, households from lower income group increasingly construct toilets in comparison to their higher income counterpart even within the same region, originating a paradox in sanitation access in India.

Conclusion: The performance index has the potential to be served as an instrument to monitor and evaluate regional performances on sanitation and to inform investment decisions for targeted

improvement. The index can be utilized as “future proof” for evaluation of regional performance towards attainment of Sustainable Development Goal (SDG) in the field of sanitation. This index is a useful tool for policy watch as it clearly identifies the best and the worst performers by allowing fair comparison among them.

Keywords: Performance Index, Efficiency, Equity, Equality, SBM (Swachh Bharat Mission), SDG (Sustainable Development Goal).

JEL classification: Q01, Q59, R10

Technology Choice and Institutional Options in Urban Sanitation: Towards a protocol for town level sanitation planning

NC Narayanan

Indian Institute of Technology Bombay, Mumbai

ABSTRACT

Sanitation and wastewater management in India have suffered historical neglect, first, under colonial rule and later, within a post-colonial state. Though "WATSAN" infrastructure has received increased policy attention worldwide since the early 2000swith MDGs, and has been a target of big influx of budgetary allocations in India from 2005, the pace of change of sanitation on the ground remains excruciatingly slow. The dominant preference is for large-scale and centralized systems of sanitation and wastewater treatment to follow the tested and capital/resource intensive pathway adopted in the past by ndustrialized countries. A resulting thrust on making this into an infrastructure sector has deflected the attention away from the original public health concerns. Consultants have been especially pervasive in the design and operationalization of specific choices of mega infrastructure projects and associated managerial protocols. In developing countries these conditions are often not met due to lack of funds or lack of capacity and these systems end up becoming point sources of pollution. The JNNURM experience shows how these projects were skewed in favor of biggest cities with widespread neglect of the needs of small towns and marginalized groups.

Parallel to this, there has been a steady development in the alternative technologies for wastewater management that prioritize wastewater treatment close to where it is created. They follow the definition of sustainable sanitation system as one that is economically viable, socially acceptable, technically and institutionally appropriate, and protects the environment and natural resources and needs moving beyond traditional sanitation planning, However, translation of this idea at the micro level remains limited (especially in India) to philanthropic projects or cater to private sector requirements. An urgent need is to have a governance shift that will take sanitation planning incorporating heterodox options at a town level as espoused in the National Urban Sanitation policy, 2008. Even though the 74th Constitutional Amendment in India has empowered urban local bodies (ULB) with many functions including water and waste water management, in practice, important decisions like choice of technology and institutions are taken at higher levels. The paper is based on a review of the problems and presents two case studies from Maharashtra and Kerala that strived to develop a protocol for participatory sanitation planning at a town level.

Urban Sanitation, Co-Financing And The Myth Of Co-Production: The Case Of Indian Slums

Indranil De

Assistant Professor, Institute of Rural Management, Anand

ABSTRACT

Cost sharing arrangements are followed when there is lack of incentives to allocate resources on the part of both government and citizens. The fallout of insufficient incentives results in tardy improvement of services. This argument has been theoretically established and empirically tested for sanitation services in slums of India. This article draws from collective action literature and envisages co-production as collective action of the government and citizens with the former sharing the major burden of costs and initiatives. The contribution of citizens uplifts the production of public good to the optimal level. Cost-sharing in the absence of co-production curtails the accountability of service delivery. For empirical analysis, the National Sample Survey data on basic services of slums in India has been analysed. The results evince that improvement of sanitation is slower in slums where majority use improved public or community pay toilet as compared to slums where majority use improved public or community toilets without payment or own toilet. The other public health services are better but improvements are slower in slums where majority use pay toilet. Community participation and association for slum improvement play a significant role in these slums. Notification of slums impacts improvement of sanitation positively. Cost sharing through user charge, in the absence of institutional co-production, impedes improvement of basic services. Cost sharing, argued for accountable service delivery, should be coupled with development of trust and partnerships between different parties. The findings are useful for designing institutions for public service provision in developing countries.

Keywords: User Charge, Sanitation, Slums, Association, Collective Action, Decentralization

Waste Management in the Himalayan Hill City Shimla: Concerns for Ecology, Economics and Governance

Rakesh Kumar Sharma

Associate Professor, Department of Economics, RKMV Shimla, Himachal Pradesh

Vibhor Sood

Indo-German Environment Partnership Programme, The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Shimla, Himachal Pradesh

ABSTRACT

Waste management whether solid or liquid is a serious area of concern in rural as well as in urban areas. The local government is directly responsible for the planning and policy initiatives for the safe management. Municipal Solid Waste (MSW) management is one of the key challenges in recent times. In the mountainous regions, typical watershed conditions of tough terrain and environmental sensitivity make MSW a daunting task. Over the last few years, Shimla Municipal Corporation has gone through severe crises in waste management especially with respect to treatment of the waste and land filing. With the failure of PPP agreement on solid waste treatment, the waste had to be shifted to a distance place Chandigarh with the intervention of Green Tribunal. Under such a background, the paper tries to analyze the MSW of Shimla City in the light of some literature review on various dimensions of MSW so as to analyze the economics of waste management, environmental well being, and the related governance issues, especially in terms of public-private partnership (PPP) agreement and convergence of all related agencies. Certain policy implications also emerge for the benefit of better MSWM policy in similar tough mountainous urban centres.

Keywords: Environment, Governance, Himachal Pradesh, MSWM, Municipal Corporation, Solid Waste Management

Enabling Institutions to achieve efficient Waste Management

Shivani Wadehra

Ph.D. Scholar, TERI University

Arabinda Mishra

Senior Social Scientist, ICIMOD, Nepal

ABSTRACT

Why do households in Delhi not segregate their waste? Despite the Municipal Solid Waste Management Rules (MSWM), 2016 stating that landfills are to be used only inert, non-recyclable and non-biodegradable waste, landfills are being used as dumpsites for all kinds of waste. While it makes sense for households to segregate their waste as it will reduce emissions to air, ground water and lesser requirement of landfills but even then households do not segregate waste at source. The paper frames this problem of non-compliance as that of a **'social dilemma'**. The data comes from 880 households across 15 localities in Delhi (11 in the treatment group and 4 in the control group). Unit of randomization was localities while unit of analysis was the household. It analyzes the effect of information, norms and economic incentive on households' compliance to rules using field experiments. In order to be policy relevant, Resident Welfare Associations (RWAs), which are legally recognized entities within each locality, were roped in from the beginning of the study. Field observations showed that RWAs can play a pivotal role not only in effective dissemination of information regarding the MSWM Rules but also in shifting the burden of monitoring from the Urban Local Bodies (ULB) to the RWAs. It was also found that changes in the present collection systems and improvement of infrastructure available at the locality level are necessary to ensure compliance to the rules.

Keywords: Field Experiment, Segregation at source, waste management

Urban Food System Transitions and Social-Ecological Resilience in Kerala

Anita Pinheiro

ABSTRACT

Urban systems heavily depend on the external system for input supply and waste expulsion and food has reduced to be a mere commodity in an urban setting. Urban food production enhances sustainability and resilience to shocks in a social-ecological-technical network of urban system. To address the vulnerabilities associated with food deficit economy, Kerala is in a transition towards sustainable food systems. Looking from sustainability transitions theory, urban gardens emerging in Kerala represent a socio-technical niche that are spaces where innovative social practices and technologies are continuously developed, modified, and adopted. Strategies based on memories of past experiences influence the choices of new technologies and practices and also enhance the adaptive capacity of the system. This in turn influences the relations between its users and the ecosystem and shape social-ecological resilience. Taking the case of urban gardening in Thiruvananthapuram Corporation, this paper looks into how mainstream as well as societal actors function within the emerging niche and how they shape and accelerate the transition to sustainable urban food systems and socio-ecological resilience. The study has found that urban gardening in Kerala narrates a different story of food system transitions which emphasis the significance of bringing mainstream technology and policy level changes along with social practices to bring about long-term changes towards sustainability. The case of urban gardening in Kerala underlines the inevitability of urban food system transitions as a key towards sustainable urban environment improvement and social and ecological resilience. Urban gardening also enhances conservation of local and traditional agri-biodiversity, social cohesion and urban environment improvement by managing household waste at source and thereby eliminating waste export.

Keywords: Sustainability Transitions, Urban Food Production, Social-Ecological Resilience, Adaptive Capacity, Kerala

16:00–16:30

Photo Exhibition:

The City and the Farms- agriculture in periurban Bengaluru

"Experience the nature bliss", exhorts a huge hoarding put up against the idyllic backdrop of verdant farmlands and grazing cattle in Mudenahalli village, off Kanakapura road. Umpteen such boards advertising gated communities now dot the rural peripheries of Bangalore: the epicentre of India's IT boom and its third most populous city that is home to nearly 10 million inhabitants. Fertile agricultural land turning into industrial, residential, infrastructural and commercial construction, shrinking ecological commons including *kavals* (grazing lands) and *gundathopes* (wooded groves), polluted water resources: the havoc wreaked by unbridled urban expansion over the last two decades goes on unchecked. Drastic transitions also extend to the economic, social and cultural fabric of communities inhabiting the rural-urban interface.

Interestingly, the impacts of urbanisation are not uniform and are felt differently by famers as a function of their socio-spatial situations. While farming in some parts of the rural-urban continuum have benefited from year round availability of sewage water from the city, in some areas farming ceased to be a viable livelihood option due to severe water stress. This photo-exhibition titled "*The city and the farms"* is an attempt to capture the multiple and often contradictory narratives around the unruly urban sprawl engulfing agricultural peripheries of Bangalore.

The three-day photo-exhibition, organized by Azim Premji University is part of a long term multi-institutional research project titled '*The Rural-Urban Interface of Bangalore: A Space of Transitions in Agriculture, Economics, and Society'* sponsored by Department of Biotechnology, Government of India.

The exhibition will showcase diverse facets of agricultural changes in peri-urban Bangalore under the following themes

1. Myriad manifestations of urbanisation
2. Croplands, cattle and commons: Caught in the urban quagmire
3. Beacons of hope: Resilient spaces, perseverant people

Around 20 stories with 50 photographs spanning the above mentioned themes will be displayed in the exhibition. These photo-stories are contributed by researchers and practitioners from India and abroad who have been looking into the dynamics and consequences of agricultural transitions in peri-urban Bangalore through diverse disciplinary lenses and seeking to address some of the challenges associated with peri-urban agrarian livelihood sustainability.

Organising Team: Seema Purushothaman, Dhanya Bhaskar, Sheetal Patil, Raghvendra Vanjari and Meghana Eswar, School of Development, Azim Premji University

DAY 2

NOVEMBER 09, 2017

Parallel Session I

(11:00 – 13:00)

Parallel Panel discussions

09:00–10:30

Environment, Climate Change, Biodiversity and Local Governance

Moderator: **Padma Mahanty,** Director, Directorate of Environment and Climate Change, Government of Kerala

Panellists:

1. **Dineshan Cheruvat**, Secretary Kerala State Biodiversity Board – Biodiversity Management Committees by Panchayats
2. **Unnikrishnan Divakaran**, Senior Policy Adviser, GIZ – Climate Financing Strategy vis a vis Development Financing at district level
3. **Beena Vijayan**, President, Meenangadi Gram Panchayat - Towards a Carbon Neutral Panchayat
4. **Asainar**, Vice President, Meenangadi Gram Panchayat - Towards a Carbon Neutral Panchayat
5. **J B Rajan**, KILA – Building capacities of local governments on environment, climate change and biodiversity

Respondents:

1. **S. Gopikrishna Warrier**, Secretary, Forum of Environment Journalists in India (FEJI) and Member, IUCN Commission on Education and Communication 2017-2020

2. **T.P. Kunhikannan**, Kerala Sasthra Sahithya Parishad

Marginal Ecologies: examining Sustainability on the peripheries of Nature and Society

Moderator: **Asmita Kabra**

Speakers: **Budhaditya Das**, **Arnab Mukherji**, **Sonam Mahalwal**, **Rohit Negi** and **Shaina Sehgal**

Panel Members:

Moderator:

1. Asmita Kabra, Professor and Dean, School of Human Ecology, Ambedkar University Delhi (AUD) ()

Speakers

2. Arnab Mukherji, Associate Professor and Director, Centre for Public Policy, Indian Institute of Management, Bangalore
3. Rohit Negi, Assistant Professor, School of Human Ecology, AUD
4. Budhaditya Das, Visiting Fellow, School of Human Ecology, AUD
5. Shaina Sehgal, Doctoral Candidate, School of Human Ecology, AUD
6. Sonam Mahalwal, Doctoral Candidate, School of Human Ecology, AUD

Abstract

Sustainability concerns have found their way into the realm of public policy, media and popular culture in recent times and catalysed debates about consumption, conservation and the future of human and non-human life on earth. Much of the conversation however seems to revolve around flagship species such as tigers and rhinoceros, spaces explicitly devoted to conservation such as national parks and wildlife sanctuaries, and iconic and threatened biodiversity hotspots. Without diminishing the importance of any of these discussions, this panel seeks to bring together research that focuses on social-ecological systems marginalised *within* environmental discourses. Marginality is best understood relationally, as culturally produced asymmetries of power and knowledge, rather than as effects of geography and ecology. We consider landscapes that do not adhere to popular conceptions of 'nature' and receive insufficient attention in environmental policy and governance: farm-forest frontiers, grasslands and drylands. Rural producers who occupy niches within these ecosystems—smallholder cultivators, forest dwellers and pastoralists—find themselves on the margins of the local economy, law and society. Within the standard environmental narrative, they are often uncritically represented as victims, villains or heroes; variously held responsible for protecting or degrading their local environments. The panel invites empirically grounded research that takes cognisance of the role

of human agency, social dynamics, structures of power and local histories in shaping ecological and economic outcomes. We also welcome theoretical interventions that reflect dialogue between the social and ecological sciences, and contribute to a better understanding of the dynamism, stochasticity, heterogeneity and non-linearity that exist in human-environment interactions. Papers in the panel will be in conversation with each other via a human ecology framework, a multidisciplinary endeavour that eschews abstraction of nature from society (and vice versa) and recognises that environmental issues are simultaneously technical, social and political in nature.

Paper Abstracts

Paper I: *Conservation-displacement and land-based rehabilitation: Assessing the impact of alternate land distribution schemes on livelihood trajectories*

Asmita Kabra (School of Human Ecology, AUD) and Arnab Mukherji (Centre for Public Policy, IIM Bangalore)

Conservation-displacement is believed to be a major driver of impoverishment among natural resource dependent households living on the farm-forest frontiers in the Global South. Land-based livelihood restoration which retains spatial integrity of previous settlements is considered least disruptive, since it enables households to retain some links with previous livelihood patterns and also enables them to continue to deploy existing social capital in mutually beneficial ways. However, little research is available to indicate the impact of *variations in land quality* within and across resettled villages on future livelihood restoration. This paper examines post-resettlement livelihood outcomes for Adivasi villages displaced from a wildlife sanctuary in central India. These villages were relocated adjacent to the sanctuary with a land-based resettlement package where land quality at the relocation site was variable.

During 1999-2001, more than 5000 Sahariya Adivasi from around 1600 households in 24 villages were displaced from the Kuno wildlife sanctuary in north Madhya Pradesh and resettled on the periphery of the sanctuary in the same district. The rehabilitation package included a 2-hectare plot of land for each displaced household. Village relocation took place in two phases. For the villages moved out in Phase 1, land parcels were allocated to each household through a simple lottery, where the village land was divided into numbered plots of 2 hectares each and all household heads picked a number randomly. Depending on chance, the household received a land plot of good or bad quality. In Phase 2, the land-distribution lottery took into account variations in land quality. The total farm land for every village was divided into two parcels of ‘good’ and ‘poor’ quality respectively and each household picked two numbers, one belonging to

each parcel. Thus, each household received land in two segments and was assured of at least a small plot of good quality farm land. The two lotteries experiment is a natural experiment that allows us to study how household income and risk-management abilities vary in two different systems which share most properties but are different in terms of a key variable that affects livelihood outcomes. The findings from the study have important implications for public policy relating to resettlement of people displaced due to infrastructure or conservation projects.

Paper II: *Opportunities, Marginalities and Risk: Examining Urban Change in the Himalayas*

Rohit Negi, School of Human Ecology, AUD

This paper is interested in the forms of social ecologies that emerge alongside the growth of urban centres in the Himalayas. Development initiatives and expanded reproduction of rural livelihoods have seen increasing number of households in the Western Himalayas—especially in the state of Himachal Pradesh—route available surplus to nearby urban areas in search of speculative footholds. Yet, the region continues to be viewed as essentially rural, owing to its historical-geographical specificities. The paper examines the rapidly shifting spatiality of the region by investigating the contours of urban change in the town of Banjar in Kullu District of HP. It shows how social mobility is spatialised in the form of diverse built environments that are overlaid on differentiated locations to co-produce a dynamic landscape of opportunities, marginalities and environmental risk. The paper draws on over a year of collaborative ethnographic fieldwork in the town.

Paper III: *Agrarian Change and Upland Environments in Central India: Implications for Ecosystem Sustainability and Governance*

Budhaditya Das, Visiting Fellow, School of Human Ecology, AUD

Agricultural policies and management of tropical forest ecosystems have proceeded along distinct axes in central India, mirroring the farm-forest binaries that exist in policy thinking and the political imagination. Evidence suggests that upland landscapes of central India are hybrid 'agrarian environments' (Agrawal & Sivaramakrishnan, 2000), where forest ecosystems have been historically managed by the state and local communities for in-situ provisioning services, including timber, food and non-timber forest products. This paper examines forest management policies and changing upland livelihoods in the Satpuda hills of central India, in a 'branded forest' ecosystem where commercial forestry for Tectona grandis (teak) extraction has been the dominant land use for nearly 150 years. The research is based upon ethnographic fieldwork carried out by the author in four forest villages in Harda district, Madhya Pradesh as part of a doctoral dissertation. It is argued that since the 1990s, forest villages in the Satpuda hills have witnessed management intensification (Jackson et al, 2009), with low-input, subsistence agriculture giving way to high-input cultivation of crops like wheat and soybean. I examine the social and political drivers of commercialisation of agriculture in the uplands (Bonnin & Turner, 2012; Marquardt, Khatri & Pain, 2016; Mundoli, Joseph & Setty, 2016), including the role of the community forest management programme of the Madhya Pradesh Forest Department. My research shows that agrarian change in the uplands is characterised by increasing integration with capitalist circuits of exchange, with significant contributions made by roads, developing commodity markets and lowland labour opportunities. With the declining importance of forestry labour and forest products in local livelihoods and increasing demand for agricultural inputs, provisioning services of the forest ecosystem, contingent on human wants (Boyd & Banzhaf, 2006), have been transformed as well. The paper will speculate upon the implications of such emergent transformations for human well-being, ecosystem sustainability and governance in the Satpuda uplands.

Paper IV: *Interlinked and diversified strategies of a Trans-Himalayan village at the socioeconomic, political and ecological margins*

Shaina Sehgal, Doctoral Candidate, School of Human Ecology, AUD

The principal challenge in marginal environments is successfully adapting to and appropriating its resources and conditions. Understanding the range of livelihood strategies and cultural practices by people in marginal environments is becoming increasingly critical to address the social and environmental concerns of the present. In this paper, I share the interlinked and diversified human-environment interaction in a high altitude cold desert region of the Indian trans-Himalayas. The paper aims to provide an elaborate and contextualised understanding of human-environment interactions relating to livelihood and way of life in the Pin River Valley of Spiti. I then argue that marginality itself is a complex construct of social, economic, ecological and political factors.

This paper draws on two seasons of ethnographic fieldwork at the largest village in the Pin Valley of Spiti in 2011-12. The methods used include interview surveys on livelihood, lifestyles, expenditures, natural resource use and livestock for 43% of households; participant observation, and multiple focused group discussions and key person interviews. The study describes five key spheres of activity in the village, relating to cultivation, animal husbandry, environmental extraction, employment and energy that formed an intricate interdependent system.

Paper V: *Diversification and Dependence: Livelihoods Study of an Adivasi Cohort in Dryland Central India*

Sonam Mahalwal, Doctoral Candidate, School of Human Ecology, AUD

Rural livelihoods in drylands are precarious in nature. Socio-ecological constraints prompt poor households to engage in multiple earning activities in order to spread risks (Mortimore, 1994; Scoones, 1996; Scoones, 1992). With an assorted livelihood basket that includes farming, wage work and dependence upon forests and common property resources, households in semi-arid landscapes are occupied in a complex process of assessing risks and opportunities. Livelihood portfolios, far from being of rigid nature, get modified in response to ecological as well as household specific socio-economic factors (Ellis, 1998, 2008). A defining feature of the contemporary rural economy has been a trend towards non-farm livelihood opportunities (Ellis, 2008; IDFC, 2015; Rigg, 2006).

This paper examines the livelihood portfolios and trends towards diversification in a Sahariya Adivasi village in the Sheopur district of Madhya Pradesh. One of the 75 Particularly Vulnerable Tribal Groups of India (MoTA, 2017), Sahariya are known for political marginalisation, poverty and lack of sustainable livelihood opportunities. The paper is based on a repeat survey of 44

Adivasi households in 2015 comparing their income and livelihood portfolios that year with results from a similar survey in 2004. The study explores the changes in household livelihood portfolio over the period. What have been the changes in the portfolio? Whether the households have diversified and if the changes are uniform across the income spectrum? – are the key research questions that have guided this study.

The comparison between livelihood portfolios between 2004 and 2015 shows processes towards livelihoods diversification, rather than specialisation. The Herfindahl Hirschman Index (HHI) suggests that households were more diversified in 2015 as compared to 2004. However the HHI across income quartiles for the two years brings out the nuances of diversification across the income spectrum. Lastly, the study links the diversification trends with the changes in the real per capita income for the village.

Parallel Session II

(14:00 – 16:00)

Session 2.2.1: **Perceptions and Behavioural responses**

Chair: **L Venkatachalam**

What affects the willingness to pay for arsenic safe drinking water? A case study in rural West Bengal

Monalisa Ghosh, Shyamasree Dasgupta[3], Joyashree Roya and Jayanta Talukdara

Global Change Programme, Jadavpur University

ABSTRACT

Access to clean water is one of the major Sustainable Development Goals (Goal no. 6). Despite several attempts from public sectors, one of the nested issues that remained mostly unresolved is access to safe drinking water in the arsenic contaminated areas in India. This paper is based on the findings of a bigger research project (funded by IUSSTF), the objective of which is to ensure commercialization of a community-scale arsenic remediation technology ECAR (Electro Chemical Arsenic Remediation) and to understand challenges to ensure sustainable access to arsenic safe drinking water for people in the command area of the project. The project location is in rural West Bengal, where almost 36% of the population is exposed to the risk of arsenic contaminated ground water and are living with experiences of short time technology deployment without any long term social embedding and lack to robustness. Under this project, while ECAR was tested for robustness at the field site, simultaneously a primary survey was carried out on a stratified random sample of 1003 households. The study reveals that existing drinking water supply system in the study area suffers from irregularity and lack of quality assurance. Findings suggest that people are willing to pay for reliable and safe drinking water services. Average monthly per capita expenditure, educational attainment, knowledge about arsenic contamination and distance from the plant location significantly affected the maximum magnitude of willingness to pay. Families residing closer to the plant find an association with it; they often visit the location, ask questions about the technology and tend to enjoy being a stakeholder in the process. This is translated in a higher willing to pay as compared to those residing further.

Keywords: Arsenic remediation; Social embedding; ECAR; Safe drinking water; Willingness to pay; Logistic regression.

[3] School of Humanities and Social Sciences, Indian Institute of Technology Mandi. Himachal

Economic Valuation of a Recreation Model: Challenges and Way Forward

Prajna Paramita Mishra

Assistant Professor, School of Economics, University of Hyderabad

ABSTRACT

Worldwide, a number of studies have used environmental valuation methods, such as the Travel cost Method (TCM) and Contingent Valuation Method (CVM), to examine the effects of a change in water quality on demand for recreation. Many of the TCM studies, however, estimate benefits from recreation considering only the current level of water quality. This is mainly because the single site TCM does not allow for shifts in the demand curve from an improvement in water quality. This study attempted to combine the stated preference and revealed preference approach to get an understanding of how welfare changes with quality changes. The main benefit is that while they are revealed preference based, they are also able to present less biased and more precise welfare measures of quality changes. This combined approach allows us to widen and evaluate management policies that are yet to be implemented.

The main objective of this paper is to discuss the methodological issues related to valuation studies in developing countries in general and India in particular. It presents the challenges related to sampling, avidity bias (people who visit an area where the sample is being selected more often, are more likely to be selected), over-dispersion (variance is greater than the mean, a few visitors make many trips and most visitors make only a few) truncation (all members must have taken one trip) and endogenous stratification (over sampling most frequent visitors). It discusses the solutions that exist in the valuation literature to deal with these challenges.This study offers a methodological improvement by estimating off-site demand in addition to demand for recreation by on-site users. The analysis makes the importance of including off-side respondents clear. Without including off-site respondents, we would incorrectly estimate consumer surplus as well as revenue possibilities.

Perception of Stakeholders on the maintenance of Irrigation Tanks in Sivagangai district of Tamil Nadu

Prof. V. Ragupathy

Department of Political Science and Development Administration, Gandhigram Rural Institute-Deemed University, Gandhigram, Tamil Nadu

Dr.G.Uma

Assistant Professor in the School of Gender and Development Studies, Indira Gandhi National Open University, New Delhi

ABSTRACT

73rd and 74th Constitutional Amendment Acts (CAA) pave the way for the establishment of constitutional structures at the grassroots as local self -governments. Gram panchayat plays a critical role in the lives and livelihoods of the people living in the rural areas among all three tier structures established as per 73rd CAA in the rural areas. The gram panchayats have not only assigned role to play, it may assume various roles for the efficient governance mechanism as it is close to the people and it directly involves itself in implementing various development programmes. It is mandatory for the gram panchayat to conduct Gram Sabha meetings regularly to interact with the people to maintain transparency and accountability in the governance mechanisms. One such significant assumed role is to identify, revive, restore and sustain Common Property Resources (CPRs). There are various types of CPRs available in the areas of gram panchayats. The revenue department of the State government keeps the records of CPRs to maintain the same. Gram Panchayats need to coordinate with the revenue department to identify CPRs. Rural districts in Tamil Nadu, especially Sivagangai district has notable number of irrigation tanks. Historically, the irrigation tanks are maintained by the local committees formed by the villagers. After the formation of constitutional panchayats, there is a need to study the role of gram panchayats and traditional structures in identifying, restoring, reviving and maintaining CPRs. With this background, the present study raises the following question. How do people perceive the assurance provided to them by the local community organizations and panchayats in the management of irrigation tanks? The study was conducted among stakeholders of CPRs in two villages of Sivagangai district.

Keywords: 73rd Constitutional Amendment Acts, Local Community Organizations, Common Property Resources and Gram Panchayats

Trust and Life Satisfaction: Evidence from India

Maya. K

Ph.D Research Scholar, Department of Econometrics, University of Madras

Chennai, Tamil Nadu

ABSTRACT

Trust is directly and strongly linked to subjective wellbeing, in addition to supporting many other economic and social activities that also affect well-being directly, it is important to consider what contributes to building and maintaining trust. Survey data and experiments alike suggest that trust is built on a base of shared positive experience, and is nurtured by continued connections. This paper presents evidence linking trust and life satisfaction based primarily on data from the sixth wave of World Value Survey in Indian context. It answers the question of whether trustful people are happier than suspicious people. We are taking life satisfaction as a proxy for subjective wellbeing. How trust related to life satisfaction in India and also finds out the factors affecting different measures of trust. Literature show there is a large and significant linkage to both household income and various measures of trust; therefore they can estimate income-equivalent compensating differentials for different types of trust. This paper also tries to estimate the income equivalent compensating differentials to various measures of trust. Measures of trust studied include general trust, trust in family, trust in neighbours, trust in friends and relatives, trust in strangers, trust in people from other religion and nation, trust in police and trust in Government. Analysis is expected to do with the help of ordered probit econometric model. This is because our dependent variable is ordinal one. The main hypothesis, that there a positive relationship between the level of trust and subjective life satisfaction. This paper will support much more study of how trust can be built and maintained, or where it has been damaged and our tentative analysis of the factors supporting different types of trust will suggest where we have to pay more attention for creating time and space for social connections to flower.

Keywords: Subjective well-being. Life satisfaction. General Trust. WVS14. Social Capital. Log Income.

Condensing the Integral Sustainability of Individual Economic Agents, Branches and Economies into the Sustainability Index *NAX*

Claudia Lemke, Rita Bergmann and Dr. Dennis A. Ostwald

WifOR Berlin, Joseph-Haydn-Strasse 1, 10557 Berlin, Germany

ABSTRACT

This paper develops an evidence-based sustainability reporting with the final goal of computing a sustainability index called the *NAX* (from the German "*NAchhaltigkeitsindeX*"). The special feature of this index is the ability to be applied to any kind of aggregation level, i.e. individual economic agents, branches and total economies of different geographical regions. The index is based on a set of sustainability key indicators, covering the economic, environ-mental and social dimension. The comparability among the aggregation levels is obtained by firstly transforming microeconomic data into macroeconomic categories and secondly by stand-ardising to the size of the object of investigation in terms of gross value added or number of employees. The goal of the *NAX* is to depict the actual sustainability performance of economic units. Hence, not growth rates but the respective time series data is retrieved for scaling, ac-counting for the indicators' diverse units. Weighting of the indicators is accomplished by a principal component analysis and subsequently, aggregation of the indicators is performed by utilising the geometric mean to reward good performance and punish bad performance. Calcu-lation results for an exemplary individual economic agent, selected branches of the German economy and the total German economy are shown. Next steps of this work in progress involve the inclusion of further sustainability key indicators, testing sensitivities by varying the multi-variate statistical analysis as well as the scaling method and using the calculation result for an evidence-based sustainability policy.

Keywords: sustainability reporting; sustainability monitoring; sustainability indices; compo-site indicators; multivariate analysis; principal component analysis.

Session 2.2.2: **Impacts of Climate Change and adaptation by farmers 2**

Chair: **Indira Devi**

Impact of Drought on Agriculture in Chittoor District of Andhra Pradesh

L.Umamaheswari, P. Raghavendra, K.C. Ayyoob and N. Swaminathan

Department of Agricultural Economics and Extension, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal – 609 603, U.T. of Puducherry, India

ABSTRACT

Droughts asa recurring feature in India are adversely affecting agriculture. The present study was undertaken in the chronically drought affected district, Chittoor of Andhra Pradesh. The study examined the probability of drought (IMD classification) using 30 years (1985- 2014) monthly rainfall data. Mann Kendall (MK) trend test (Hirsch *et al*, 1982) was used to study the trend in annual, seasonal and monthly rainfall series. It revealed a statistically significant declining trend in annual rainfall, positive trend in South-west monsoon and significant negative trend in North-east monsoon.

Out of 66 mandals in Chittoor district, Santhipuram an irrigated mandal and B. Kothakota a rain fed mandal were selected. Primary data on crop production was collected for drought year (2014-15) and normal year (2011-12) from a survey of 120 farm households to discern the impact of drought and identify the farmer's drought coping measures.

There is decline in Gross Cropped Area by 15.05 % in Santhipuram and 21.87 % in B. Kothakota over normal year. Yields declined by 8.39 % to 31.20 % for various crops except tomato in Santhipuram which registered a 9.29 % increase against normal year. Returns per rupee investment were high for groundnut, tomato and red gram during drought; and ragi and horse gram in normal year. Major coping strategy of farmers was disposal of inventories in Santhipuram and migration in B. Kothakota. Regarding government relief works, all farmers availed inputs, 90 % participated in MGNREGA and 23 % attended demonstrations. Training in water saving technologies, timely credit and early drought warning were strategies suggested by farmers for managing drought.

Drought affects the lives of farmers with their continuous trapping in a vicious cycle of low income and low productivity. An effective anchorage of farmers in drought prone areas with agriculture is a dire necessity and an imperative priority. The study calls for designing appropriate strategy towards capacity building of farmers and empowering farming towards production and higher income.

Keywords: Mann-Kendall rainfall analysis, probability of drought, impact, coping measures

Climate Variability and Agriculture Vulnerability for Vidarbha region of Maharashtra, India

Deepika Swami and Devanathan Parthasarathy

Interdisciplinary Program in Climate Studies, IIT Bombay, India

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.

Keywords: Climate Variability, Agriculture yield, Agriculture Labor, Time-series analysis, Multivariate regression, District level modeling

Propagating Salt Tolerant Rice: Possible Adaptation Strategy Against Climate Change in Coastal West Bengal

Saptarsi Chakraborty

Research Scholar, Department of Economics & Politics, Visva-Bharati, Santiniketan

Dr. Santadas Ghosh

Associate Professor, Department of Economics & Politics, Visva-Bharati, Santiniketan

ABSTRACT

This study sheds lights on the need for propagating local salt tolerant rice varieties in Sundarban delta region in India. Under Climate Change predictions, the area is susceptible to increased frequency of storms and cyclones in the Bay of Bengal and resulting saline water ingression in agricultural land. The region's major agricultural crop is monsoon paddy. Cyclone Aila in 2009 had devastated the monsoon rice submerging paddy fields with saline water and amply demonstrated its vulnerability in terms of local food security. The experience had induced the local farmers to bring back the local salt tolerant folk rice varieties which were almost driven out by HYVs in recent past. The study is based on a sample 157 of farming households who produced at least one folk rice variety in one of its plots in monsoon 2015.

The study finds that in spite of significantly low productivity, farmers still regard the folk rice varieties for their nutritional value, greater salt tolerance property and recognize their role for food security. It was found that some of them are profitable in spite of their low productivity as they can fetch price premium through their scent and texture. It was found that many of such varieties exist in the remote delta region and there is a renewed interest in them after cyclone Aila. It is found that the elderly farmers with better education are more inclined to produce these varieties. However, larger number of plot holding induces a farmer to opt for a larger mix of varieties in terms of HYVs.

Keywords: *Sundarban, Climate Change, Cyclone Aila, Food security, Folk Rice, Farming households*

Impact of Climate Change and Variability on Rice Yield in Assam

Asfika Begum

Assistant Professor, Department of Economics, DKD College, Dergaon, Assam

Ratul Mahanta

Associate Professor, Department of Economics, Gauhati University, Assam

ABSTRACT

Assam, one of the north-eastern states of India is experienced with climate change and variability. The paper analyses the effect of climate variables on rice yield in Assam. To carry out the effect, 30 years (1981-2010) data on yield of three types of rice-winter, summer and autumn has been regressed on growing season climate variables as well as HYV area for each type of rice. The quadratic climate variables are also included to capture the non linear effects of climate on crop yields. The study finds that maximum temperature has significant negative effect on winter rice during ripening and harvesting seasons while minimum temperature has significant negative effect during growing period on winter rice. In case of summer rice, minimum temperature during sowing period has positive significant effect while maximum temperature is not showing any significant effect. For autumn rice, both maximum and minimum temperature during growing period is harmful. Both summer rice and autumn rice is significantly harmed by April-May rainfall while winter rice shows no any effect by rainfall.

Climate Change Impacts and Adaptation in Sorghum Production in Tamil Nadu

V. Saravanakumar

ABSTRACT

Recent research indicates that increase in temperature and rainfall variability in India would increase the risk of drought and productivity loss in sorghum crop. This study estimates the impact of climate change on yield sensitivity of sorghum in Tamil Nadu and documents the adaptation strategies practiced at farm level. Here, we first use panel regression with fixed effects model to estimate the marginal impacts of changes in climate variables on yield responses using panel data from 1971 to 2010. These estimates are then used to examine yield sensitivities in the future based on projected climate variables from the Regional Climate Model (RegCM4). At last, we use primary survey to document adaptation strategies at farm level during the year 2015-16. Results show a quadratic relationship between climate variables and yield i.e. as temperature and rainfall increase, crop yield initially increases up to a threshold level, and then decreases. RegCM4 model climate predictions showed that increase in temperature and rainfall anomalies would continue in the future, which could result in a 9 percent loss in sorghum yield. Adaptation strategies such as soil and water conservation measures, mixed crops and adoption of drought tolerant varieties were widely practiced at farm level. This call for research investments and extension efforts are to be intensified to adopt above strategies to combat the vagaries of climate.

Keywords: Climate change, Sorghum, Productivity changes, Adaptation, Regional Climate Model, Tamil Nadu

JEL Code: Q54, Q51, Q15, Q18

Session 2.2.3: **Conservation**

Chair: **Jayshree Vencatesan**

Media Reporting On the Protected Areas in Maharashtra

A thematic analysis

Trupthi Narayan

Independent researcher interested in issues of wildlife conservation and indigenous peoples

Pankaj Sekhsaria

Senior Project Scientist, DST-Centre for Policy Research, HUSS, IIT-Delhi

ABSTRACT

This paper is an account and an analysis of media reporting of issues related to wildlife conservation and protected areas in the state of Maharashtra, as reported in the English media between 1994 and 2015. The analysis is based on a set of 269 articles that were first reported in the media and then edited for publication in the *Protected Area Update*, a newsletter on wildlife and conservation that has been published every two months for the last two decades by the environmental action group, Kalpavriksh.

The analysis attempts to draw out significant themes that the media deems important in matters of wildlife conservation in general and sanctuaries and national parks (the protected areas) in particular. The analysis reveals interesting insights into reporting by the media – some protected areas like the Sanjay Gandhi National Park in Mumbai and the Tadoba Andhari Tiger Reserve in Vidarbha receive disproportionately large media space, while a third of the protected areas in the state have not been reported on at all. One also sees prominent themes emerging – with issues of land, displacement of people, developmental projects and tourism attracting more attention as compared to scientific research outside tiger reserves and less charismatic species of fauna.

We argue that media content analysis is a useful tool because the media is the first interface for the general public on issues of wildlife conservation and plays an important role in shaping public opinion. Understanding the reportage can provide insights into the biases of the media at the same time as indicating themes and issues that are perceived to be important both to the public and the media.

To our knowledge, this is the first such state-wide study of media reporting of wildlife conservation issues and we believe that this could be very important in understanding and shaping the conservation discourse in the country as also the political economy of the media.

Keywords: wildlife, protected areas, national parks, wildlife sanctuaries, conservation, media, thematic analysis, India

Dual Control of Forests in a Federal Structure

Indrani Roy Chowdhury

Associate Professor, Jawaharlal Nehru University, New Delhi, India

ABSTRACT

In the post liberalization period, the Indian economy is exhibiting a voracious appetite for land leading to rampant land acquisition and a drastic change in land use pattern and diversion of forest land for various developmental purposes in many of the Indian states. A paradoxical situation arises where the forest rich states are constrained to promote development plans (and are therefore struggling with the opportunity cost of land being locked as forest). This scenario is more interesting in the context of environmental resources in a federal structure with multiple caretakers - the Union Government and the respective state governments.

The channels that I am interested in runs through a potential conflict between the central government, that is more interested in protecting the environment, and state governments, that are more interested in mineral extraction, industrialization, employment generation.

As is usual, the central question is the conflict between efficiency and rent extraction. With the state governments having private information about its type, the central government would need to incur informational rents in extracting this information. This in turn would distort the choice of the center, as it would try to reduce such informational rents. We solve for the principal agent problem in this context under various scenarios, where the actions available to the two actors, the central and the state government would vary from case to case.

The paper develops a simple analytical framework that formalizes the tradeoff between centralized and decentralized control of forest. To focus on the central trade-off between incentives and the environment, we consider the stylized polar versions of either system. We derive the optimal values of the share of the gains of the two classes in the society, subsidy shared by the two classes and the degradation of the forest for the creation of public goods under both the first best situation (where the social planner's maximizes the welfare in the absence of elite capture) under both the first best situation and under the state control of forest. We examine the comparative statics result under the state control for an increase in elite capture. We find that an increase in elite capture in the state bureaucracy leads to further degradation of forest. 2

Moreover our analysis demonstrate that forest degradation under first best is always less than that under the state control. Further we show that the gains from the public goods creation by degrading forest is appropriated more by the rich as compared to the poor under both the first best situation or under the state control of the forest, irrespective of the presence of elite capture or not. The poorer are more marginalized and are in the worst situation under state control due to

the presence of elite capture. Moreover under the state control of forest the richer class out compete the poor in appropriating the subsidy. The subsidy share of the rich is lesser under the first best as compared to the state control (Sl >0, Ss=0).

Keywords: Principal Agent Framework, Federal structure, Elite capture,, Forest, degradation.

Eco-tourism under Different Institutional Framework- Comparison of Turtle Nesting Sites in Goa and Maharashtra.

Sulochana Pednekar

Research Scholar, Goa University

ABSTRACT

Sea turtle population faces increasing threats in India due to multiple reasons. We studied two turtle nesting conservation sites in Goa and Velas, Maharashtra to understand the dynamics of tourism and turtle conservation in these areas. The turtle nesting period which is from October to March coincides with the tourist season in Goa and Maharashtra. These states provide two different models of turtle conservation. On the one hand in Goa, there is a conflict of interest between tourism and conservation goals. And on the other hand in Velas Maharashtra, tourism activities with collective action are used as a strategy to promote turtle conservation.

Our study finds that tourism and turtle conservation need not be in conflict with each other if there is community level collective action. The Velas model of turtle conservation and nature-based tourism has possibilities of replication to other nesting sites and may have solutions to the sustainability of turtle conservation in this country.

Keywords: Turtle conservation, Community involvement, Eco-Tourism, Home stay, Sustainable Development.

Conservation Vs Livelihood: Stakeholder Preferences over the Improved Conservation of Loktak Lake in Manipur, India

Binilkumar Amarayil Sreeraman

National Institute of Industrial Engineering (NITIE), Mumbai, India

Konthoujam Gyanendra Singh

National Institute of Technology (NIT), Mizoram, India

ABSTRACT

Societies across the world depend on natural resources for the sustenance of their livelihoods. They depend on these resources due to the diverse goods and services provided by them, which have got immense social, cultural and above all economic value. However, indiscriminate use of these precious resources, lead to degradation or even destruction of the same. Loktak Lake in India, is one of the examples for such case. Loktak Lake is considered as the lifeline of the State of Manipur due to its importance in the socioeconomic and cultural life of the people. It is the largest natural freshwater lake in the north-eastern region of India and plays an important role in the ecological and economic security of the region. Keibul Lamjao National Park, the World's only floating national park, is a part of Loktak Lake, which is the natural habitat of the endangered Manipur brow antlered deer '*Sangai*'. The Lake is also an important Bird Area and Ramsar site, considered as a potential breeding site for waterfowl. Moreover, the Lake attracts numerous migratory birds during winter season. A large population living in and around Loktak Lake depends purely upon the lake resources for their sustenance. They largely depend on the lake for fish, cultivation, water, etc. Their social, cultural and economic life, purely depend on the lake. The Lake is currently threatened with several conservation issues leading to its degradation, like, siltation, eutrophication, pollution, and excessive proliferation of Phumdis, etc. Loktak Development Authority (LDA) undertakes conservation and management of the Lake including removing Phumdis from the lake and controlling the economic activities. But these conservation activities are conflicting with the livelihood options of the local communities in the area. In the present study, we employ discrete choice experiments to identify the preferences of the local stakeholders over the improved conservation of the wetlands. Random parameter logit model with socioeconomic interactions is estimated to identify the preference heterogeneity of the local stakeholders over the improvement of the Lake. The results reveal that there exists heterogeneity in significant scale across stakeholder preferences. The conflict of conservation and livelihood is evidenced from the study.

Session 2.2.4: **Economic-ecological systems in Kerala**

Chair: **Sunny George**

Conservancies and Conservation: Women Forest Protection Group in the Western Ghats of Kerala

Saji M Kadavil
Ph.D. Scholar, JNU Delhi

ABSTRACT

This paper attempts to understand how the forest department as an institution encompasses the participatory process in the changing scenario of forest governance at the fringes of the Western Ghats in Kerala.The paper looks at how the process of local community participation constitute tribal women as 'agents for poachers' and analyses the emergence and functions of *Vasanthasena*, a forest protection group dominated by migrant women and initiated by the forest department. The study is based on the theoretical framework of 'institutional economics' where institutions and social positioning of stakeholders get equal importance. The study is grounded on a primary survey conducted among heterogeneous social groups and various institutions to understand their strategies, relationships and negotiation capabilities. It specifies how existing power equations extend to the ecological space of the tribal community, especially the women folk, and howthe dominant group made them ecological refugees in their traditionally inhabited space by using regulations. An 'access to forest' was enabled by forming the women's protection group, comprising women from the settlers' community. Going beyond the patrolling 'duty', the group was increasingly directed to regulate 'adivasi women poachers'. Forest officials made sure that the existing social positioning of caste groups continued. This may be one of the incentives for them to keep the movement going strong. The process of empowering 'women's participation in conservation' in one way reproduces the prevalence of 'caste and poachers' within the sphere of gender-conservation. Through diversified schemes, the *Sena*emerges as a powerful institution which de-constructs the contribution of tribal women and labelled them as 'poachers'.

Keywords: Kerala, Forest Governance, Western Ghats, Women and Adivasi Participation, Forest Conservation, Social Capital and Inhabitants

Local Community Knowledge and Revival of Mangroves in Two Districts of Kerala: the Role of Collective Action

Deep J Francis

Research Scholar, Center for Studies in Science Policy, JNU, New Delhi.

Anita Pinheiro

ABSTRACT

The governance of natural resources used by many people in Common has been an issue in policy analysis. The world today is full of examples capturing the scenario of tragedy of commons which argues that whenever many individuals use a scarce resource in common, it gives rise to depletion of the resource (Hardin 2009). On the contrary even the emergence of private property rights has not been able to resolve the issue of security of these natural resources. When the property rights are not well defined, the dilemma increases. The scenario of depletion of mangrove belt in Southern India is one such example. This paper studies the mangrove conservation from two districts of Kerala: Ernakulam and Kannur. Despite the ambiguity of property rights regarding conservation and maintenance of the mangroves, we observe local people taking initiative to restore the resources. The involvement of local people and use of traditional methods of planting mangrove seeds for the environment sustainability has motivated the institution of collective action and public participation programs resolve the issue of mangrove depletion.

Keywords: Property Rights, Common Pool Resource, Institutions, Collective Action, Local Knowledge, Mangroves

An Economic Assessment of Trends in Land-Use-Land-Cover Data of Kuttanad Wetland Ecosystem (KWE), Kerala and Investment Measures Adopted for its Sustainable Development

Lisa Mariam Varkey

International Rice Research Institute (IRRI), Bhubaneswar, Odisha

Pramod Kumar, Nilimesh Mridha

ICAR- Indian Agricultural Research Institute (IARI), Pusa, New Delhi-110012

ABSTRACT

Wetlands are one of the marvellous ecosystems on earth, which by providing a diverse array of goods and services sustain life in this planet. Kuttanad Wetland Ecosystem of Kerala, the southern portion of the renowned Ramsar site, Vembanad-Kol Wetland, is not only significant for its ecological charisma, but also for its agricultural relevance. This erstwhile tranquil ecosystem, a Globally Important Agricultural Heritage System (GIAHS), however, was observed to be under ecological fatigue due to degradation in the serenity and quality of services. The present study was an earnest attempt to understand the ecological status of this beautiful ecosystem along with the potential effects of efforts conceived under Kuttanad package for its sustainable development. To appreciate the land-use-land-cover modifications that have occurred in Kuttanad Wetland Ecosystem during the last two decades (1990-2014) Landsat 5 TM, Landsat ETM+ and Landsat 8 OLI satellite data were procured. While the increase observed in paddy area in the last decade gave a glimmer of hope, the drastic decrease in the area of major water bodies stood as a looming shadow. Further, major proposed benefits of Kuttanad package were quantified using economic evaluation tools such as market price method and discrete choice experiment. The study focussed only upon market benefits flowing from specific interventions in paddy fields and major non-market benefits namely flood protection, fish productivity, water quality and aesthetic appeal, due to time ,cost and manpower constraints. The present value of proposed benefits quantified using various discount rates lay within the range of Rs. 1797-2994 crores. The estimates being conservative and representing the lower end of a benefit stream indicated that, the package if implemented earnestly, could bring good fortunes to the region.

Keywords: Kuttanad, Land-use-land-cover, Wetland, Discrete choice experiment, Market price method

Pilgrim Tourism and Ecological Sustainability of Pampa River in Kerala

Dr.Anitha V

Associate Professor, Department of Economics, University of Kerala

ABSTRACT

The problem of renewable resources particularly water resources is location specific and which need specific conservation practices. The anthropogenic pollution created by pilgrims in the Pampa river affects the provisioning, regulating, supporting and cultural services of the river. The polluted water affects the human well-being and the biodiversity. This is affecting not only the tourists but also the downstream population and creates sustainability issues to the river.Government had taken a series of steps to control pollution during the pilgrim season. However the existing financing is inadequate to conserve the river. This study tried to develop an alternative permanent solution to this issue. In order to find the value of the river the study used both contingent valuation technique and life satisfaction approach to value the Pampa River. The average willingness to pay by the tourist is Rs.63.29.Based on the Tobit modelthe study found thatthe major factors positively influencing the willingness to pay are the total hours spent in the vicinity of the river and the temple, monthly income of the tourist and size of the family. Whereas the pollution and expenditure incurred for the visit influence the satisfaction level.

Keywords: Water quality, Water pollution, Life Satisfaction Approach, Pampa River, Economic valuation, Sustainable development

Acknowledgement: This paper is the outcome of the project financed by Inter University Centre for Alternative Economics, University of Kerala during the period 2016-17.

Using geotagged photos from social media to value the recreational benefits of Kerala's wetlands in India

Michael Sinclair[1], Andrea Ghermandi[1],SheelaA. Moses[2],SabuJoseph[3]
[1]Department of Natural Resources and Environmental Management, Faculty of Management, University of Haifa, Haifa, Israel
[2]Kerala State Pollution Control Board, Thiruvananthapuram, Kerala, India
[3]Department of Environmental Sciences, University of Kerala, Thiruvananthapuram, Kerala, India

This study uses innovative techniquesbased on the analysis of the metadata of geotagged photographs uploaded to the photo-sharing website Flickr for the valuation of the recreational ecosystem services of wetland ecosystems in Kerala, India.

First, we investigate the suitability of using geotagged photograph counts as proxies for annual visitation rates, finding a good correlation with observed district-level data (R-squared=0.59, OLS regression). Such correlation is subsequently applied to estimate annual visitation rates for all of Kerala's major wetlands.
Second, we explore through regression analysis the correlation between the estimated number of visits and a series of wetland attributes for 139 sections of major wetlands in the state. Forward Stepwise Negative Binomial Regression highlights that wetland visitation has a significantly positive correlation with wetland accessibility, surrounding population density, and elevation. A negative correlation is observed with water quality, supporting the notion that tourism activities play an important role as determinants of water quality in Kerala's wetlands.
Third, we extend the analysis to estimate a willingness to pay (WTP) for recreation in Vembanad lake, the largest of the three Ramsar wetlands of Kerala, and the adjacent backwaters. Public information from the users' profiles and spatial analysis of the entire set of geotagged photographs uploaded by the users are employed to infer the home location of 138 visitors to Vembanad lake who are located within a 150 miles (241 km) radius from it. A calibration to assess reliability of these estimates, comparing revealed home location to a set of 53 stated home locations, finds them 98% accurate at state level with a 22.6km error. An individual travel cost demand function is generated, which reveals a mean return travel distance of 92km, a mean travel cost of 448Rs, and a mean WTP of 985Rs per visit for the investigated Vembanad visitors. Such information is combined with the previously calculated
annual visitation rate to estimate the yearly recreation benefits of Vembanad lake and its backwaters.

DAY 2

NOVEMBER 09, 2017

Parallel Session III

(14:00–16:00)

Session 2.3.1: **Politics, Resistance and Movements**

Chair: **T P Kunhikannan**

‘Politics of Pollution: A Case of Godavari Mega Aqua Food Park (GMAFP) in West Godavari (WG) District of Andhra Pradesh (AP)’

P. Omkar Nadh

Institute for Social and Economic Change

ABSTRACT

The paper is a case study of a specific industrial development project namely ‘Godavari Mega Aqua Food Park (GMAFP)’ in Andhra Pradesh (AP) state of India and the resistance that it encountered. GMAFP which was proposed to be set up in Tundurru village of West Godavari (WG) district in AP is a development project sanctioned as a part of the Mega Food Park (MFP) scheme by the Ministry of Food Processing Industry (MoFPI). On the other hand the project encountered a huge resistance from the residents of almost 30 villages close to the project site and demanded that the project be shifted to a place which is distant from their local habitat since this project threatens to pollute their sources of livelihood in various forms. The environmental movement has been happening for almost three years by now and the role of state in this whole process is important to take in to account. The state and its machinery played a dual role in this whole process. On the one side it provided huge incentives for the industries going much beyond their own permissible limits and on the other hand it has brutally clamped down on the local residents who were protesting against this food park. This paper is a ground level study that provides a clear understanding of the reasons why the local residents have been resisting this project and what is the basis for their apprehensions about the polluting nature of GMAFP. It also provides evidence of how certain institutions of state displayed their over enthusiasm in an attempt materialise this project.

Keywords: GMAFP, State, Resistance, Over Enthusiasm, Development.

Increasing Water Vulnerability of Indian Megacity, Mumbai: Interconnected web of Politics and Policies

Deepika Swami and Devanathan Parthasarathy

Interdisciplinary Program in Climate Studies, IIT Bombay, India

ABSTRACT

India owns 4% of world's water and is the oldest civilization which is surrounded by Indus and Ganges and is still blossoming. But in recent decades urbanization, population growth, climate change and improper planning of cities and towns have led to water scarcity. The gravity of situation can be analyzed by reduction of per capita water availability from 5177 m3 in 1951 to 1545 m3 in 2011 (Water Resource Division, TERI). The present study focuses on Mumbai megacity, which accommodates huge population of approximately 22 million which is the highest number of urban population in comparison to other cities in India. There has been continuous increase in the number of water reservoirs from past 50 years along with increase in population of the city, but still there is huge gap between the demand and supply of water in the city. Most of the studies done so far report the issue of water scarcity in Mumbai. In the current work we have tried to validate the raised scarcity issue by analyzing gaps in demand and supply of water. The study analyzed that there is no water shortage or scarcity in Mumbai, infact the problem lies in distribution, management, and politics over water. The probable reasons for demand-supply gap are inequitable distribution of water between rich and poor, climate change, urbanization, mismanagement, low tariffs for water, political and governance issue. At the same time, if there is enough water available to meet the city's demands then the causes behind water scarcity in Mumbai are explored through political and governance perspective. A case study of "Kaula-Bandar" slum area in Mumbai was performed and by using this case study the relationship between water and governance has been explained. The study has also carried out the stakeholder analysis for a deeper understanding of water governance and privatization of water in Mumbai.

Policy issue: Regulating water abstraction

Keywords: Water crisis, Climate change, water politics, governance and water, privatization of water

Ecology and Capitalism at the crossroads: A Case study of Telangana

Ramesh Dheeravath

PhD (Philosophy), Department of Philosophy, School of Humanities, University of Hyderabad.

ABSTRACT

Capitalism is an economic system which treats labor power as a commodity to be traded in the market. As the structure deepens, commodification becomes a characteristic feature of every resource in the economy; so does the Environment. But the degradation of environmental resources is featured by irreversibility and is irreplaceable. More so, in a globalized economy, technological optimism drives the exponential growth process that is unsustainable. In this era of integrated production systems, the natural resource conflicts further deepens to meet the needs of imperialist structure of capitalism. Within this larger context, the work seeks to understand the long standing environmental struggle led by communities in the regions of Telangana, the newly carved 29th state of the Indian Union. The discourse on development has always tend to emphasize on rapid and heavy industrialization and Indian State in this thought process tend to provide incentives to capitalists so as to invest in the country. In this line, Mrs. Indira Gandhi flagged off the initiative in the late seventies and early eighties as part of her electoral politics in Medak district, proximate to the global city of Hyderabad. The industrialists were induced to set up here as it provided the required infrastructure to flourish. One of the sectors that got hugely established in this region is the pharmaceutical and chemical industry. These giant companies continue to produce toxic and hazardous chemicals and let the effluents to the local water bodies adversely affecting the soil's fertility and the health of the inhabitants including the animals. The level of pollution is so high that Patancheru, industrial belt in the Medak district of Telangana is declared by Central Pollution Control Board as one of the 24 'critically polluted regions' and calls for 'urgent attention for the control of pollution'. This paper questions the framework of environmental Kuznets curve and seeks to provide environmental justice as these companies continue to produce those drugs despite being banned in developed countries as it harms their environment. This means the global south is subsidizing the global north by extending its space and resources to undertake the production activity and the resultant pollution caused thereof for the sake of consumption by developed economies. This paper tries to understand the struggle of the communities with the neoliberal state as the dumping of untreated industrial waste is a matter of global concern because of the current structure of production, distribution and consumption.

Keywords: Environment, Capitalism, Kuznets Curve, Pharmaceutical Companies

Ecological Distribution Conflicts (EDCs) over mineral extraction in India: An overview

Arpita Bisht

Department of Policy Studies, TERI University, New Delhi, 110070, India

Julien-François Gerber

International Institute of Social Studies, The Hague, The Netherlands

ABSTRACT

Mineral extraction is growing worldwide, generating serious social and environmental impacts, and in the process, sparking significant resistance. The present article provides the first overview of non-fuel mining conflicts in India. The analysis is based on 100 cases of conflicts that occurred between 1992 and 2014, which constitutes the most exhaustive database compiled to date. In each case, location, mineral extracted, actors involved, cited causes of protest, conflict duration and outcomes were recorded. We found that the commodity responsible for the most conflicts is sand, the extraction of which is widespread and often carried out illegally by smallscale actors near rivers. Resistance against metallic ore mining, in contrast, typically pits local populations against larger corporations. Most resistance movements are composed of subaltern rural and/or indigenous populations; very few national and international NGOs were found to be involved in local movements. The causes of such conflicts have largely been ecological and responsible for an undermining of local livelihoods. Mineral extraction is expected to increase in India over the next decade, and with it, the number of associated conflicts.

Keywords: conflicts, mining, extraction, metallic ores, sand mining, India

The EJOLT project (2011-15) and the EnvJustice project (2016-21) at the ICTA UAB, Barcelona

Joan Martinez-Ali Joan Martinez-Alier

Professor of Economics and Economic History and senior researcher at ICTA, Autonomous University of Barcelona.

Abstract

The purpose of these research projects has been and it is to delve beneath the surface manifestations of conflict related to mining activities, biomass extraction, fossil fuel extractions, hydroelectric and nuclear energy, new infrastructures and also waste disposal, in order to develop a deeper understanding of their nature and uncover their root cause and their historical significance.

The root cause of the thousands of Ecological Distribution Conflicts (EDC, as collected in the EJAtlas, www.ejatlas.org) is the Growth and Changes in the Social Metabolism. This awakens a myriad movements of resistance around the world (led by EJOs) that together constitute the Global Movement for Environmental Justice. Its strength differs depending on the countries and regions in question, and the political conjuncture (as in the current wave of popular anti-mining and anti oil consultations in Colombia). The slogans, banners, songs and documentaries shown in the local manifestations of this movement appear in many different forms (e.g. T. M. Krishna's song on Ennore Creek north of Chennai). We could indeed ask, is there one global movement for environmental justice? How are network formed and campaigns organized among different EJOs? How are local and global issues brought together - for instance, climate justice with the local complaints againts coal mining and CFPP or against gas fracking? Is this movement a powerful force to bring the world economy into a less unsustainable path?

In this paper some empirical materials will be presented on EDCs from various countries and topics (including India) drawn from the EJAtllas (that contains over 2200 cases worldwide by September 2017), doing comparative analysis of the social actors involved, their repertoires of actions and the languages of valuation they deploy, the outcomes of the conflicts including the rates of success in achieving environmental justice.

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Session 2.3.2: **Aquatic Ecosystems**

Chair: R C Bhatta

Economic Value of Biodiversity Loss: A Case Study of By-catch from Andhra Pradesh Marine Fishery

Jyothis Sathyapalan

Associate Professor, Centre for Economic and Social Studies

ABSTRACT

The increasing rate of biodiversity loss is a major global concern today. India is endowed with rich marine biodiversity areas, with a coastal line of about 8118 km, and with an exclusive economic zone of 2.2 million km sq. They play a crucial role in human food and nutritional security. In addition, millions of people are dependent on marine ecosystems for livelihoods and employment. Nevertheless, overfishing has been reported as one of the important drivers of marine biodiversity loss. Many vulnerable species of fish and crustaceans have become endangered are on the brink of biological extinction. This is an unintended consequence of fishing on marine biodiversity, a cost to the society. This study provides estimates of social cost in terms of by-catch and juvenile species loss besides suggesting solution to minimize the cost so that the stock of fish resources and biodiversity are sustained while simultaneously harvesting fish for human purposes. This study was conducted in Andhra Pradesh state, which is located in the east of India with a coastal line of 974 kilometers and a relatively narrow continental shelf of 33,227 km2. This study has made use of secondary data on fish landings from the government of Andhra Pradesh and the Central Marine Fisheries Research Institute to examine the trends and composition of species harvested over time in Andhra Pradesh. Two primary data sets collected during the period 2013-14 and 2014-15 have been used to estimate the proportion and values of catch and by-catch.The study has found that 14.41 percent of the total biomass harvested is in the form of by-catch (9.9 percent landed and 4.42 discarded), which constitute a cost to the society in terms of forgone fishing effort and loss of future biomass to an extent of 35 percent of the present landed value. Around 59.8 percent of the biomass is forgone due to juvenile catch that needs to be regulated. The cost of by-catch can be avoided by regulating the excessive fishing efforts used for by-catch, which is estimated to be 210051 standard fishing days a year for Andhra Pradesh. An analysis of secondary data shows that marine fishery is facing an increased fishing pressure due to an increase in the number of fishing population, technological advancements, institutional weaknesses like poor enforcement of rules and non-compliance with rules. The increased demand for by-catch materials for industrial purposes is also creating pressure on marine ecosystems. These are the major underlying drivers of the economy with far-

reaching implications for marine biodiversity. In the light of these changes, it is important to have a long-term precautionary policy approach towards marine biodiversity conservation.

The ecology and history of the Andaman Islands: Bottom up and through the lens of fiction

Pankaj Sekhsaria

Member, Kalpavriksh Environment Action Group

Senior Project Scientist, DST Centre for Policy Research, IIT Delhi.

ABSTRACT

This paper is a first person account and reflection on research and activism in the Andaman and Nicobar Islands, but viewed through the lens of fiction. The key questions this reflection seeks to ask are about the challenges and relevance of fiction as a form of communicating the wide-range and multi-disciplinary nature of any particular bio-geography, of the possibilities that this might offer for creative expression and for communication and the nature responses in one particular case involving this author. I will be approaching these questions through my personal experience of activism in the islands for 20 years, the publication in 2014 of my debut novel *The Last Wave*, which is a story deeply embedded in the history, ecology and people of the islands and also present some of the responses the book has received, particularly from readers in the islands themselves.

Keywords: Andaman, activism, fiction, communication, literature

An interdisciplinary risk assessment: harmful microbes, shellfish, climate change and urbanisation in Mangalore, southwest India

Lucy M Turner *et al*

There is growing evidence that climate change will increase the prevalence of toxic algae and harmful bacteria, which can accumulate in marine bivalves. However, we know little about any possible interactions between exposure to these microorganisms and the effects of climate change on bivalve health, or about how this may affect the bivalve toxin-pathogen load. In mesocosm experiments, mussels, *Perna viridis,* were subjected to simulated climate change (warming and/or hyposalinity) and exposed to harmful bacteria and/or toxin-producing dinoflagellates. We found significant interactions between climate change and these microbes on metabolic and/or immunobiological function and toxinpathogen load in mussels. Surprisingly, however, these effects were virtually eliminated when mussels were exposed to both harmful microorganisms simultaneously. This study is the first to examine the effects of climate change on determining mussel toxin-pathogen load in an ecologically relevant, multitrophic context. The results may have considerable implications for seafood safety.

Choice Modeling and Its Application to Sundarbans Mangrove Forest Preservation

Md. Hafiz Iqbal

Assistant Professor (Economics), Government Edward College, Pabna-6600, Bangladesh

ABSTRACT

Mangrove (Tidal forest) has substantial and economic importance at local, national and global perspectives. It has balanced the ecosystem-serving as fish nurseries, havens of biodiversity and carbon storehouse. Like the other mangrove forests, Sundarbans mangrove forest plays an important role in the reclamation of land, protection of coastal habitat from cyclones and tidal surges and uplifts the socio-economic conditions of the coastal people. It is the breeding ground for several globally threatened species. Sundarbans mangrove ecosystem services are now in captious position. It is affected by insects, disease and climatic and human induced factors for commercial and trading purposes. Depletion of this forest is responsible for creating imbalance ecosystem and other natural hazards. This study carried out through questionnaire survey. It includes villagers (n_1=322) and tourists (n_2=195) in the adjacent villages and major tourist spots of Sundarbans mangrove forest. To fulfill the research objectives, this study attempts to apply choice experiment approach to assess tourists and villagers perceptions or attitudes i.e. the preference and willingness-to-pay (WTP) for provisions of different attributes like donation, cutting Golpatta (Nipe fruticans), provision of visit and location option. Multinomial Logit and Random Parameter Logit models are used to quantify the respondents' perceptions on the proposed attributes of this study. All of the attributes are found statistically significant and positive. The findings of this study provide a robust basis for both policy makers and government to make more specified policies on forestry preservation.

Keywords: Choice experiment, Experimental economics, Economic benefits, Sundarbans, Bangladesh

JEL classification: C31, Q23, Q51, Q56, Q57

First-and second-order adaptation to salinity and water logging: case of coastal embankment in Satkhira district, Bangladesh

Farid Ahmed

Md. Shakil Mahamud

Md. Shafikul Islam

Md. Hafiz Iqbal

Sayed Rafiqul Hasan Milon

Abstract

Satkhira district of Bangladesh has common characteristics such as the inundation by high tides, salinity intrusion, water logging and frequent cyclonic storms along with tidal surges. Coastal embankment or locally known as Polder projects in Satkhira district were initiated in 1960s to solve the problems of tidal flooding, flooding from storms, salt water intrusion and sedimentation. The Polders were originally designed without much attention to its further impacts. Breaching the Polder due to cyclones and siltation of peripheral rivers surrounding the 3

polders enhanced water logging and salinity which led to large scale environmental, social and economic degradation. This paper deals with coping and adaptation process under water logging and salinity condition. Selected measures to water logging and salinity are critically examined with respect to this current and potential hazardous situation that these measures might imply for additional adaptation needs and changes within social-ecological systems. Under this circumstances, this study examines the feasibility of the concept of first-and second-order adaptation process under different coping measures e.g., floating garden, cage aquaculture, seed variety, pit system gardening, pork and crab cultivations and coconut plantation under water logging and salt water intrusion condition. The observation was conducted at different villages adjacent to Polder no. 3 in Satkhira district. The findings of this study might help to understand adaptation process with the local or regional context, help to understand how stabilization process is influenced by adaptation measures and show the ways and means to cope with unexpected climatic hazards.

Keywords: First-and second-order adaptation, Salinity, Water-logging, Coastal embankment, Bangladesh

Session 2.3.3: **Institutions for governance of 'commons'**

Chair: **P S Easa**

Participatory Forest Management and the Role of Institutions in Tanzania: A Survey

Anindita Roy Saha

Associate Professor, Department of Environmental Studies, University of Delhi

Grace Charles Muangirwa

Student, Department of Environmental Studies, University of Delhi

ABSTRACT

Tanzania is among the first African countries to formally recognize the role of communities in the governance of forest resources, both in terms of managing and owning forests. Some pilot activities were carried out in early 1990s in the forests of Duru-Haitemba, Migori and Suledo. This paved the way for important changes in the forest policy and legislations to support Participatory Forest Management (PFM). The Forest Act 2002 provides the legal basis for the local communities to own, manage and co-manage the forests under various conditions and management arrangements. The local communities are involved in forest management under two approaches of PFM, namely, Joint Forest Management (JFM) and Community Based Forest Management (CBFM). JFM is a collaborative management approach whereby the responsibility of forest management and returns from forest products are divided among the communities living adjacent to the forests and the government bodies. These are practised largely in forest reserves controlled by the national and local governments. On the other hand, CBFM takes place in village land where villagers enjoy full ownership and take management responsibility of the forest area within their jurisdiction that has been declared as a village forest reserve by the government.

This paper attempts to study and assess the performance of the PFM institutions in Tanzania in terms of its goals of improving livelihood of local people, improving environmental and forest conditions and improving governance. The term 'institution' implies the set of rights, rules and processes of decision making in governing the use and management of the forests. The study revealed that despite the potential of PFM in improving forest resources and livelihoods of forest communities in Tanzania, there are limitations in the existing practices and institutional arrangements to achieve the desired goals.

Keywords: Participatory Forest Management, Joint Forest Management, Community Based Forest Management, Institutions, Livelihood, Environment, Governance.

Role of Collective Action and Governance in Implementing Sustainable Fishing Practices:

A Case Study of Karnataka Marine Fisheries

Dr. S. Gunakar

Dept. of Commerce Pompei College, Aikala-574141

ABSTRACT

In coastal Karnataka two hundred thousand fishing households are directly dependent on marine fishing which provides livelihood security and minimizes the vulnerability to chronic poverty. The small-scale fisheries employing labour intensive harvesting, processing, and distribution technologies to harvest near-shore fishery resources were contributing less to the output and more to the employment. However, rapid growth of mechanization and expansion of international trade coupled with growing number of non-fishing communities in fisheries sector caused a transformation of fisheries during the past two decades. Macro level assessment of per capita income from fishing shows a declining trend during the last 10 years although the overall net domestic product in the region has been increasing. The declining resources and increasing use of coastal waters for non-fishery related activities have undermined the role of small-scale fisheries and its capacity to provide ecosystem goods and services. The restoration of small scale fishing requires a multi-pronged fishery management approach including community support and action. The recently organized stakeholder consultations with different fishing groups have evolved scope for executing collective management measures. The study is based on the outcome of a number of stakeholder consultations organized during 2016 as part of the national programme of International Collective in Support of Fish workers (ICSF) to disseminate and implement the Food and Agriculture Organization (FAO) “Voluntary Guidelines for Sustainable Small-scale Fisheries”. The study is based on expert consultations, meetings with community based organizations and stakeholder consultations. Two prominent community based organizations were consulted regarding the impact of executing the FAO guidelines. The stakeholders consultation have focused on three major action research issues such as identification of measures to minimize the negative impact of implementing FAO guidelines on small-scale fishers, restriction and gradual removal of fuel subsidy to destructive fishing practices, reducing the dependence of women on state sponsored support schemes, integration of community based management measures with state fishery regulations, mobilizing community support/social capital for discouraging un-sustainable fishing technologies. The results of the study was helpful in understanding the real issues of governance and collective action required for the implementation of common fishery management regulations such as extended closed

seasons and areas, introduction of minimum mesh size, limiting fishing effort through scientific licensing policy.

Keywords: FAO guidelines on Small-scale fisheries, Sustainability, social capital, collective action, fishery management regulations

What constitutes the 'commons' in water? A case study of irrigation systems in Puducherry district

S. Krithi

PhD Research scholar, Centre for Economic studies and Planning, Jawaharlal Nehru University

ABSTRACT

In India, ownership and access to ground water depends mainly on land rights and is 'privatised' while surface water systems are by legal rules and local conventions 'common property resources'. This paper explores these common property aspects of water use in irrigation in the case of Puducherry district in Southern Indian.

This study is based on data sets belonging to two periods- secondary data for the period 2000-04 collected during the Tank Rehabilitation Project through the government of Puducherry and primary data collected over 200 households in rural Puducherry in 2014-15. The paper presents an overview of the rules governing groundwater access in Puducherry at present and the pattern of ownership of borewells across various sections of the farmers in the two periods. The following section uses the Institutional Analysis and Development framework to analyse collective action and tank water distribution in the base period (2000-01). The impact of heterogeneity, institutional characteristics and alternative technologies on the use of the tank water system in this period is studied. The primary case study of Puducherry in the period 2014-15 is then used to understand the long-term impact of the tank rehabilitation project in the use of the irrigation systems. This paper explores how the local institutions in tank management and the ground water markets act as the sites of contestation, where power is exercised through a complex set of negotiations and access and use of the 'commons' is determined.

Keywords: Tank irrigation, ground water depletion, institutional analysis, participatory development, Common Property Resources

Self Governance Of Fishermen In Sundarban: A Case Study

Tapas Kumar Sutradhar

Research Scholar, Department of Economics & Politics, Visva-Bharati, Santiniketan

Dr. Santadas ghosh

Associate Professor, Department of Economics & Politics, Visva-Bharati, Santiniketan

ABSTRACT

This paper studies a spontaneously developed local institution, a fishermen Association, located in an important ecological site in India called Sundarban. In this mangrove delta, fishing is the major livelihood activity after agriculture. The fish catches are dwindling fast in the delta waters putting a question mark on local ecological sustainability. The Department of Forest alone could not achieve satisfactory result in its conservation efforts. The Association was formed by the fishermen themselves to improve their financial status as well as ability to obtain fishing-related and other livelihood supports that are provided by the government.

Primary survey data on 205 fishing households in the area shows that the fishing households are indeed benefitted from being members of the Association and could improve their monthly per-capita consumption expenditure by over 15 percent. It was found that fishing households with less livelihood diversification option are keener to be association members. Focus group discussions and data obtained from the Association reveal that the Association is active in protecting its members from harassment by the authority, enables the members to obtain benefits from different government schemes, helping its members to diversify into other livelihood activities so that anthropogenic stress on the ecosystem can be reduced and creating awareness of among the members realting to sustainable fishing practices and mangrove conservation. The findings add to the existing literature which shows local environmental sustainability is often facilitated by local institutions better than formal state sponsoed protection agencies.

Keywords: Sundarban; West Bengal, Anthropogenic stress, Ecological Sustainability, Local Institutions, Fishermen

An agent-based Simulation of cooperation in theuse of irrigation systems

Jingjing Cai

School of Economics, Xiamen University

Hang Xiong

Agricultural Economics and Policy Group, ETH Zurich

ABSTRACT

This study presents an agent-based simulation of the formation of cooperation in using irrigation. The simulation model is developed based on our understanding of the underlying mechanisms by which farmer households participate the cooperation. That is, a household first become a potential participant when the cost of cooperation it needs to sustain is not higher than the amount it can afford or is willing to pay; and on top of this, the propensity that the household participates is heavily affected by its personal characteristics and neighborhood effects. We use model to examine the impacts of initial participants and government support on both the reach and velocity of the cooperation diffusion. The model is calibrated to villages with successfully running Water User Association (WUA) in central China. Our results show that government support plays a critical role but the initial participants do not matter much for different types of initial participants and network structure of the village.

Keywords: Cooperation; Water user association; Agent-based modelling; Neighborhood effects; Social networks

SDGs and Global South 3 **Pollution and Health**

Chair: **Peter M. Raj**

Health Externality in terms of Respiratory Illness Related Sick days due to Air Pollution: Evidence from Open Cast Coal Mining Region of Odisha

Tapaswini Nayak

Lecturer in the Department of Economics, Kendrapara Autonomous College, Odisha

Dr. Indrani Roy Chowdhury

Associate Professor, Jawaharlal Nehru University

ABSTRACT

Coal production is treated as “dirty industry” as it is treated as the most polluting of all energy sources. Given that the coal dust and fly ashes are more contaminating and hazardous in comparison to other minerals, the health outcome of coal exposure is considered to be very critical and demand serious policy intervention. Apart from the direct impact of the occupational hazards to the coal miners, coal mining activities, particularly open cast coal mining, imposes highly negative environmental and health externalities (through air pollution) on the communities living in the neighbourhood of the mining region. Thus the present study used the health production function model and focuses on the productivity loss in terms of restricted activities or work days lost due to severe respiratory illness (RI) induced by air pollution. First we tried to predict the likelihood of RI related sickness (in terms of their restricted days / sick days) of the residents near the open cast coal mines (due to air pollution). Then we tried to estimate the relationship between the mitigating expenditure due to RI related sickness and the level of air pollution. The study is based on the seasonal household surveys using health diaries in the Angul (Talcher) open cast coal mining region of Odisha. The region records the largest reserve of coal in the state and air pollution indicators often exceed the national average by several folds. We do Count data analysis for estimating productive days lost due RI related sick days by running Poisson and Negative Binomial regression and for the mitigating expenditure we run the Tobit regression model. The result confirms that there is a positive & highly significant relationship between the level of air pollution (RSPM/PM10) & RI related sick days in the Poisson and Negative Binomial model. The positive value of the coefficient of pollution variable depicts that a reduction in air pollution level (PM10 level) causes a reduction in expected number of RI related sick days. Moreover the coefficient sign of PM10 is positive in the Tobit model, which indicates a positive association between the PM10 level and RI related mitigating activities with 5% level of significance.

Keywords: Air pollution, Respiratory Illness, Dose-Response Function, Health Production Function, Count Data Model and Tobit Regression Model.

Studies on the influence of land change and land use pattern on the mosquito vector population in Human dominated ecosystems at Palani, Dindigul district, Tamil Nadu

P. Manikandan, N. Kamaladhasan and S. Chandrasekaran

Department of Plant Sciences, School of Biological Sciences, Madurai Kamaraj University

ABSTRACT

Alteration of natural ecosystems by human beings has imparted a heavy burden on the sustenance of natural ecosystems. Rapid urbanization and other anthropogenic activities have received more attention due to their impacts on human health particularly with reference to vector borne diseases. Mosquitoes act as vector for various deadly diseases, its relative adaptability for altered ecosystems and seasonal changeover has made them a dominant aquatic insect at various ecosystems. Surveying the land use changes is very essential for monitoring mosquito vector population. In order to understand the influence of land change pattern on mosquito vector population, we have investigated immature mosquito bionomics at three different land change patterns *viz*., irrigation tank, stone quarry (mining) and riverbed. The larval density, species composition and diversity, aquatic vegetation, water quality were studied in all the study sites. Totally fifteen mosquito species has been noted in all the study sites. Larval density was found to be higher in mining site than other study sites. *Culex vishnui* were found as dominant species in pond and stone quarry. Mosquito diversity and species richness was observed to be higher in river bed than other study sites. The filamentous algal dominated sites had a higher number of immature mosquito species than the sites with other aquatic vegetation. Water quality particularly turbidity was found to have a strong influence on the habitat utilization of immature mosquitoes in all the land change patterns. Based on the habitat similarity, immature mosquitoes were separated into two distinct groups namely Group A and B. *Anopheles annularis* was found to have higher habitat similarity (0.703) with *Aedeomyia catasticta*. *Cx. vishnui* had been observed at all the types of larval habitats with no habitats specificity which could share their habitats with more or closely related species. In this study we concluded, human land change and land use pattern tend to increase the chance of disease outbreak which is directly proportional to the human usage in an ecosystem. This basic ecological data provides essential information about influence of land change and land use pattern on mosquito population which can further be extended for adopting viable control measures at field level for curtailing vector borne diseases.

Keywords: Land use and change pattern, mosquito diversity, larval density, aquatic vegetation, pond, river and water quality

Impact of Air Pollutant PM10 on House Rent in the Cities of Ghaziabad and Noida of NCR in India Using Hedonic Property Price Model

Gaurav Kumar

Assistant Professor, Department of Mathematics, N.A.S. College, C.C.S. University, Meerut (U.P.), India

ABSTRACT

Poor air quality is one of the most serious environmental problems in urban areas around the world, especially in developing countries. The air pollution problem has received more attention during the last decades whereby there has been a significant increase in public awareness of the potential dangers caused by chemical pollutants and their effects on both human beings and the environment. The reductions in emissions of NO_x, SO_x, and particulate matter (PM10) from heavy-duty vehicles and industries in NCR (National Capital Region) of India are expected to result in wide-spread reductions in ambient concentrations of fine particulate matter. These improvements in air quality are expected to result in substantial benefits in various sectors of human life. The purpose of this study is to analyze impact of air pollutant PM10 on house rent in the cities of Ghaziabad and Noida of NCR region using hedonic property price method. It is also an attempt for the valuation of Air Pollution as a commodity. Primary data collected from the household surveys is used to estimate the model. A sample of 4233 houses in Ghaziabad and Noida is taken. Factors including house size, house age, number of bedrooms, number of bathrooms, amenities around house, geographical location, air quality are considered. Secondary data about air pollutants as is captured by state pollution control board is being used in the study. Log linear form of hedonic regression is used to estimate the impact of PM10 on house rent.

Keywords: Hedonic Regression, Air Pollution, Log Linear, PM10

Promoting Collective Action to Improve Water Security in Peri-urban Areas around Bangalore City Using Social Accountability Tools

Arvind Lakshmisha, Priyanka Agarwal and Bhargavi Nagendra

Public Affairs Centre

ABSTRACT

Water security is a pressing issue in most cities of the global south, often caused due to lack of planning in addition to unplanned expansion of cities. This situation is further aggravated by the impacts of climate change, such as variation in precipitation and increase in temperature. Besides urban areas the regions on the fringe often termed peri-urban, bears the brunt of unplanned expansion in the form of overexploitation of groundwater, migration, industrialisation in addition to unscientific management of wastewater. Peri-urban regions are caught between rural and urban and are often a neglected by policy and decision makers. These areas are dynamic in nature, both in terms of demographics and flow of resources. They act as industrial hubs and as dumps for city refuse, which contaminate the resource base including, water resources. Further, climate related changes have rendered the local communities vulnerable not only to water scarcity but to its security as well. There has been limited research of peri-urban areas in India, which is concentrated to certain pockets across the country.

The paper is based on a study in Bidadi, an industrial hub, located in the periphery of Bangalore city. The study was undertaken in three phases, an exploratory phase including household surveys; an analytical phase, comprising of vulnerability ranking of water resources using fuzzy cognitive maps (FCM), accumulating stakeholder experiences on the impact of urbanisation, and climate change on water security; and a synthesis phase, includes modelling vulnerability to identify and plan for improving water security. The initial results from the survey and time series analysis of climate data highlighted an observable change in temperature, precipitation patterns. Analysis of the survey results indicated that, though water is available, it is highly contaminated. This was further augmented using FCM, combining fuzzy logic and cognitive mapping based on graph theory. Cognitive maps drawn with the help of stakeholders, revealed urbanisation though has improved the economic conditions, has resulted in water scarcity, decrease in quality and quantity for consumption. The maps were then modelled on different policy options available and shared with the wider stakeholders to prioritise options through a dialogue platform to streamline communication, interactions and coordination between stakeholders. This study is based on the ideology of collective action using social accountability tools to help bridge the gap between scientific research and policy making through stakeholder participation.

Keywords: Citizen Science, Collective Action, Climate Change, Water Security, Fuzzy Cognitive Mapping, Urbanisation

Effect of road transport infrastructure, energy use and economic growth on CO2 emission in India

Namita Singh

Interdisciplinary Programme in Climate Studies, Indian Institute of Technology Bombay

Trupti Mishraa

Shailesh J Mehta School of Management, Indian Institute of Technology Bombay

Rangan Banerjeea

Department of Energy Science and Engineering, Indian Institute of Technology Bombay

ABSTRACT

India is the fastest growing major economy of the world. It imports three quarters of its oil demand, making transport sector major contributor of greenhouse gas (GHG) emissions. In 2010, Indian transport sector was responsible for 14% of energy related CO2 emissions. In the present study, annual time series data (1970-2012) is used to examine the effect of growth in road transport infrastructure, energy use, GDP and Gross capital formation on CO2 emission from transport sector in India. Using Johansen multivariate cointegration approach and vector error correction method, the study investigates the Granger causality between the variables. Here

Transport Gross domestic product and gross capital formation, petroleum product consumption, road length are used as explanatory variables and CO2 emission from road transport is used as dependent variable. The result of the analysis indicates presence of long-run unidirectional causality from per capita petrol consumption, per capita road length, per capita transport gross capital formation, per capita transport GDP to per capita CO2 emission from transport sector and short-run unidirectional causality running from per capita road transport gross capital formation to per capita CO2 emission in transport sector of India.

Keywords: Transport infrastructure, greenhouse gas emission, energy use, Gross capital formation, Johansen multivariate cointegration, vector error correction method

DAY 3

NOVEMBER 10, 2017

Parallel Session I

(11:30 – 13:30)

Panel Discussions

16:30–18:00

Setting the Conservation and Development Agenda for the Western Ghats, India

Moderator:

1. **P. S. Easa**

Panelists:

2. **Hansraj Verma**, Additional Chief Secretary to Govt of Tamil Nadu

3. **N. Krishnakumar**, Principal Chief Conservator of Forests and HoFF (Retd) Tamil Nadu. Currently, Chairman, State Environment Impact Assessment Authority, Tamil Nadu

4. **P. K. Kesavan**, Principal Chief Conservator of Forests (Forest Land Resources, Govt. of Tamil Nadu

Abstract

Western Ghats are a globally significant range of hills located in south western India. This hill range runs north-south between the river Tapti and Kanyakumari over a distance of approximately 1600km. It is bounded in the west by the Arabian Sea and the narrow west coast.

In the east the Western Ghats merges with the Deccan Plateau over much of its length and with the uplands of Tamil Nadu in the south.

Topographically the Western Ghats rise from the sea to heights over 2000m in the southern segments peaking at 2695m ASL. Although it generally takes the form of a belt through most of its northern range, it extends eastwards as it reaches the southern end. The great diversity in topography and the associated climate and vegetation has made the southern segment of the Western Ghats encompassing the states of Tamil Nadu and Kerala the richest in biodiversity.Endemism is also higher in southern Western Ghats. The Western Ghats also has a veritable cultural history (with the earliest references being part of the Sangam compendium C 300 BC – 300 AD), and is home to some of the most primitive indigenous tribal groups such as the Kanis, Kurumbas, Malayars etc. The cultural significance is further exemplified by the presence of a number of cultural artefacts such as sacred ponds, sacred groves, totemic species etc.

Western Ghats: a Biodiversity Hotspot

India is a designated mega-diverse country, but is also known to have three biodiversity hotspots within its boundaries of which the Western Ghats is one. The term biodiversity hotspot (first articulated by Norman Myers in 2002) is often misconstrued as being a positive attribute. The fact however is that the term biodiversity hotspot indicates that the area while being very rich in its biodiversity (at three scales viz landscape, species and genetic) is also under severe human interference and manipulation. The term interference is operationally defined to be large scale, multiple impacts such as construction of reservoirs and dams, conversion of large land parcels, deforestation etc.

Development Programmes for the Western Ghats

The Centrally Sponsored Programme for the Integrated Development of Western Ghats Region called "Western Ghats Development Programme (WGDP)" was launched in 1974-75. The main objective of the scheme was the economic well-being of the local population residing in the area. The scheme covered an area of approximately 1600 km of the western coast of India from the mouth of river Tapti in Maharashtra to the southernmost tip of India at Kanyakumari in Tamil

Nadu.Initially, the immediate objective of the programme was the economic development of the region. Subsequently, the objective of the programme has gradually been changed to ecological preservation and restoration, thereby maintaining ecological balance and the overall socio-economic development of the region on a sustainable basis.

Owing to growing population and sensitive ecology of the mountain regions the Central Government has been allocating Special Central Assistance to these areas through the Hill Areas Development Programme which has been in operation from the Fifth Five Year Plan in designated hill areas. Under this programmes, Special Central Assistance is given to designated hill areas in order to supplement the efforts of the State Governments in the development of these ecologically fragile areas. Areas under HADP were identified in 1965 by a Committee of the National Development Council (NDC). The approach and strategy of the HADP have evolved through the Plans. The programmes implemented during the Fifth Plan period were mainly beneficiary oriented, while the Sixth Plan emphasized eco-development. The Seventh Plan focussed on the development of ecology and environment, namely eco-restoration, eco-preservation and eco-development. These plans were aimed at stimulate socio-economic growth, development of infrastructure and promotion of ecology of the areas covered by HADP. The Eighth Plan had essentially the same approach with special focus on involvement of the people and meeting their basic needs through improved management of their land and water resources. The measures outlined towards this end include (i) an energy policy which would reduce pressure on forests and provide alternate sources of energy, (ii) afforestation of denuded forest land with species which can provide both fuel and fodder, (iii) provision of adequate and safe drinking water by development of gravitational sources of water, (iv) emphasis on improvement of health facilities including infrastructural facilities in primary health institutions, (v) development of skilled manpower, (vi) evolving a proper land use pattern keeping the socio-economic and ecological parameters in view, (vii) development of horticulture and plantation crops, (viii) improvement of livestock, (ix) development of industries such as electronics which do not pollute the atmosphere and lead to high value addition, (x) development of network of transport and communication facilities with emphasis on feeder paths and roads; and (xi) evolution of appropriate technology and scientific inputs which would suit local conditions and harness local resources. The main objectives of the Ninth Plan of the Programme were eco-preservation and eco-restoration. This plan emphasized on dovetailing of the traditional practices

with appropriate technology to serve the need of the people of these areas.The strategy for the programme has been centred on the sub-plan approach under which a separate Sub-plan for the hill areas in the concerned State was prepared indicating the flow of funds from the State Plan and Special Central Assistance (SCA) so that convergence could be achieved and duplication avoided.

Currently, both the centrally sponsored programmes have been withdrawn, and the States have been asked to plan and develop their own programmes for the conservation and development of the Western Ghats.

Could this be an opportunity to engage and develop robust programmes that reconcile conservation and development goals within the Western Ghats? The panel explores the merits of this approach and identify key issues / concerns that impact the Western Ghats of India.

Ecosystems and farmer well being: PES as a tool in ensuring farmer welfare

Moderator:

1. **P Indira Devi**, Professor, Kerala Agricultural University

Panelists :

2. **D Suresh Kumar**, Professor, Tamil Nadu Agricultural University

3. **Lalit Kumar,** Associate Professor, Bhim Rao Ambedkar College .Delhi University

4. **Manjula M**, Principal Scientist, M S Swaminathan Research Foundation

5. **Ramachandra Bhatta**, Emeritus Scientist, Indian Council of Agricultural Research, College of Fisheries, Mangalore

Panel abstract

Analysis of National Crime Records Bureau (NCRB) data, reveals farmers as the most distressed group in the country as their suicide rates are higher than that of others.Bureau's latest estimates

show that 12,602 farmers had committed suicide in 2015, up from 2014 death toll by 2 per cent. Across states, economic factors such as poverty, bankruptcy, or farming-related issues (crop failures, inability to sell etc.) are the key drivers of farm-related suicides.The household income level of farm households indicates the state of affairs of farming community.Average farm household income in 17 states of India is reported as only less than Rs 20,000 per year(Economic Survey, 2016) ie.the average monthly income per farm family is just Rs.1666.

The developmental policies and the price support mechanisms were not very successful in solving farmer distress and it even worsened over the years as reflected by an increasing number in farmer suicides. This causes social,political and economic problems and it is very important that we ensure the sustainability in farm income and ecology.

The panel discuss the concept of payment for the positive ecosystem services provided by the farming community,as a method to improve the farm income while ensuring the health of ecosystem .The paper discuss the various aspects of implementation,institutional mechanism and the estimation challenges. The long term objective is to incentivize and reward the farmer to undertake sustainable and ecofriendly farming techniques.

Paper abstracts

Agroecosystems, ecosystem services and challenges in measurement and valuation and the concept of PES

D Suresh Kumar

Ecosystem and the ecosystem services have received much attention from the policy makers for their perceived ability to contribute significantly to the economic development and environmental sustainability. But,valuation of ecosystem services poses lot of challenges and complexities making it difficult to assign the value for a good or service particularly for those goods and services for which markets do not exist. The problem of valuation of ecosystem lies on the following: (i) inventory of various components of the ecosystem and to identify what goods and services to be valued, (ii) selecting appropriate approaches, methodologies and indicators to assess the values, and (iii) developing a framework to look after the indicators together and assessing overall value of the ecosystem (Palanisami and Suresh Kumar, 2006). As

far as ecosystem valuation is concerned, for most of the ecosystems, the challenge of valuing ecosystem services is centred on the description of various components and functions and their interrelationship between the different components, their services and the society (Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems, National Research Council, 2001).

Valuation of different ecosystem services has become increasingly important for (i) determining environmental policy and decision making, (ii) *Designing policies for maximizing income for the resource managers and farmers, (iii) Conservation and sustainable management of ecosystem, (iv)* feedback on environmental conservation programmes and (v) n*ational Income accounting.* The value of the ecosystem services are determined mainly based on the monetary value which people assign on any particular ecosystem service based on their preferences. This means that what the society prefers to pay to get the service or accept for any loss. That is the maximum willingness to pay (WTP) an individual could be considered as a value of ecosystem service. Similarly, minimum willingness to accept (WTA) for any compensation could be considered as value of ecosystem dis-service (Champ, et al, 2003). Understanding how to determine the WTP and WTA will enable us to assess values of different ecosystem services.

Cropped areas and ecosystem disservices: Assessing the damage cost and managing through PES

Lalit Kumar

Intensification of agriculture in order to meet the higher food production poor management practices in agroecosystems are a common source of numerous disservices, including loss of wildlife habitat, nutrient runoff, sedimentation of rivers, greenhouse gas emissions, and pesticide poisoning of humans. In the TEEB study, 2009, the total value of ecosystem services from cropland is around $3839/ ha /year out of which $1361 /ha/year is for food production. This is low as compared to the value of $352249/ha/year for coral ecosystem and $ 25682/ha/year for inland wetlands. The cropped land has such a low value in terms of output because it tends to be used for a single service of food production. Also the value of food production is measured in terms of market prices while the value of other ecosystem services are priced much higher as they reflect much broader societal cost but having no organized market except carbon. The

pressure to increase food production leads to a negative trade-off with other ecosystem services like water quality and soil fertility. Ecosystem disservices from agro ecosystem are mainly due to market failure as the private costs are greater than the public benefits of securing ecosystem services (underground water). Rising vulnerability and uncertain income due to multiple environmental degradation factors are the source of farmers over exploiting soil and water resources. These poor practices contribute to the potential loss of ecosystem services which increases farmers' vulnerability to ecosystem change.

In India, subsidies are a major source to support farmer incomes and manage the supply of agricultural commodities. But Payment for Ecosystem services (PES) is a more effective tool to mitigate the disservice emanating from agro ecosystem. Farmers require financial payment from society to maintain and increase the provision of ecosystem services for both current and future generations. A comprehensive PES would do a cost benefit analysis of social benefit of food provisioning and private monetary cost to the overall food security of India. Since support and payments under PES require some income foregone from agriculture, the same can be compensated by reduction in disservices from agriculture providing relief to both farmers and society.

Net Ecosystem Service Value from Paddy Wetlands – What does the Studies Say?

Manjula M

Environmentalists and ecologists worldwide have contrasting views on the utility of paddy wetlands. There is a group of environmentalists and ecologists who believe paddy lands contribute to methane emission and thereby to climate change (Charles &Bollich (1993), Cicerone et.al.(1992), Minoda and Kimura (1994)). And on the other hand, there is a group of environmentalists who recognise paddy lands as agricultural wetland ecosystems having significant role in ensuring food and environmental security. Studies conducted by Baker *et.al.*(2009); Martina and Emma (2011), Iwasaki *et.al (*2012), Shivakoti and Bastakoti (2010) provides evidence for the role of paddy lands in ground water recharge, water regulation, flood

and drought control and conservation of biodiversity, in addition to their primary role in food production.

The term multi-functionality is used to refer to the ecosystem services provided by paddy landscapes and multi-functionality of paddy lands is a focal issue in agricultural policies related to international trade negotiations of predominantly rice growing E.Asian countries (FAO 2007). Research conducted in Japan, Korea and Taiwan (Huang et al., 2006; Kim et al., 2006; Matsunoet al., 2006) on the multifunctionalities of paddy cultivation has proven the role of rice cultivation in controlling floods, ground water recharge, prevention of soil erosion, decomposition of organic waste, maintaining water quality, climate mitigation and biodiversity conservation. Conversion of paddy lands is said to have impacted many of the ecosystem services leading to water scarcity in the converted paddy areas of Waynad District in Kerala (Vinayachandran, and Joji, 2007). Gopikkuttan and Kurup (2004) assessed the ecological and economic aspects of paddy land conversion in Kerala. They observed erosion of biodiversity (decline in species population, loss of frogs and fish, loss of beneficial plants like leafy greens, medicinal plants etc) and depletion of water table in the rice converted areas.

Similarly, several attempts have been made across the globe to value ecosystem services from paddy wetlands. These studies provide an overview of the various techniques used in valuing the different wetland services. None of the studies take up a comprehensive valuation of all the services offered by wetlands which are multiuse, multifunctional ecosystems. Omission of any one of the values – direct use, indirect use, or non-use values- will lead to an undervaluation of the wetlands studied. This will have reflections in the management and policies governing paddy wetlands making them ineffective in protecting/conserving these wetlands. The paper attempts to arrive at net economic value for ecosystem services/disservices accrued from paddy wetlands using results from published studies across the globe.

Institutional forms for implementation of PES mechanism in agriculture : Experiences from across the globe

Ramachandra Bhatta

By definition, PES is defined as a voluntary transaction where a well-defined environmental service is being bought by a service buyer from a service provider, if and only if, the service

provider secures service provision (Wunder, 2005).This naturally warrants the presence of a middleman between the provider of service and the enjoyers of the same. In this case,where the provider himself is a beneficiary of the service,while he provides it. The complex nature of the situation ,starting from the awareness on the part of consumers, their willingness ,payment vehicle and the institutional system for transaction necessitates detailed and indepth study on experiences from across the world . The analysis helps to prescribe a possible model for implementing PES in agriculture

18:00 –19:00

Learning game: **Operationalising IWI for policy-making through a learning game**

Bharath Palavalli and **Anantha Duraiappah**, MGIEP

Cantors World – A simulation game to teach the Inclusive Wealth Model

The Inclusive Wealth model (IWM) developed by Partha Dasgupta and Ken Arrow offer a viable substitute for GDP to measure progress. The underlying premise of the IWM is that the real progress of a country should be not based on the flow of income produced by the stock of capital a country is able to accumulate. This stock also called the Productive Base provides a sustainable measure as it gives an indication of the potential asset a country has to produce the level of output to meet wellbeing objectives.

The Inclusive Wealth Report (IWR) was an attempt to provide an alternate report to the World Bank's World Development Report and the UNDP's Human Development Index. The first report under the directorship of Anantha Duraiappah was released at the 2012 World Summit at Rio and was acclaimed by the Economist as a credible substitute for GDP.

The challenge we face is to present the IWR is a relatively clear and simple manner that is attractive to policymakers as well as students of economics and sustainability. IT was therefore decided to develop a simulation driven game that allows students to learn the IWM by playing the game using real data at the country level.

In order to understand the uncertainties involved in governing a complex socio-economic system such as a country where there are no true or false solutions, we need a space that allows the decision makers to explore different decision trajectories, understand implications of our actions, and to be able to learn from that experience. In order to make policy decisions, it often becomes important that the trade-offs between resources and constraints of policy operationalization are mapped. Games provide the players a framework within which they can weigh various parameters, a few of which are quantified and tangible with those that are often intangible and unquantifiable. This allows players to then understand the implications of their decisions.

The three objectives of the game are to understand a) the implications of policy decisions, b) the relationship between the three capitals (produced, human and natural) and c) what it could mean to achieve the sustainable development goals in the future. The different interconnected parameters that underlie a country's social, political and economic context are modelled based on the parameters and variables available in the Inclusive Wealth Index.

The participants play the role of ‘sole’ decision makers of the country who decide the specific targets for their respective countries. The players then make changes to the various parameters in the game through specific policy interventions that are available either as monetary investment or regulatory change or providing subsidies. These actions by the players affect the status of resources in the country and then have a cascading effect on the produced, natural and human capital. They will then be able to measure the impact of their decisions on the various variables and make course corrections every year. The game will be played between the period 1990 and 2010. The facilitators of the game session will be able to monitor the decisions and trajectories of the players in the game.

Discussion

Green Finance in India: Challenges and Research Requirement

Moderator: **Saudamini Das**

Speakers: **Atin Prakash** and **Baiju N Kurup**

Day 3

November 10, Friday

Session 3.2.1: **Livelihood**

Chair: **Amita Shah**

Ecosystem services and agricultural livelihoods: An analysis of trade-offs in peri-urban Bangalore

Dhanya B., Sheetal Patil, Meghana Eswar, Raghvendra Vanjari and Seema Purushothaman

School of Development, Azim Premji University, Bangalore

ABSTRACT

Rural-urban interfaces worldwide are increasingly witnessing massive transformations that alter functions and services of peri-urban ecosystems. This study attempts a systematic mapping of ecosystem services in diverse agricultural systems in peri-urban areas of Bangalore, one of India's fastest growing metropolis. Exploratory visits were undertaken to 32 locations in transects along both north and south directions from the city. The villages were sampled using a composite stratification index based on distance from city centre and percent built up space along the urbanrural gradient. Information collected from visual observations and interactions with farmers were collated to identify the crucial ecosystem services from agricultural landscapes along the gradient and the prominent tradeoffs between and within the categories of ecosystem services that impact farming livelihoods. The analysis revealed that the tradeoffs varied in temporal and spatial dimensions with complementary interactions leading to synergies in services in some situations. Stakeholder interactions also highlighted disservices from agricultural systems in the peri-urban space in some cases. The paper further discusses the potential consequences of the tradeoffs/synergies on sustainability of farming livelihoods.

Keywords: agro-ecosystems, peri-urban, small farmers, trade-offs, synergies

Can Third Party Certification Programs Improve Livelihoods and Reduce Food Insecurity: An Empirical Study from Southern India

Pradyot Ranjan Jena

School of Management, National Institute of Technology Karnataka

Bibhu Prasad Nayak

School of Livelihoods and Development, Tata Institute of Social Sciences (TISS), Hyderabad

ABSTRACT

Impoverishment in the tribal regions of India stands at a striking difference to the substantial economic growth achieved in other regions of the country. With lack of access to key infrastructural facilities tribal people traditionally engage in subsistence activities such as collecting forest products and undertaking subsistence farming. Coffee as a cash crop and coffee certification as a marketing channel has been introduced in the last decade in some of the tribal regions in India to ameliorate the livelihoods of the people. This paper analyzes the welfare impacts of fairtrade coffee certification on small-scale coffee producers in the Araku valley of Andhra Pradeshin India. The paper uses endogenous switching regression to account for the heterogeneity in the decision to be certified, self-selection issue and endogeneity problem. The analysis is based on a unique panel survey of around 200 households over the years 2010 and 2011 undertaken in the hilly and disadvantaged geographical terrains of Araku. The findings show that certification has a positive impact on household income and poverty meaning that certification has improved the welfare of the households.

Keywords: Coffee, India, Smallholders, Fairtrade certification, Endogenous Switching Regression

Role And Movement Pattern Of Women Entrepreneurs In The Fish Value Chain: A Micro Level Study In India

Sneha G

MBA Student, Amrita School of Business, Amrita University, Coimbatore

Gopakumar V

PhD Scholar, Amrita School of Business, Amrita University, Coimbatore

Amalendu Jyotishi

Professor, Amrita School Of Business, Amrita University, Bengaluru Campus

ABSTRACT

Entrepreneurs operating in the subsistence markets, especially women, are often susceptible to external shocks than those in affluent markets. This paper studies the vulnerabilities and resilience of women entrepreneurs involved in fish supply chain. Commodity value chain analysis is used to study the links (or nodes) between the production line and the consumption line. We extend this value chain analysis in the context of marine fisheries.

We identify the processes and actors in the fish value chain and locate women entrepreneur role in this matrix. The multiple vulnerabilities that they face at the various nodes are mapped and then the Sustainable Livelihood Approach is used to study the resilience strategies. The vulnerability may be political or regulatory, economic, catch, and technological. Against the backdrop of these vulnerabilities, endowment of natural capital, physical capital, social capital, financial capital and human capital among the women entrepreneurs play important role in the resilience against the backdrop of these vulnerabilities.

By studying the role of women as entrepreneurs in the fish value chain we intend to do a twofold contribution. At the first level, we identify the role of women entrepreneurs in the spectrum of fish value chain. Second, through the qualitative analysis based on interactions with the women entrepreneurs in Tamil Nadu and Kerala we identify the characteristic and evolution of women entrepreneurs in this value chain.

Keywords: Commodity Value Chain Analysis, Women Entrepreneurship, Fisheries, Kerala,

Tamil Nadu, India, Resilience, Vulnerability

Drivers of adaptation decisions in marine fishing community of Mumbai, India

Krishna Malakar

Interdisciplinary Programme in Climate Studies, Indian Institute of Technology Bombay

Trupti Mishra

Shailesh J Mehta School of Management, Indian Institute of Technology Bombay

Anand Patwardhan

School of Public Policy, University of Maryland, USA

ABSTRACT

The Koli community in Mumbai, whose primary means of livelihood is fishing, faces a number of climate and non-climate related stresses, including changing patterns of extreme weather events, dwindling fish population and increasing pollution. In response to these changes, some community members have adopted strategies such as investing in motorized and mechanized boats, diversifying fishing gear, increasing the distance and length of fishing trips, and migrating to different fishing villages. This study attempts to evaluate the factors that influence the decisions to adopt such response measures. 200 fishermen from six fishing villages of Mumbai have been surveyed for the purpose. Logistic regression models are estimated to assess the contribution of different factors to the probability of decision to adapt. Capacity to adapt can be dependent on various social, economic and institutional factors such as education, health, experience in fishing, economic assets, sources of credits/subsidies, membership in cooperative/public bodies and presence of social support, for example, trust among the community and presence of relatives in the profession. The decision to adapt can also be influenced by perception of changes in the environment/climate, trade competition and future livelihood planning. Hence, various socio-economic and perceptual factors form the independent variables in the logistic regression models. Overall, economic and social capital, and perceptual factors are found to be important determinants of adaptation decisions. These results provide useful insights for the design of adaptation interventions to support the livelihood of the Koli community.

Keywords: Adaptation decisions, determinants, marine fishing, Koli community, Mumbai (India), logistic regression

Agricultural production and income in a disaster year: Findings from the study of Melanjippattu village affected by cyclone Thane

Harshan Tee Pee

PhD Scholar, Tata Institute of Social Sciences

ABSTRACT

The extreme events like flood, droughts, tropical cyclone, heavy precipitation and heat waves are known to affect agriculture production and livelihood of farmers. Many scientific predictions indicate that climate change will increase the number of extreme events, leading to more frequent natural hazards such as floods and cyclones. The impact of weather and environmental shocks are unevenly distributed among nations, regions, and classes as a result of different exposure and vulnerabilities. The poor sections of the society are severely affected due to disaster. The livelihood which depends up on natural resources have also affected due to the increasing cases of external environmental shock. The poor sections are compelled to sell their assets to smoothen their consumption immediately after the disaster. This study is based on a village study in a disaster affected village in Tamil Nadu. The village was surveyed in two periods; first, immediately after the disaster and second, after two years of disaster. Incomes and assets of the household have calculated in three agriculture years as part of this study. This study assesses the differential impact of the cyclone across the social and economic classes in the village. The result of the study shows that a drastic reduction in the income of poor peasant and rich peasant can easily cope with the disaster due to their surplus from cultivation and other sources of income. The poor households sold their land after the disaster. Many small landholders moved out from cultivation one year after disaster.

There is a tendency of reverse tenancy in the village. Women headed agriculture labor household have to depend on MGNREGA for the income after the disaster. The study shows that external environmental shocks deprive the material conditions of the poor households.

Keywords: Climate change; Disaster; Agriculture income; village study

Session 3.2.2: **Valuations, evaluations and viabilities**

Chair: **M N Sudhakaran**

Do Consumers Really Care about Green Practices? A Case Study of GHMC Star Hotels

Arakhita Behera

PhD Research Scholar, School of Economics, University of Hyderabad

ABSTRACT

The aim of this study was to investigate consumers' perception and attitude of green practices in star hotels in Greater Hyderabad Municipality Corporation (GHMC) and their influence on their willingness to pay. This article analyses data collected from 147 star hotel consumers across GHMC to gain insight into consumers' perception and attitudes towards green practices and their willingness to pay. An ordered logit regression model was applied to obtain the value of willingness to pay and determine the factors influencing it. Survey results showed that about 75.5 percent of the respondents were both partially and strongly agree for willingness to pay for green practices of star hotels; while 93.2 percent were willing to pay from 1-5 percent to more than 20 percent of premium in which 20.4 percent of consumers were willing to pay from 11 percent to 20 percent of the premium for green practices. According to results, some factors of consumer perception like b*eing more socially responsible; performing environmental practices; willing to stay at a green hotel when travelling; planning to stay at a green hotel when travelling* with demographic variable like marriage and having children status *significantly* influencing for willingness to pay premium for green practices in stat hotels. The findings illustrate that there is an unfilled market niche for 'green' in star hotels, as consumers care about star hotels that protecting the environment and would be willing to pay more to offset any additional costs associated with 'green' practices.

Keywords: Consumers' Perception, Attitude, Green Practices, Star Hotels, Willingness to Pay, Ordered-Logit model

Assessing the economic viability of alternative option for water management: a case study of Coimbatore District, Tamil Nadu

Sukanya Das and Karthick Radhakrishnan

Department of Policy Studies, TERI University, New Delhi-110070.

Bouzit Madji

BRGM, D3E/NRE-University of Montpellier, 1039 rue de Pinville, 34000 Montpellier, France.

ABSTRACT

Recycling of wastewater is becoming an important water management practice in recent years. Current usage of groundwater is also unsustainable, which presents an urgent need for integrated water resource management combining efficient use of water and options for reusing wastewater. Tamil Nadu is one of the water starved states of India where the surface water resource has been fully tapped and there is an increasing pressure on groundwater exploitation. Previous research also shows an increasing trend in public acceptability of wastewater reuse after being informed about and exposed to recycled water systems. The paper have two specific research objectives based on survey of stakeholders and farm households in Coimbatore district, Tamil Nadu, India. The first objective is to elicitate stakeholders perception and knowledge in using wastewater for irrigation. The proposed methodology applies Multi-criteria analysis using Analytical Hierarchical Process (AHP) involving a range of stakeholders (government officials, academicians, researchers, farmers and general public) to assess the multifunctional benefits of wastewater recycling. The second objective is to capture the total economic value of these benefits of wastewater reuse in agriculture by conducting the Contingent Valuation Method (CVM). The CVM survey was undertaken over 106 farm households in three groundwater over-exploited blocks. The CVM data were statistically analysed with the use of tobit regression method. The main results show that 90% of the farmers are willing to pay for recycled wastewater and accept to use it as an alternative option. The average willingness to pay by farmers for getting treated wastewater is 54 Rupees/year and the overall average willingness to pay (WTP) by the farmers is 165 Rupees/year. More interstingly, farmers

having less than one acres of land are willing to contribute maximum of Rs.127/ per annum with statistically significant and backward classes farmers are ready to contribute more for using treated wastewater and it is statistically significant. In particular, this framework would be useful for implementation which takes into consideration the choice across different stakeholders, and the application of cost-benefit analysis.

Keywords: wastewater, reuse, irrigation,, Analytical Hierarchy Process, Ccontingent Valuation Method, willingness to pay.

Improving evaluation knowledge for better regulation in the forest policies

Jyostna Puri, Megha Nath and Raag Bhatia

International Initiative for Impact Evaluation

Raag Bhatia and Louise Glew

World Wildlife Fund - USA

ABSTRACT

Forests are vital to sustainable development. An important component in decision making about forests and related sectors is understanding the evidence on what works, why, when, under what circumstances, and for whom it works. This study uses an intensive search strategy across multiple databases to systematically examine and illustrate as an Evidence Gap Map (EGM) the existing stock of evidence related to the forest conservation sector in low and middle-income countries. The study highlights policy-relevant findings based on environmental, ecological, and social welfare outcomes for interventions and identifies key gaps where little or no evidence from rigorous impact evaluations and systematic reviews is available. Our search yielded 110 impact evaluations, eight systematic reviews and four protocols for systematic reviews that focus on fifteen different forest conservation interventions in low and middle-income countries from 1990 to 2015.

The EGM highlights critical gaps in the areas of climate change policies, trade laws and management, and education and awareness campaigns. There is no evidence of measuring impacts in transparency and accounting, biodiversity, knowledge and behavior, supporting services and cultural services. Though few interventions like protected areas, decentralized forest management and payment of ecosystem services have been well studied; but the evidence base for them is skewed geographically and also focus on small number of outcome types. Most frequently measured outcomes have been forest cover and condition, and income and poverty reduction as there is readily available secondary data and geospatial data.

Keywords: Forest conservation, Policy and forest governance, Income and poverty reduction, Forest management practices, Impact evaluation and systematic reviews, Evidence gap map

Economic Valuation of Coastal and Marine Ecosystem Goods and Services in India

K. S. Kavi Kumar and Lavanya Ravikanth A.

Madras School of Economics, Chennai

(Ramachandra Bhatta, College of Fisheries, Mangalore; P. Naren, National Centre for Sustainable, Coastal Management, Chennai; Megha Nath, International Initiative for Impact Evaluation, New Delhi; Abhijit Sharan, Iora Ecological Solutions, New Delhi; Pranab Mukhopadhyay, Vanessa da Costa and Sulochana Pednekar, Goa University; Santadas Ghosh, Visva-Bharati University, Santiniketan)

ABSTRACT

India has a long coastline of 8118 km (including its island territories), along which 25 percent of its population resides within one kilometer of the coast. The Exclusive Economic Zone (EEZ) of the country spans over 2.02 million km2 and the total wetland cover area along the coastline is over 40,230 km2. The Indian Coastal Regulation Zone (CRZ 2011) notification lists a comprehensive set of ecosystems that play a critical role in maintaining the integrity of coasts providing ecosystem services. This study has chosen nine coastal ecosystems among 13 listed in the CRZ Notification to assess the economic valuation of the services they provide. Further based on an opinion survey of 120 coastal ecologists, the most important ecosystem services were delineated and prioritized using the pair-wise ranking method. There are very few studies on the macro-level assessment of economic value coastal ecosystems in the Indian context although there are valuation studies on individual ecosystems such as mangroves (Das, 2015). In this paper, the authors made an attempt to estimate the value of the coastal ecosystem services by using three approaches – direct market valuation, travel cost & benefit transfer method. The results of the study show that the total value of the selected ecosystems for provisioning services was INR 357 billion; regulating services (from mangroves, coral reefs, etc.) was INR 659 billion; and recreational value being INR 454 billion for 2012-13. Thus the mean estimated value of the coastal and marine ecosystem services for India was INR 1.5 trillion, approximately 3.2 percent of the Net National Product (NNP) in 2012-13. However, the estimates do not include the value of consumer surplus, hence the study represents a highly conservative estimation.

Keywords: Ecosystem; Valuation; Coastal; Provisional; Regulating; Recreational

Session 3.2.3: **Governing and Managing Climate Change**

Chair: **Bibhu Prasad Nayak**

What lies ahead for global climate governance? A discussion on key approaches and the experience so far

Udayakrishnan Azhakath

Research Associate, Business Research- Clean Energy & Sustainability Services(CESS)

Ernst & Young LLP - Global Talent Hub Division

ABSTRACT

One of the most important challenges in the creation of a comprehensive global plan is the existence of multiple mechanisms, regimes and targets. The paper will attempt to critically evaluate the advantages and disadvantages of the market-based models and state-based models of climate change mitigation and adaptation. Post the expiry of Kyoto Protocol, we have witnessed a shift from the market oriented flexible mechanism to a state oriented mechanism where states assess their capability to reduce emissions (developed nations) or take mitigation measures (developing nations).

The paper will include an extensive review of the progress and performance of the marketbased approaches to tackling similar global collective action issues such as ozone layer depletion, biodiversity and poverty reduction. While the Kyoto protocol was legally binding, the post-Kyoto agreements are a 'set of guidelines' to ensure all the countries participated in the process. How successful were other legally binding global targets on social, economic and environmental issues? Looking ahead, this paper will make an earnest effort to assess the chances of success for state-based non-legally binding approaches like the Paris Agreement.

The paper will also look at the efficacy of both the approaches in the developing country context and how the major developing countries have fared in terms of meeting targets under both regimes. There will be a review of Millennium Development Goals (MDGs) and their implementation and the current Sustainable Development Goals (SDGs) – both of which are non-legally binding state-based mitigation programs. Finally, the paper will also explore and discuss the possibility of any other alternative approaches – bottom-up approach, decentralized carbon abatement targets and strategy within nation states.

Keywords: Climate Change, Environmental Governance, Paris Agreement, Market-based mechanisms, state-based mechanisms

What would a socio-economic and energy technology system be like if we limit climate change to Paris Agreement? An hybrid modelling system approach

I. Arto

Basque Centre for Climate Change, Bilbao, Spain

T. Bulavskaya, H. Boonman, J.Hu, and S. Moghayer

TNO, Netherlands

K. Dhavala

Nalanda University

T. Filatova, and L.Niamird

University of Twente, Netherlands

ABSTRACT

We illustrate the integration method by designing and linking three model within a social-economy-energy system of coupled models across different spatial and temporal scales and sectors. For the policy simulations, the study will investigate two scenarios with respect to the technology costs. The effects of these two different pathways in combination with the climate target constraints are then assessed compared to the SSP2 scenario “Middle of the Road” as a reference scenario. For this, first the energy technology scenarios are modelled in the Global Change Assessment Model (GCAM). The (socio-) economic analysis is then mainly carried out by a macro-economic Computational General Equilibrium (CGE) model, EXIOMOD. EXIOMOD, in turn, provides economic trajectories to the third model: NIROO, an Agent Based Model (ABM). NIROO aims to quantify the cumulative impacts of household’s behavioral changes with respect to energy use (demand side activation) and their role in supporting a transition to a low-carbon economy in Europe. We present simulation results tracking the cumulative impact of behavioral changes among 3500 households in the Navarre region in Spain over 43 years (2007-2050).

Keywords: Climate change; Mitigation policy; integrated modeling

Climate Change Induced Migration: Challenges and Opportunities under International Law: A Case Study of India and Bangladesh

Akanksha Jumde

Ph.D. Research Scholar, Faculty of Law, Jamia Millia Islamia

Nishant Kumar

Assistant Professor Law, MVN University, Palval, Haryana

ABSTRACT

Climate change represents, perhaps, the greatest challenge of the twenty-first century. As temperatures and sea levels rise, governments around the world will face massive and unprecedented human displacement that international law currently has no mechanism to address. While estimates vary, the scope of the migration crisis that the world will face in the coming decades is startling. In addition to losing their homes, climate change migrants, under the current law, will encounter a refugee system governed by a decades-old Refugee Convention that offers neither protection nor the right to resettle in more habitable place. Armed with the most recent developments international climate change law following the December 2015 Paris climate conference (COP21), this paper considers which of the existing bodies in the United Nations are best equipped to address forced migration caused by climate change. As opposed to an amendment of the 1951 Refugee Convention or a new rights-based treaty for climate migration, the framework provided within the UNFCCC provides the greatest possible flexibility, autonomy, and cultural retention for climate change migrants while still protecting their essential human rights.

Keywords: climate change, global warming, migration, UNFCCC, human rights, refugees

Integrating Space Technologies into River Basin Management: An Indian Scenario

Ramnath Reghunadhan

School of International Relations & Politics, Mahatma Gandhi University, Kottayam

ABSTRACT

The river deltas are often characterised by rapid development, and because of the fragility leads to problems like flooding, land subsidence and environmental degradation. Space technologies could play a major role in the management and conservation activities, while supplementing development of the river basin region, its topographical information like baseline information, land use-land cover; geo-technical information incorporating both the developmental and environmental aspects can be incorporated. Globally, the use of tools such as satellite imagery, navigation and positioning, telecommunications and their integration in Geographic Information System (GIS) brings positive effects to economic development, environmental management and societal integration, redefining the meaning of development from that of conventional usage. This paper tries to understand the major activities related to diffusion of technology that takes place in the form of spin-off technologies, available from auxiliary development of space technology in India‘s space programme. This has supplemented and supported the need to engage in sustainable development as well as data collection and dissemination for analysis and flood forecast results, both natural and manmade, disaster risk reduction, prevention and mitigation. The use of space technologies for collection, creation and dissemination of a data and information system, which can act as an enabler for the management of river basin and its related ecological, social and economic factors, thus helping in integrating environmental and social factors into the existing developmental approach and governance mechanism.

Keywords: River basin management, space technologies, India, environmental management, societal integration, disaster management.

Role of voluntary compliance in managing climate change at firm level in India

Mousami Prasad

Research Scholar, SJMSOM, IIT Bombay

Trupti Mishra and Varadraj Bapat

Associate Professor, SJMSOM, IIT Bombay

ABSTRACT

CO2 emission is contributing to climate change that is likely to have an adverse impact on human health. Firms are one of the important stakeholders in managing climate change. The present study examines the role of voluntary compliance in managing climate change at firm level in case of developing nation. Using the economics of emission framework, voluntary compliance is modelled as a demand side factor that is argued to shift the demand curve of emissions that may contribute in lowering CO2 emissions. Voluntary compliance is measured using environmental management standard - ISO14001 procured by firms. CO2 emissions for firms are estimated from energy consumption using IPCC reference approach. The study uses data of 76 firms from Indian iron and steel sector over the time period FY2007 to FY2012. Panel data regression is used to examine the relationship between voluntary compliance and emissions. The results of the study find that there is a negative relationship between voluntary compliance and CO2 emissions, suggesting that ISO 14001 may help firms in achieving low carbon growth. The findings have implications for policymakers and company managers.

Keywords: CO2 emission, climate change, iron and steel sector, voluntary compliance, economics of emission

Session 3.2.4: SDGs and Global South 4 **Inequality, inclusion, access**

Chair: **Shyjan Davis**

Factors Influencing Corporate Social Responsibility Expenditure of Indian Mining Firms: Implications for Ecology and Social Inclusion

Saswat Kishore Mishra

Dr. S. Radhakrishnan Post-doctoral Fellow with Nabakrushna Choudhury Centre for Development Research (NCDS), Bhubaneswar, Odisha

Pulak Mishra

Associate Professor of, Indian Institute of Technology Kharagpur, West Bengal – 721 302, India.

Srijit Mishra

Professor of Economics and Director, Nabakrushna Choudhury Centre

ABSTRACT

The *Companies Act, 2013* raises a few questions: First, what explains the need for mandating CSR in India? Second, what is the incentive for the firms to comply and spend the minimum standard compliance in the absence of any sanctions from the government? Third, will the Act persuade the bigger mining firms who may already have been spending amounts well beyond the bare minimum requirement through traditional philanthropy to cut down their CSR expenditures to minimum standard compliance? The objective of the present paper is to determine the factors which influence CSR expenditure of Indian mining firms and understand peoples' perception towards CSR initiatives across caste-based social strata at Talcher coalfields in India. The study has been carried out at two levels: First, the factors influencing CSR expenditure are determined through secondary data sourced from the Prowess database. Second, peoples' perception towards various kinds of CSR initiatives undertaken is analyzed at household level through primary survey using structured schedule and focus group discussions. Using panel data estimation technique and random effects Tobit regression models, it is found that larger firm size or higher firm expenditure on advertisement or greater extent of vertical integration induces the firm to spend more on CSR activities. Conversely, firms would desire to spend less on CSR, greater their scale of operation. However, the amount of TCSR which the mining firms would be desirous to spend neither depends neither on their fiscal benefits received during that year nor on their profitability made in the previous year.

Keywords: Mining; Ecology; Social Inclusion; CSR; India

Perspectives on gender equality in the context of environmental sustainability

Lavanya Suresh

Assistant Professor, Birla Institute of Technology & Science-Pilani, Hyderabad

ABSTRACT

This paper looks closely at the sustainable development goal of gender equality in the context of environmental sustainability. It has been seen that without the inclusion of feminist concerns for gender equality, most green approaches are incomplete and may even threaten to intensify women's subordination. This is illustrated in this paper through a case study from the Nilgiris District of Tamil Nadu, where in, a local organization that operates successfully for environmental sustainability and women's financial inclusion does not achieve gender equality due to a choke hold patriarchy has on local organizations. This has lessons for the wider asia-pacific region as resource management in this region is subject to the intersectionality of capitalism, colonialization, caste, class, race and gender. This paper uses gender as the focal point to understand these intersectionalities in the context of environmental sustainability.

This paper challenges the claim often made that women, mainly tribal women, are biologically sexed or socially gendered beings are commensurate with, or in some way represent, the natural world. This is an unwarranted claim and undermines the struggle that has been waged against the way the identification of women with nature has been used to justify women's subordination. Women have been seen as limited and determined by their bodies and thereby excluded from playing an equal role in public life. It also posits a biologically based unity between women and the natural world that excludes men and unites women through their essential life-giving, life-loving 'natures'. This view presents a universalizing image of 'women', that ignores differences and inequalities. These claims infect further strengthen the patriarchal modes of subjugation of women. This paper instead situates itself theoretically in Bina Agarwal's idea that differences in attitudes to conservation between genders can stem especially from the gendered division of economic resources, and the gendered division of labour. Given this understanding this paper concludes that unless the idea of environmental sustainability understands the relationship between women and nature in the global south in the right manner, the policy initiative that stem from it may undermine the goal of gender equality rather than further it.

Distributional Impact of Common Property Forest Incomes on Rural Income Inequality: Case Study from Odisha

Abhilas Kumar Pradhan

Associate Professor, Ph. D, (Economics) Indira School of Business Studies

ABSTRACT

More than 300 million people across the world, especially the poor and marginalized depend substantially on forest resources for their daily subsistence and survival. Several studies have found that they serve as an important life support system for the rural poor, a source of income for the marginalized and low income households and impact considerably on household level income distribution. With this backdrop, the current piece of work has been conducted in a forest rich state Odisha in India; where forest covers 37.34 per cent of the state's geographical area and more than 57 per cent of villages are located in forest fringe areas. The study has threefold objective; First, it has attempted to estimate the extent and nature of dependency of the rural households on common property forest resources. Second, it assesses the impact of forest incomes on household level income inequality and Third, it examines the impact of different forest income sources on the overall income inequality. The research work is based on primary data, collected through a micro-level sample survey for 210 households in six villages of three blocks in three districts of the state Odisha. The study has used the Gini-coefficient of inequality and its source-wise decomposition technique (Stuart (1954), Pyatt, Chen and Fei (1980) and Lerman and Yitzhaki (1985)) for investigation. The field survey results reveal that forest income sources constitute 30.97 per cent of the total household income. Further, inclusion of forest incomes brings down the Gini-coefficient of inequality by 26.638 per cent hence reduces household level income inequality. The decomposition analysis indicates that forest incomes, irrespective of their sources serve as income equalizers (help reducing income inequality). Therefore, inequality in household level income distribution could be reduced considerably through appropriate policy interventions that would enhance incomes from forest sources while caring the forest ecology.

Keywords: Common Property Forest Income, Income Inequality, Gini Coefficient, Source wise Decomposition**.**

Can Increasing Human Development and Income Reduce Impact from Natural Disasters? Empirical Evidence for Floods in India

Chandra Sekhar Bahinipati

Gujarat Institute of Development Research, Ahmedabad, India

Unmesh Patnaik

Centre for Climate Change and Sustainability Studies, Tata Institute of Social Sciences, Mumbai

ABSTRACT

Using a data set on reported loss and damage from floods across the Indian states between 1953 and 2011, this paper empirically tests the hypothesis of whether the states are becoming flood resilient with increasing human development and income. Although voluminous studies have been carried out across the world to examine the role of disaster specific and the generic adaptation measures in mitigating damages from climate extremes, there is a limited empirical studies in the Indian context, particularly conducting an analysis among the flood affected states and also taking a dataset of more than 50 years. With employing zero-inflated negative binomial model, this study comes up with three major findings. *First*, an increasing trend has been observed for the reported loss and damage indicators not only in India but also across the flood affected states. *Second*, human development does not significantly reduce floods' impact as we found statistically insignificant coefficients. *Third*, except the house damaged indicator, income variable is found as insignificant. Results indicating that the higher human development and income do not necessarily mean that the states are becoming resilient towards floods. Therefore, this study suggests that the ongoing development strategies must take into account climate risk and address persistent adaptation deficit. Climate change likely to increase frequency and intensity of such events in the foreseeable future, and hence, these findings have larger policy implications in the context of declining potential impacts.

Keywords: Human Development; Income; Loss and Damage; Floods; Resilience; Indian States

Inequality in Access to Quality Housing in Kolkata- A Micro Level Spatial Analysis using

Geographically Weighted Regression

Ismail Haque

Research Scholar, Center for the Study of Regional Development (CSRD), School of Social Sciences (SSS), Jawaharlal Nehru University (JNU)

ABSTRACT

This detailed study examines the spatial dimensions of housing quality dynamics- a welfare issues increasingly gaining importance in many of the developing countries- considering the case of India‘s oldest metropolitan city, Kolkata, by modelling the determinants of access to quality housing to contribute to the emerging body of empirical knowledge. The evidence suggests that more than half of the wards (52%) suffer from housing quality deprivations with below average HQI scores reflecting colossal spatial inequality in the quality housing distribution in Kolkata. This paper uses both global and local models to determine the spatial variability of the select predictors of housing quality. Our result reveals that *geographically weighted regression* model outperformed the conventional least square estimates in terms of both model performance and prediction accuracy. In particular, % of Schedule Caste (SC) and Schedule Tribe (ST) population, % households living- the below the poverty line and in slum areas, and % voting turnout shows negative impact on housing quality. While % literate female, % female engaged in main workforce, followed by housing tenure, housing status and household with at least two married couples report to be a significant positive determinants of housing quality. A stark spatial dynamics in the access to quality housing has been unfolded from this study. Prioritizing the deprived wards concerning ensuring access to safe and affordable housing could help increase quality housing in Kolkata.

Parallel Panel discussions

14:30–16:00

Is there A Global Environmental Justice Movement?

Ecological distribution conflicts arise from an unequal distribution of benefits and burdens of economic activities derived from natural resources due to rising social metabolism (Martinez-Alier et al., 2016). They are struggles over who benefits from an environmental change and who bears the cost and often involve contradictory languages of valuation (Martinez-Alier, 2005). Environmental justice movements are a manifestation of these ecological distribution conflicts and are on a rise due to the increase in material and energy flows as mapped in the Environmental Justice Atlas (www.ejatlas.org).

This panel is proposed with the main objective to understand the theory of ecological distribution conflicts and the corresponding environmental justice movement and further substantiate it with evidences from fieldwork. The panel consists of 4 speakers who will give theoretical as well as empirical evidences to answer this question. Deepak Malghan will discuss the moral and material foundations of ecological justice drawing upon Gandhian and Marxian thoughts. This will be followed by two speakers discussing about cases of environmental justice movements in countries of the global South based on their field research: Arpita Bisht will provide an overview of ecological distribution conflicts over mineral extractivism in India and Sofia Avila-Calero will be analysing new forms of environmental justice movements over wind energy conflicts in the peripheries of Americas, Africa and Asia. Bisht will discuss ecological distribution conflicts resulting from 7 different commodities (non-fuel minerals) in different regions on India, by identifying incidents of social mobilization against extractivism and associated environmental injustices. The analysis of the occurrence, causal factors, distribution, protesting actors and forms of social mobilization will help in address some of the broad questions which come up when we question whether there is a global environmental justice movement, such as the linkages, the commonalities in vocabulary of protests, the socio-ecological and cultural background etc. Avila-Calero will be talking about another unique dimension of ecological distribution conflicts, that of transition to low-carbon energy systems by unevenly affecting rural and peripheral communities across the world. She will also explore the political dimensions of such environmental justice movements. This will be followed by Joan Martinez-Alier's talk discussing whether we have a global environmental justice movement which is caused by the growth and change in social metabolism and how it varies across regions and actors.

The panel intends to provide a platform for examining and comparing the different factors and processes that leads to the protests for environmental justice, and deliberate about the global movement for environmental justice. A few questions to be explored in this panel are: how does

the involvement of different actors, such as indigenous communities, women leaders or international NGOs affect the environmental justice movements? What are the difference and similarities in the vocabulary employed in the struggles across the global South? How are network formed and campaigns organized among different EJOs? How are local and global issues brought together? Is this movement a powerful force to bring the world economy into a less unsustainable path?

References

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Martinez-Alier, J., Temper, L., Del Bene, D., & Scheidel, A. (2016). Is there a global environmental justice movement? *The Journal of Peasant Studies*, 43(3):1-25.

List of Speakers and moderator, their affiliation and their contributions

1. Sofía Ávila-Calero, PhD Student, Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain

Email id- acalerosofia@gmail.com, Phone No. +34 693594231

Sofía Ávila-Calero is a PhD student at the Institute of Environmental Science and Technology (ICTA-UAB) and part of the Environmental Justice Research Group. Her ongoing project addresses the social and biophysical dimensions of renewable energy production under the lens of political ecology and ecological economics. Before starting her PhD, she completed a Master's Degree in Interdisciplinary Studies in Environmental, Economic and Social Sustainability (ICTA-UAB), and a Bachelor's Degree in International Relations (National Autonomous University of Mexico). She is also an active member of the Advisory Board of the Mesoamerican Society of Ecological Economics.

2. Arpita Bisht, PhD Student, TERI University, New Delhi, India

Email Id- arpitabisht1990@gmail.com Phone No. +91 8860574593

Arpita Bisht is a PhD student at TERI University, New Delhi, India. She is studying biophysical expansion of extractivism and related socio-ecological conflicts, ecological degradation and human rights violations in India. She is interested in exploring linkages between, and implications of, social mobilization on unsustainable patterns of extractivism. Her research interests also include anthropological studies of indigenous and tribal communities with a special

focus on the pluralistic conceptualization of nature as God, and on the nature of human-nature interactions in these cultures.

3. *Dr. Deepak Malghan, Assistant Professor, Centre for Public Policy, Indian Institute of Technology, Bangalore, India*

*Email Id- **dmalghan@iimb.ac.in** Phone No. +91 8026993355*

Deepak Malghan is an ecological economist with primary interest in the development of an analytically consistent characterization of the physical size of the economy relative to the ecosystem that contains and sustains it. Malghan is an eclectic scholar whose work spans several disciplines, and has made original contributions to disparate areas that lie outside the pale of theoretical ecological economics. His work engages with ecological political economy and human geography most broadly conceived. His writing cover topics ranging from social hydrology to historical political economy of interwar South Asia to intellectual history. He has an MPA from Princeton University and a Ph.D. in chemical engineering and ecological economics from the University of Maryland. He is the recipient of the Fung Global Fellowship (2014) and the VKRV Rao Prize in Social Sciences (2015).

4. Prof. Joan Martinez-Alier, Senior Researcher, Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain

Email Id- joanmartinezalier@gmail.com Phone No. +34 932682591

Joan Martinez-Alier is a senior researcher in the Institute of Environmental Science and Technology 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 Ramachadra 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 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 and in 2017 was awarded the prestigious Leontief Prize for his ground-breaking theoretical and applied work which has effectively integrated ecological, developmental, and justice-oriented approaches into the field of economics.

Moderator

Brototi Roy, PhD Student, Institute of Environmental Science and Technology, Autonomous University of Barcelona, Spain

Email Id.- brototi.econ@gmail.com Phone No. +34 602092003

Brototi Roy is a PhD student at the Institute of Environmental Science and Technology (ICTA-UAB) and part of the Environmental Justice Research team. Her doctoral research focuses of ecological distribution conflicts and environmental justice movement in the Indian subcontinent using a political ecology and ecological economics framework. Before starting her PhD, she completed a Master's Degree in Economics from TERI University, New Delhi, India and she holds a B.Sc. degree in Economics from the University of Calcutta, India. She is also an executive committee member of the Indian Society for Ecological Economics and a member of Research & Degrowth, Barcelona.

Marine Fisheries Resources and Technology: Some Sustainability and Equity Issues

Moderator:

1. Ramachandra Bhatta, ICAR- Emeritus Scientist, College of Fisheries, Mangalore

Members:

2. TV Sathianandan, Head, Fishery Resources Assessment Division (FRAD), ICAR-Central Marine Research Institute (CMFRI) Kochi.
3. Lynda Rodwell, Associate Professor (Reader) in Ecological Economics, School of Geography, Earth and Environmental Sciences, University of Plymouth, UK
4. John Kurien, Visiting Professor, Azim Premji University, Bengaluru
5. Aarthi Sridhar**,** Dakshin Foundation, Bengaluru and Ph. D Scholar, AISSR, University of Amsterdam

Panel Abstract

India's marine environment consists of ecosystems bearing cultural, ecological and economic value for millions of its inhabitants. Spread along the coastline of 7500 km of the main land and island territories, the marine ecosystems also are the cultural and economic backbone of many communities that live in the region. Over the last three decades, particularly since the late 1990s, the coastal regions have seen the rapid expansion of infrastructure, industrial, tourism, construction and other anthropogenic activities that threaten India's marine ecological spaces and its biodiversity. The significance of bio-resources in general and marine biodiversity in particular is not fully understood and valued because of the limited knowledge of their role. Most studies on biodiversity often focus on the number of species in an ecosystem but neglect ecosystem functions and cultural meaning.

Historically, the development of particular disciplines such as fisheries economics but also fisheries science itself led to particular framings of fisheries management. Many of these disciplines did not really engage with the social sciences such as anthropology or sociology which tended operates in isolation of the natural science disciplines. Each of these disciplines often generated concepts such as the 'tragedy of the commons' or MSY (maximum sustained yield), the histories of which are now being unraveled. Such concepts were based on multiple assumptions that were not only grounded within developments in the disciplines but on the social-political climate. This in-turn tended to influence greatly the ways in which fisheries, its development or its conservation were being understood.

For instance, the work of economists in the mid 20th C.E, led to the notion of the 'tragedy of the commons' of which marine fisheries was seen as exemplary. They postulated that there is a constant tendency among individual fishers to overexploit the rich fishing ground until the total revenue is equal to total cost. The total Indian catch was estimated to be twice the official landings reported as 75 million tones within EEZ for the period 1950-2010. The industrial sector contributed 35 % of the total catch and the subsistence sector which is not included in any official statistics was estimated to be second largest sector and the remaining 32% was contributed by the artisanal sector. Fisheries economists therefore suggested that privatization or sole ownership would lead to economically efficient allocation of fishing effort among grounds of different productivity. Thus most economists started believing that natural resources such as fisheries should be either privatized or managed by the government. Since governments are expected to be relatively less efficient, private participation was the only choice left before the social planner. With the introduction of the EEZs in 1982, coastal nations began increasing their fishing capacity through modern fishing methods and technology for exploiting fishing stocks within their EEZs.

Given this understanding, this panel brings together scientists from the natural and social sciences who reflect on the experience of fisheries development, the nature of fish, ways of understanding fisheries its technologies but also ultimately fishers' behavior and ways forward through the discourse of sustainability.

Some of the questions that the panel will address are:

1. What are the developments in fisheries resource assessment methods and in what ways do such practices contribute to either a situation of over-exploitation or sustainability in fisheries?

2. In what ways can the scholarship and concepts around the notion of 'ecosystem services' influence fisheries management and towards what ends? How does the notion of 'precautionary approaches' fit in with ecosystem services and fisheries management?

3. In what ways do technologies, rights but also the nature of resources interact to affect the ecological health of fisheries but also issues of sustainability and equity?

Paper Abstracts

Technological advances in Resources Assessment and Harvesting methods

T.V. Sathianandan

Being a natural resource marine fishery resources have the capacity to rebuild through reproduction which other natural resources like petroleum, coal, minerals etc. are lacking. Unless proper management measures are implemented regularly for sustainable harvest this natural resource also will suffer depletion and in the worst case extinction. The management measurers for sustainable harvest of fishery resources are derived through fish stock assessment based on fish stock assessment models and by using necessary data and information generated over a time period.

Traditional fish stock assessment models consist of two major categories known as micro analytical models and micro analytical models. Data requirements for the first category of models is comparatively less than for the second one. Micro analytical models generally use time series data on fish catch and fishing effort as input and these models explain the dynamics of the resource biomass by a mathematical function. After the analysis it yields the maximum sustainable yield (MSY) as well as the fishing effort and biomass corresponding to the MSY level based on which management measures are derived. In the second category different biological data and information about the resource such as growth, mortality, fecundity, life span, age/size distributions etc. are necessary for assessment exercise. A set of modelling separately for growth, mortality, yield predictions are to be carried out arrive at the estimate of MSY and other biological reference points based on which management options are to deduced.

An important advancement in the approach towards fish stock assessment is the ecosystem approach where in the entire ecosystem is taken into consideration starting from the phytoplankton where the conversion of solar energy into biomass takes place and the entire food chain (prey-predator) is traced up to the top predator each category finding a place in the ecosystem model. The advancement of computing power helped in the development of ecosystem approach and the popular ECOPATH model is an example. The model provides simulation of different scenarios and facilitates impact study on the ecosystem.

Further advancement in fish stock assessment that happened in the recent years includes multi-species models, ecosystem models such as OSMOSE and ATLANTIS, stock synthesis and size spectrum models. Stock synthesis is anintegrated approach that takes a more inclusive approach to modelling fish population dynamics utilizing a wide range of available data such as CPUE, fishing effort, survey abundance data, discards, length, age, weight composition data and tag-recapture data. Size spectrum is the distribution of biomass or abundance as a power function of individual mass or size. Spatial and temporal variability in community structure can be examined in terms of change in the shape of biomass size spectra.

A global perspective on the sustainability of marine resources –

Lynda Rodwell

This talk will cover the need for a more precautionary approach to the management of marine resources with particular focus on fisheries and aquaculture. There is a need for marine management to acknowledge not just the flow of marine resources extracted to satisfy human demands but the need to sustain a healthy marine resource fund which, in its natural state, provides us with ecosystem services. The talk will discuss the role of valuing ecosystem services in achieving sustainability.

Sustainability and equity issues

John Kurien

What I wish to highlight arise importantly from the triad of (1) nature of fishery resources, (2) the choice of technology and the (3) framework of rights both to the resource and the technology. There is an interaction between these three which is greatly influenced by socio-political factors and in turn influence the sustainability and equity issues. I will attempt to explain my case using a few examples from the evolution of Indian marine fisheries.

A social history of marine fisheries resource assessment in India

Aarthi Sridhar

How much fish are there in Indian waters and how much fish does the nation collectively produce? Resource estimation and catch assessments have become important markers of productivity of a nation's marine territories, influencing the country's fisheries development policy. In this paper, I trace the history of scientific activity around this problem of estimation of resources from colonial times to the present. One of the longest standing divisions of the Central Marine Fisheries Research Institute of India is the one known today as the Fisheries Resource Assessment Division (FRAD). This division has consistently produced data on fish catch within the country. I draw from multiple historical sources to piece together the history of resource assessment in the country, from archival records, scientific reports and from oral histories of scientists. In my talk, I trace the work of specific individuals and organizations that led to present-day practices around fisheries resource estimation that find traces in the contemporary work of state fisheries scientists. This enables us to appreciate the emergence, circulation and transformation of particular scientific concepts between and within territories.