



SUSTAINABILITY FAIR 2021

The Centre hosted its third annual Sustainability Fair online on March 26, 2021, on the theme of “Renewable Energy and Water Resources.” The Fair was inaugurated by Shri Vijay Rupani, Chief Minister of Gujarat.

The event featured keynote addresses by Dr Kalanithy Vairavamoorthy, Executive Director, International Water Association; Dr Ashok Das, Founder CEO, SunMoksha; and Dr Rajendra Singh, Chairman, Tarun Bharat Sangh, on topics related to challenges and opportunities in the international water sector, sustainable energy for rural development and community decentralised water management respectively.

Online interactive networking sessions and nearly 50 virtual exhibition stalls by industries and organisations working on renewable energy, water and other sustainability issues were hosted at the event. More than 600 participants attended the Fair from India and across the globe, including Singapore, Thailand, United Arab Emirates, Bangladesh, Germany, United States, Pakistan, Malaysia, Nigeria, Indonesia, Egypt and Sri Lanka.



Shri Vijay Rupani
Chief Minister of Gujarat

SUSTAINABILITY SEMINAR SERIES

The Sustainability Seminar Series brings prominent scholars and professionals in the area of sustainability to IIT Gandhinagar campus or online to discuss their works on sustainable development.

The Centre organised 15 webinars between September 2020 through June 2021 under the series. Speakers from world renowned organisations covered topics related to water, pollution, climate

change, energy and natural resources, wildlife and ecosystems at the webinars. More than 1,000 people from India, as well as the USA, UK, UAE, Switzerland, Japan, Africa, Australia, Brazil, Ecuador, France, Indonesia, Hong Kong SAR, Kyrgyzstan, Spain, Sri Lanka and Saudi Arabia, attended the series.



Mr Henrique Veiga, Brazil

Speaker	Affiliation	Title
Dr Dipankar Saha	Secretary, Indian Chapter of International Association of Hydrogeologists, Former Member (Head Quarters) Central Ground Water Board and Former Member Secretary, Central Ground Water Authority	Unsustainable Use of Groundwater Resource: Threat to Food and Drinking Water Security
Dr Auroop Ganguly	Professor, Civil and Environmental Engineering and Director, Sustainability and Data Sciences Laboratory (SDS Lab), Northeastern University, Boston, USA	CARE with MIRACLE: Climate Adaptation and Resilience Engineering (CARE) with Machine Intelligence for Regional Assessment of CLimate Extremes (MIRACLE)
Dr Subimal Ghosh	Professor, Department of Civil Engineering, Centre for Urban Science & Engineering and Interdisciplinary Program in Climate Studies, IIT Bombay	Feedback from Land Processes to Indian Monsoon
Dr P P Mujumdar	Professor, Department of Civil Engineering and Chairman, Interdisciplinary Centre for Water Research, IISc Bangalore	Floods in a changing climate
Mr Henrique Veiga; Mr Emilio Gabbrielli	Brazilian Federal Govt officer; Ex-president of International Desalination Association, and ex-head of sales for Latin America of Toray Membranes Ltd.	Programa Agua Doce (Fresh Water Program): Drinking water to semi-arid rural communities through desalination in Brazil
Dr Sagnik Dey	Coordinator, Centre of Excellence for Research on Clean Air (CERCA) and Associate Faculty of School of Public Policy, IIT Delhi	Air Pollution and Health Burden in a Changing Climate

Speaker	Affiliation	Title
Dr Sachchida Tripathi	Higher Administrative Grade (Senior) Professor and Head of Department of Civil Engineering, IIT Kanpur	Air Pollution-Land Use-Cloud Interactions: Impacts on Climate Change, Agriculture, Hydrological Cycle, Human Health and Monumental Heritages
Dr R R Hoque	Head of Department of Environmental Science, Tezpur University, Assam	Does biomass burning matter?
Dr Aditi Mukherji	Principal Researcher, International Water Management Institute	Effectiveness of water adaptation responses in reducing climate and associated risks: Early findings from a meta review
Dr Virendra Tiwari	Director, CSIR-National Geophysical Research Institute (CSIR-NGRI), Hyderabad	Sustainable Water Availability
Amb Venkatesan Ashok	India's Ambassador to the Czech Republic and Zimbabwe and Former Secretary, Govt. of India	Ensuring India's Water Security: The Five R's
Dr Sejal Worah	Programme Director, WWF India	Conservation at Scale: What have we learnt?
Mr Raghav Pachouri	Associate Fellow, Electricity & Fuel Division, The Energy and Resources Institute (TERI)	India's Power sector Transition to 2030: Modelling and Insights
Prof Abhijit Mukherjee	Associate Professor at the Department of Geology and Geophysics, and School of Environmental Science and Engineering, IIT Kharagpur	Achieving Sustainable Development Goal for Clean Water in India: Microbial Pollution of Groundwater and Socio-economy
Dr Michael White	Senior Editor, Nature	Publishing in Nature: a climate science perspective

KPCSD SPONSORED PROJECTS

Golden Plastic

KPCSD provided a seed grant to Prof Amit Arora and Prof Madhu Vadali for the project "Golden Plastic - Turning plastic waste into local businesses through 3D printing." The seed funding supports preliminary work for a larger project titled "Golden Plastic" submitted to the DST Indo-Portugal Bilateral joint call in collaboration with Instituto Superior Técnico (IST), Portugal. The grant will support preliminary feasibility studies and proof-of-concept prototypes at IITGN. It will be utilised for equipment and hardware, such as FDM printer, extruder, shredder, components for controlled heating, temperature and pressure sensors, and other mechatronic components for design evaluation and proof-of-concept.

Weekly Surveillance of Wastewater for SARS-CoV-2 Gene Detection in Gandhinagar for Pandemic Curve Monitoring

The Centre funded a project related to COVID-19: "Weekly Surveillance of Wastewater for SARS-CoV-2 Gene Detection in Gandhinagar for Pandemic Curve Monitoring." The project, led by Prof Manish Kumar of Earth Sciences, seeks to detect and quantify variation in the genetic material of SARS-CoV-2 in the wastewaters of Gandhinagar to understand the pandemic, to maintain weekly resolution of the data for three months in genetic material loadings in the wastewater treatment plant at different stages and time period, to establish applicability of Wastewater Based Epidemiology (WBE) for COVID-19 surveillance as a potential tool for public health monitoring at the community level and to understand the pathogen diversity (viral and bacterial) from wastewater to establish early signs of WBE as a prediction tool.



Q & A



with **Prof Vimal Mishra**

Associate Professor
Civil Engineering

EXTREME CLIMATE EVENTS

How has climate change affected the rainfall pattern in India over the last few decades?

The summer monsoon (June-September) rainfall has declined in a major part of north India, Gangetic Plain, northeast India, and Western Ghat region. On the other hand, western India (Gujarat and Rajasthan) has experienced an increase in rainfall during the monsoon season. Other than rainfall totals, the intensity of rainfall has also changed significantly over the past few decades. For instance, low intensity rainfall has declined while high intensity rainfall has increased in a large part of the country. The change in total rainfall and the intensity of rainfall has implications for water availability, especially the groundwater recharge in India.

What is the most significant impact of climate change?

Climate change is likely to bring more extreme hot temperatures and heat waves that can lead to mortality and other impacts on public health. On the other hand, heavy rainfall and flooding cause enormous damage to infrastructure and agriculture every year.

How has the frequency and intensity of extreme precipitation events altered in India?

Intensity and frequency of extreme rainfall has increased in major parts of India. Moreover, in the future, the frequency and intensity of extreme rainfall is likely to increase because of the warming climate. The most notable consequences of extreme rainfall are flooding, damage to agriculture and infrastructure, and reservoir operations.

How and why has the pattern of extreme climate events changed in urban areas?

Heat waves and extreme precipitation events considerably affected urban areas in India during the recent decades. A large number of cities in India experience heat waves during the summer. The intensity, frequency, and duration of heat waves have also increased, which affected public health and posed challenges for cooling energy demands in cities. Similarly, extreme rainfall events and flooding in urban areas have now become common. Urban floods disrupt transportation and cause damage to infrastructure.

What are the challenges and limitations of existing climate models in forecasting in India?

The current climate models have greatly improved if you see the progress in the last two-three decades. However, a majority of the global climate models do not simulate the characteristics of the Indian summer monsoon very well. Moreover, several models are overly sensitive to increases in temperature, which somewhat limits our understanding of the projected future changes in water availability and extreme weather events in India.

What are the advantages of hydrologic monitoring and prediction?

We need better monitoring and prediction of extreme weather events such as heat waves and floods. Flood early warning systems are essential for saving lives. The number of floods and affected areas have tremendously increased over the last few decades in India. Real-time monitoring and prediction of floods, droughts, and heat waves are essential for disaster risk reduction.

Prof Mishra's research interests include surface water hydrology, climate variability and climate change, global food and water security, water resources management and large scale hydrologic modelling. Prof Mishra leads the Water and Climate Lab at IITGN, which has a team of research scholars and project staff working on various aspects of climate change such as hydrologic monitoring and prediction, climate and urban systems, climate extremes and understanding hydrologic sensitivity and change.

RESEARCH

Five research, consultancy and internally funded projects were initiated at the institute between January to June 2021, on different areas of sustainable development:

- **Jaichander Swaminathan**, Harnessing solar energy to achieve near-zero carbon emission for brine treatment (*Department of Science & Technology*)
- **Vimal Mishra**, Implications of COVID-19 on Gujarat State from climate change perspective (*Gujarat Energy Development Agency*)
- **Sameer Patel**, Investigating the exposure to airborne pollutants and risk of airborne transmission of pathogens in built environments (*internally funded*)
- **Sameer Dalvi**, Synthesis of magnetic catalyst coated microbubbles for removal of trace pollutants (*Department of Science & Technology*)
- **Arup Lal Chakraborty**, UAV-based laser spectroscopic monitoring of greenhouse gas emissions in urban and rural India (*Royal Academy of Engineering*)

IITGN faculty published nearly 15 journal papers, books, or conference papers during January to June 2021 on sustainability related themes:

Water

- Karunanidhi, D.; Aravinthasamy, P.; Subramani, T. and Kumar, Manish, "Human health risks associated with multipath exposure of groundwater nitrate and environmental friendly actions for quality improvement and sustainable management: a case study from Texvalley (Tiruppur region) of India", *Chemosphere*, DOI: 10.1016/j.chemosphere.2020.129083, Feb. 2021.
- Zang, Jian; Kumar, Manish and Werner, David, "Real-world sustainability analysis of an innovative decentralized water system with rainwater harvesting and wastewater reclamation", *Journal of Environmental Management*, DOI: 10.1016/j.jenvman.2020.111639, vol. 280, Feb. 2021.
- Maity, Jyoti Prakash; Vithanage, Meththika; Kumar, Manish; Ghosh, Ashok; Mohan, Dinesh; Ahmad, Arslan and Bhattacharya, Prosun, "Seven 21st century challenges of arsenic-fluoride contamination and remediation", *Groundwater for Sustainable Development*, DOI: 10.1016/j.gsd.2020.100538, vol. 12, Feb. 2021.
- Mukherjee, Santanu; Thakur, Alok Kumar; Goswami, Ritusmita; Mazumder, Payal; Taki, Kaling; Vithanage, Meththika and Kumar, Manish, "Efficacy of agricultural waste derived biochar for arsenic removal: tackling water quality in the Indo-Gangetic plain", *Journal of Environmental Management*, DOI: 10.1016/j.jenvman.2020.111814, vol. 281, Mar. 2021.
- Taki, Kaling; Raval, Nirav P. and Kumar, Manish, "Utilization of sewage sludge derived magnetized geopolymeric adsorbent for geogenic arsenic removal: A sustainable groundwater in-situ treatment perspective", *Journal of Cleaner Production*, DOI: 10.1016/j.jclepro.2021.126466, vol. 295, May 2021.
- Nema, Ayush; Srinivasan, Babji; Majoji, Thokozani and Srinivasan, Rajagopalan, "A

simple strategy to maximize water-reuse in multistage, multiproduct batch processes", *Chemical Engineering Research and Design*, DOI: 10.1016/j.cherd.2021.02.012, vol. 168, pp. 327-339, Apr. 2021.

- Bhagat, Chandrashekhar; Puri, Mukul; Mohapatra, Pranab K. and Kumar, Manish, "Imprints of seawater intrusion on groundwater quality and evolution in the coastal districts of south Gujarat, India", *Case Studies in Chemical and Environmental Engineering*, DOI: 10.1016/j.cscee.2021.100101, vol. 3, June 2021.
- Kumar, Manish; Sharma, Ayushi; Tabhani, Nareshkumar and Otaki, Yurina, "Indoor water end-use pattern and its prospective determinants in the twin cities of Gujarat, India: enabling targeted urban water management strategies", *Journal of Environmental Management*, DOI: 10.1016/j.jenvman.2021.112403, vol. 288, June 2021.

Climate Change

- Mishra, Vimal; Aadhar, Saran and Mahto, Shanti Shwarup, "Anthropogenic warming and intraseasonal summer monsoon variability amplify the risk of future flash droughts in India", *npj climate and atmospheric science*, DOI: 10.1038/s41612-020-00158-3, vol. 4, no. 1, Jan. 2021.
- Asoka, Akarsh; Wardlow, Brian; Tsegaye, Tadesse; Huber, Matthew and Mishra, Vimal, "A satellite-based assessment of the relative contribution of hydroclimatic variables on vegetation growth in global agricultural and non-agricultural regions", *Journal of Geophysical Research: Atmospheres*, DOI: 10.1029/2020JD033228, Feb. 2021.
- Harilal, Nidhin; Singh, Mayank and Bhatia, Udit, "Augmented convolutional LSTMs for generation of high-resolution climate change projections", *IEEE Access*, DOI: 10.1109/ACCESS.2021.3057500, Feb. 2021.
- Dangar, Swarup; Asoka, Akarsh and

Mishra, Vimal, "Causes and implications of groundwater depletion in India: A review", *Journal of Hydrology*, DOI: 10.1016/j.jhydrol.2021.126103, Feb. 2021.

- Khan, Shahzaib; Kamboj, Nishant and Bhatia, Udit, "Lifeline infrastructures and hydroclimate extremes climate: a future outlook", in *Climate change and extreme events*, DOI: 10.1016/B978-0-12-822700-8.00004-4, Amsterdam: Elsevier, pp. 105-123, Mar. 2021, ISBN: 9780128227008.
- Mishra, Vimal; Thirumalai, Kaustubh; Jain, Sahil and Aadhar, Saran, "Unprecedented drought in South India and recent water scarcity", *Environmental Research Letters*, DOI: 10.1088/1748-9326/abf289, Mar. 2021.

Energy

- Sukumar, Shivashankar; Pindoriya, Naran M. and Singh, Sri Niwas, "Short-term solar PV generation forecast using neural networks and deep learning models", in *Fundamentals and innovations in solar energy*, DOI: 10.1007/978-981-33-6456-1_7, Singapore: Springer Nature, pp. 127-140, 2021, ISBN: 9789813364561.
- Muthiah-Nakarajan, Venkataraman; Cherukuri, S. Hari Charan; Saravanan, B. and Palanisamy, K., "Residential energy management strategy considering the usage of storage facilities and electric vehicles", *Sustainable Energy Technologies and Assessments*, DOI: 10.1016/j.seta.2021.101167, vol. 45, June 2021.

Natural resources, wildlife and ecosystems

- Aiyadurai, Ambika, *Tigers are Our Brothers: Anthropology of Wildlife Conservation in Northeast India*, India: Oxford University Press, June 2021, ISBN: 9780190129101.
- Aiyadurai, Ambika and Pandya, Mamata, "Tales from Dibang valley: why are the akru's horns curved?", *Current Conservation*, vol. 15, no. 1, pp. 15-19, 2021.