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DIVECHA CENTRE FOR CLIMATE CHANGE

Newsletter of the

DIVECHA CENTRE FOR CLIMATE CHANGE

Pre-COP 30: National priorities for COP30

Conference of the Parties (COP30) Belém, Brazil

Training programme on climate change and forests

Indian Institute of Science
Bengaluru
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FROM THE CHAIR

Greetings!

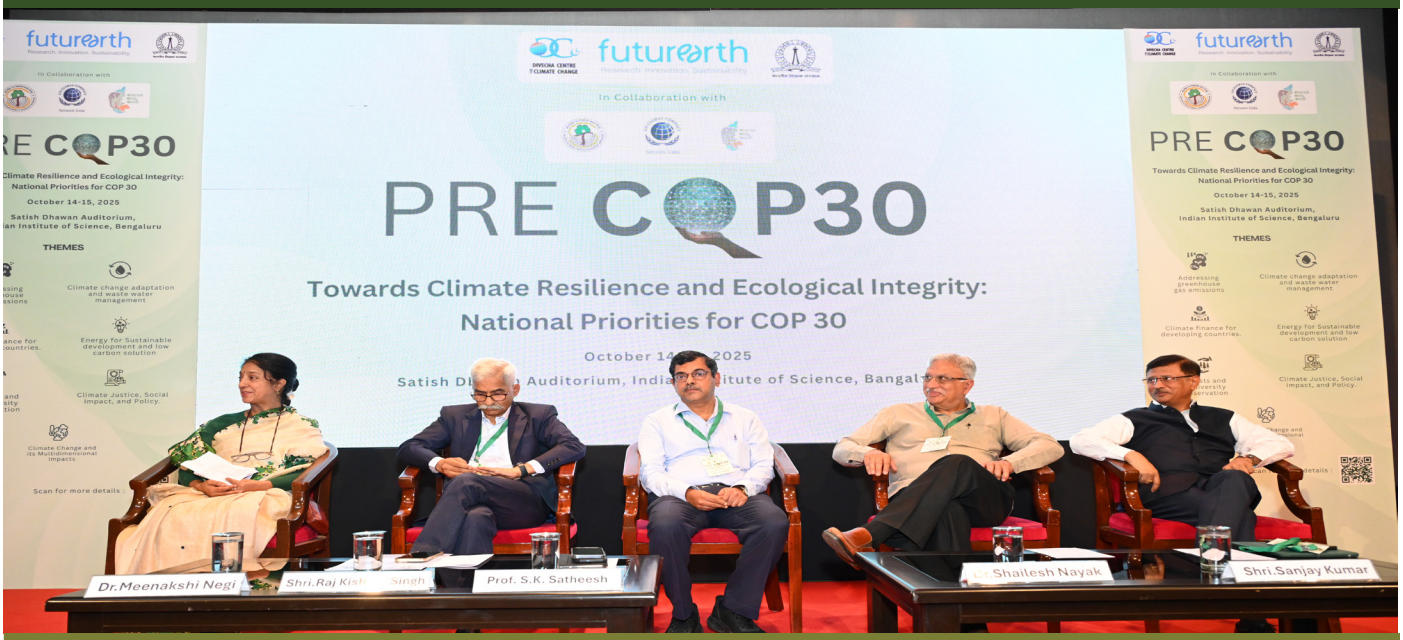
The United Nations Framework Convention on Climate Change (UNFCCC) held its annual conference, COP3 in Kyoto in 1997 where the Kyoto protocoal was adopted. In this protocol the industrialized countries agreed to reduce their carbon emissions. This promise was , however, not fulfilled. In COP13 in Bali, the Kyoto Protocol was replaced by the Bali Roadmap which required all countries to reduce carbon emissions. In COP15 in Copenhagen a commitment was made not to allow the global mean temperature to go above 2^{o}C its Pre-inudstrial value. In COP21, the historic Paris agreement was adopted. During the last decade efforts have been underway to ensure that goals of the Paris agreement can be met. In COP28, held in Dubai, the need to protect vulnerable nations from the repercussions of climate change was agreed. Another key theme addressed at COP28 was the impact of climate change on global health. Many tropical countries have experienced more heat waves and storms during the past 25 years. A major outcome of COP29 held in Azerbaijan,was a shift from climate change mitigation to adaptation. The New Collective Quantified Goal was a key outcome of the COP29 climate conference, setting new financial targets to support developing countries in their climate action. During the past decade several efforts have been made to ensure that all countries make a commitment to reduce the use of fossil fuels. Some developing countries felt that restricting the use of fossil fuels will affect their development plans. They wanted technoloigal and financial support to achieve the goals of the Paris agreement

Hence everyone looked forward to COP30 held in Belem, Brazil from 6th to 22nd November 2025. Ahead of COP30, António Guterres, the Secretary General of the United Nations, stated that “The truth is that we have failed to avoid an overshooting to 1.5°C above the pre-industrial value”. At the end of COP30 meeting the developed countries agreed to triple adaptation funding to protect communities against climate impact. The meeting did not come up with plans to transition away from fossil fuels and end deforestation. The COP30 failed to deliver major new pledges to curb greenhouse-gas emissions.

The final agreement in COP30 states ”The global transition towards low greenhouse gas emissions and climate-resilient development is irreversible and the trend of the future”. The global greenhosue gas emissions have not declined during the past ten years and hence there is a hope that we may be able to accelerate the lowering of greenhouse gas emissions in the future.

S. K. Satheesh

PRE-COP 30: NATIONAL PRIORITIES FOR COP30



Speakers of the Pre COP30 workshop organised by DCCC and Future Earth South Asia Hub at Satish Dhawan Auditorium from 14th to 15th Oct 2025.

The Pre-Conference of the Parties30 (Pre COP30) workshop, organised by Divecha Centre for Climate Change, and Future Earth South Asia Hub at the Indian Institute of Science, Bengaluru, on October 14–15, 2025, in collaboration with the Karnataka Forest Department and the Institute of Wood Science and Technology, Bengaluru, brought together over 250 participants, including scientists, policymakers, industry representatives, NGOs, government officials, and students from across India.

The COP is the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC), bringing together nations to negotiate and advance global climate action. COP is crucial for encouraging international cooperation, ensuring accountability to climate goals, and aligning national policies with global commitments to limit temperature rise and enhance climate resilience. India's forests sequester 1.97 billion tonnes CO_2 and support 300 million people, while renewable capacity rose to 46.3%, driving forest restoration, carbon farming, and clean energy transition toward net-zero by 2070. India's historical contribution to global emissions stands at merely 3 % (1850-2020), ranking 129th in per capita emissions, yet the nation faces disproportionate climate impacts. India's principled stance on Common but Differentiated Responsibilities and Respective Capabilities, emphasizing that developed nations must achieve net-zero by the end of this decade to provide essential carbon space for developing countries' growth

trajectories. In addition, the climate finance outcome of COP29 was profoundly inadequate, setting the New Collective Quantified Goal (NCQG) at only $300 billion annually by 2035. This dramatically falls short of the $1.3 trillion minimum required by developing countries for climate action. Moving forward, the global community must urgently shift to grant-based, non-debt-creating finance mechanisms that uphold the principle of climate justice to successfully bridge this financial gap. It is not that India would not support the global climate goals. India's concern is with the funding mechanisms prevalent for achieving these goals. At COP30, India needs to focus on certain key aspects which are of significance not merely to the country but in general to talk in the interests of Global South.

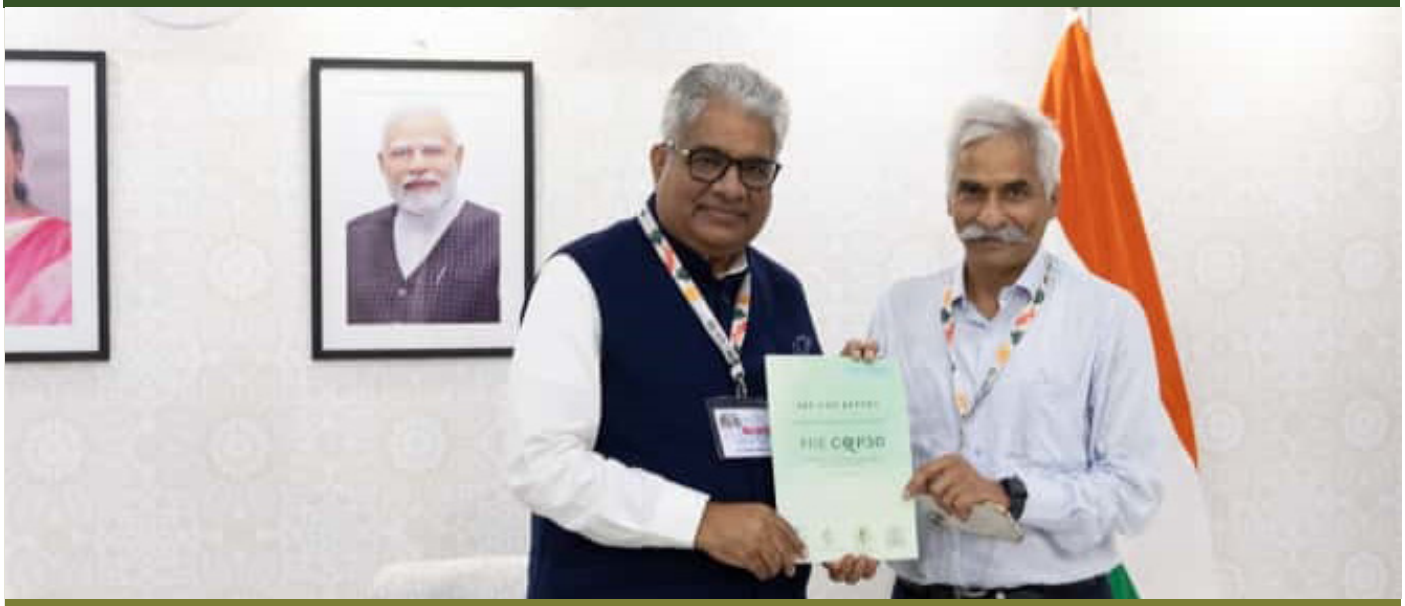
Some of these key focus areas, which have been elaborated in the subsequent sections of the report in greater detail, include:

- Enhanced climate finance with clear grant-based provisions and recognition.
- Protection of indigenous forests and biodiversity.
- Fair carbon budgeting reflecting historical responsibilities.
- Adaptation finance with mitigation, addressing sectoral challenges such as heat stress among vulnerable populations and rising Glacial Lake Outburst Flood (GLOF) risks in the Himalaya.
- Promoting sustainable lifestyles through energy efficiency, dietary shifts, circular economy, and efficient waste management.
- Get a deeper understanding of nuclear energy as an energy source and if feasible prioritizing it for reliable low-carbon power.
- Evidence-based policies grounded in scientific research and local knowledge are essential to ensure targeted, feasible, and measurable climate actions across forests, energy, agriculture, and disaster preparedness.

These were discussed in depth with practical considerations through the two-day workshop.

Participants of the Pre COP30 workshop.

CONFERENCE OF THE PARTIES (COP30) BELÉM, BRAZIL



Mr. Raj K. Singh, Co-Director, Future Earth South Asia Global Hub, Consultant Visiting Scientist, DCCC, IISc., presenting the Pre-COP30 booklet to Hon'ble Minister for Environment, Forest and Climate Change, Shri Bhupender Singh Yadav at the COP30 event

The 2025 United Nations Climate Change Conference or Conference of the Parties to the UNFCCC, more commonly known as COP30, was the 30th session of the United Nations Climate Change Conference. It was held at the Hangar Convention Centre (pt) in Belém, Brazil, from 10-21 November 2025. The theme of COP30, centered on "Delivering on the Paris Promise", emphasizing the urgent need for implementation, adaptation, and equity, especially with a strong focus on nature, forests (the "Amazon COP"), finance, and inclusive solutions for vulnerable communities. Key goals involved strengthening multilateralism, connecting climate action to people and economies, and accelerating Nationally Determined Contributions (NDCs) under six pillars: mitigation, adaptation, finance, technology, capacity-building, and implementation.

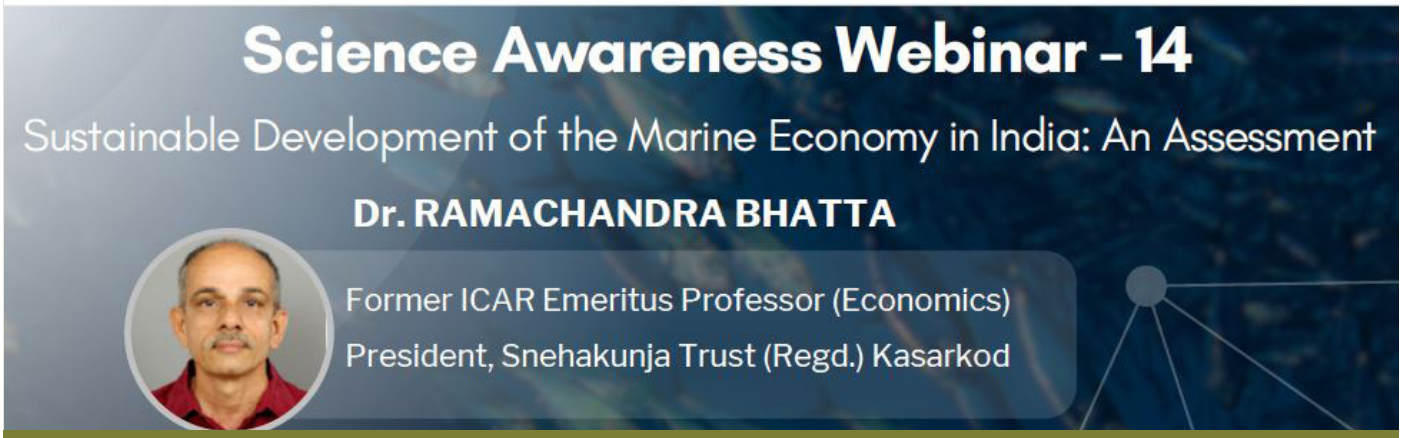
Mr. Raj K. Singh, Co-Director, Future Earth South Asia Global Hub, Consultant Visiting Scientist, DCCC, IISc., participated in COP-30, held in Belém, Brazil, from November 11th to 20th, 2025. During the conference, he had the honour of meeting India's Hon'ble Minister for Environment, Forest and Climate Change, Shri Bhupender Singh Yadav, and briefing him about the initiatives of the Divecha Centre for Climate Change (DCC), Indian Institute of Science, particularly the organisation of the Pre-COP Workshop held on 14–15 October 2025. He highlighted that the workshop brought

together leading scientists from diverse disciplines to identify India's climate priorities and to frame clear, evidence-based scientific messages for COP-30. He also presented the Hon'ble Minister with a copy of the Pre-COP Workshop Report. He also held a detailed discussion with Mr. Acquino Vimal, Joint Secretary (UNES), Ministry of External Affairs, focusing on the importance of presenting robust, evidence-based scientific outcomes in global climate negotiations. They discussed how institutions like IISc can strengthen India's technical framing in such high-level meetings.

At COP-30, Mr. Raj K. Singh had the opportunity to contribute as a panellist in the session titled "Afghanistan's Climate Struggles: Voices from the Ground." The discussion brought out the acute vulnerabilities faced by communities in conflict-affected regions and the need for international support to build resilience. He also attended a side event at the ECOWAS Pavilion, where he participated in deliberations on sustainable forest management, climate resilience, and community-centric development pathways for an inclusive green future in West Africa. Further, he visited the GAUC Pavilion and interacted with the young students managing the pavilion. Their enthusiasm and engagement with climate science and action were noteworthy. A significant interaction during the conference was with Ms. Cecilia Gumtree Najena, Director, Intergovernmental Support and Collective Progress Division at the UNFCCC. It centered on the role of scientific institutions in strengthening global climate governance. Overall, participation in COP-30 provided valuable opportunities for scientific exchange, policy dialogue, and showcasing the work of the Divecha Centre for Climate Change to global stakeholders.

Mr. Raj K. Singh attending a side event at the ECOWAS Pavilion

FE WEBINAR: SUSTAINABLE DEVELOPMENT OF MARINE ECONOMY IN INDIA



Dr. Ramachandra Bhatta, delivering his talk on : Sustainable Development of the Marine Economy in India: An Assessment on 23rd October 2025.

The Future Earth Global Secretariat Hub South Asia, DCCC, hosted an online webinar titled "Sustainable Development of the Marine Economy in India: An Assessment", by Dr. Ramachandra Bhatta, Former ICAR Emeritus Professor (Economics) & President, Snehakunja Trust (Regd.) Kasargod on 23rd October 2025. The Karnataka coast, stretching 300 km, supports rich marine productivity with a fisheries potential of 4.25 lakh metric tons. Over the last two decades, large-scale mechanization has enabled fleets to exploit deeper waters, while parallel industrial growth in oil, shipping, power, fertilizer, cement, and other sectors has intensified anthropogenic pressures on coastal and marine ecosystems. The stretch between Mangalore and Udupi is particularly vulnerable, hosting single buoy moorings, oil jetties, power plants, and multiple industrial and urban effluent outlets. Dr. Bhatta's report examines the trade-offs between ecological and economic hotspots and presents an assessment of how fisheries, industries, tourism, and local communities utilize coastal and marine ecosystem services. Key recommendations include interstate collaboration on biodiversity conservation, notification of marine sanctuaries, linking fish productivity with pollution impacts, and improving fisheries infrastructure, subsidies, and women's participation in processing and marketing. The report further emphasizes establishing an SDG Cell within line departments, integrating marine ecosystem services into national accounting, strengthening data systems on marine landings, and prioritizing budgetary allocations for SDG 14 action plans.

FE WEBINAR: AIR QUALITY, CLIMATE AND HEALTH

(*From Left*) Dr. Kalpana Balakrishnan, Dr. Pallavi Pant and Dr. Sagnik Dey, speakers for webinar series - I on Air quality, Climate and Health conducted on 6th October 2025.

The Future Earth Global Secretariat Hub South Asia, DCCC, hosted the NC-India FE South Asia Webinar Series - I on Air Quality, Climate and Health an online webinar titled "Air Pollution and Health - What do we know and how far do we have to go?" on 6th October 2025. The first series was delivered by three eminent speakers, Dr. Kalpana Balakrishnan - Professor and Dean (Research) and Director of the WHO Collaborating Center for Research and Training in Occupational and Environmental Health at Sri Ramachandra Institute of Higher Education and Research in Chennai, India, Dr. Sagnik Dey, Vipul and Mahesh Chaturvedi Chair Professor in Policy Studies and Heads the Centre for Atmospheric Sciences, IIT Delhi, India, and Dr. Pallavi Pant who is an Environmental health scientist and Head of Global initiatives at the Health Effects Institute.

Air pollution is now recognised as the largest environmental health risk globally. Exposure to household and ambient air pollution causes an estimated 8 million premature deaths each year, according to the World Health Organisation (WHO), and is responsible for a substantial amount of disability for those living with diseases caused by air pollution. While most people in the world live in areas that exceed health based WHO guidelines for air quality, the impacts on health, quality of life and economy is disproportionately borne by low and middle income countries (LMICs).

FUTURE EARTH SOUTH ASIA KNOWLEDGE TO ACTION INITIATIVE

Mr. Raj Kishore, Visiting Scientist, DCCC, Co-Director of Future Earth South Asia, meeting with Ms. Uma Mahadevan (*Center*), Additional Chief Secretary & Development Commissioner, Government of Karnataka, on 4th November 2025.

The second joint review meeting between Mr. Raj Kishore Singh, Co-Director of Future Earth South Asia Hub, Visiting Scientist, IISc and Ms. Uma Mahadevan, Additional Chief Secretary & Development Commissioner, Government of Karnataka, was held on 4th November 2025 in Vidhan Souda to discuss the Future Earth South Asia Knowledge to Action Initiative. For the benefit of new members, Mr. Raj Kishore Singh, briefed the participants on the background and objectives of the proposed project, which aims to develop sustainable villages in Karnataka through a replicable protocol-based approach. Ms. Uma Mahadevan emphasized the need to develop a robust system that can be replicated across villages. She observed that although there have been isolated examples of sustainable or carbon-neutral villages, the key challenge lies in scaling up and replicating such initiatives across the State. A brief presentation was made by Future Earth South Asia Team, highlighting the framework of the proposed project, key objectives, and potential sources of funding.

The following points was discussed:

- The Co-Director, Future Earth South Asia Hub, informed that the purpose of developing a protocol is precisely to identify and demonstrate the most efficient pathways for building sustainable communities. This will enable replication of the prototype model in different locations using a scientifically validated approach. He further

requested the chair to issue suitable directions 'for the convergence of projects and schemes of corresponding sectors for implementation in the selected villages.

- After detailed deliberations, five districts in Karnataka were shortlisted for initial implementation: Uttara Kannada, Chamarajanagar, Ballari, Chitradurga (Challakere taluk), and Gadag.
- It was informed that at this stage, selection of suitable villages is very crucial. The Development Commissioner advised that the Future Earth South Asia Hub team may directly approach the Deputy Commissioners and Chief Executive Officers (CEOs) of Zilla Panchayats in these five districts to identify and finalize the villages for implementation.
- The Development Commissioner emphasized that the process of identifying the right village should involve field visits and detailed assessments across few villages before final selection.
- Additional Chief Secretary and Development Commissioner further noted that out of approximately 6,000 Gram Panchayats in Karnataka, nearly 700 comprise single-village Panchayats, which may be more suitable for piloting and effectively implementing the programme.
- The Mission Director, National Livelihood Mission (NLM) and the Commissioner, Watershed Development Department, were requested to hold a joint meeting with Future Earth South Asia Hub to discuss the existing field structures under their programmes and explore possibilities of convergence for implementation.

Funding and Convergence:

- It was noted that funding proposals are submitted to the Asia Science Mission.
- The Development Commissioner emphasised that this initiative should draw strength from the convergence of existing programmes and schemes of both the State Government and the Government of India, including ongoing missions and projects.
- The data collection, analysis, feedback, and monitoring system will be designed to support implementing agencies in fine-tuning interventions and ensuring effective decision-making.
- It was also suggested that convergent support may be explored from the Department of Science and Technology, and also other departments like Forest, Energy, Rural Development, Health etc., of the Government of Karnataka.

TRAINING PROGRAMME ON CLIMATE CHANGE AND FORESTS

Prof. S. K. Satheesh, Chair, DCCC, and Director, Future Earth South Asia Hub inaugurating the training programme on "Climate Change and Forests" at the Divecha Centre for Climate Change, IISc, on 8th December 2025.

The Future Earth Global Secretariat Hub South Asia, DCCC, hosted a two-week training programme on "Climate Change and Forests: An Interactive Approach to Science and Governance", from 8-19 December 2025 at DCCC, IISc. About 30 participants from across the country attended the workshop Many speakers from the Indian Forest Service (IFS) provided their insight to the participants. The programme was inaugurated by Prof. S. K. Satheesh, Chair, DCCC, and Director, Future Earth South Asia Hub. Mr. Raj K. Singh, Visiting Scientist, DCCC and Co-Director, Future Earth South Asia Hub outlined the scope of the workshop. Mr. B. P. Ravi, Principal Chief Conservator of Forests (PCCF) for Evaluation, Working Plan, Research & Training (EWPRT) and Climate Change (CC) was the chief guest.

The lectures discussed the following topics: 1. Understanding concepts of Climate Change, 2. Ecology and Biodiversity 3. Forest Governance, 4. Forestry systems and Conservation, 5. Forest based livelihoods and ecosystem services, 6. Understanding Climate Change from the lens of Forestry and Forest Biodiversity, 7. Biodiversity, Conservation Mechanics and Climate Change, 8. Forest Loss, Land Degradation and integrating indigenous knowledge into forestry, 9. Use of Digital tools in forestry.

Prof. J. Srinivasan, Former Chair, DCCC, spoke about climate change and climate models. He pointed out that the Arctic has warmed nearly four

times faster than the globe since 1979. Early warning signals indicate that several systems, such as parts of the Greenland Ice Sheet, Atlantic meridional overturning circulation (AMOC) and the Amazon rainforest may be losing resilience, which could mean their tipping points are approaching. There is a risk of tipping the overturning circulation due to increasing rates of ice melt leading to collapse of the Atlantic Meridional Overturning Circulation. A climate model is needed to test of understanding of the climate system, for the prediction of climate change, for attribution of causes of climate change. Climate models have certain limitations such as they cannot resolve some processes, and many approximations are made to model the complex Earth's system.

Ms. Madhu Sharma, Indian Forest Service (Retd. IFS) deliberated on "Community Centered Natural Resource Management for Climate Adaptation". She pointed out that water scarcity, high temperature, droughts, crop failures and floods were noticed more frequently. The ecosystem has changed and hence has impacted the biodiversity of forests. Dr. Dipak Sarmah, (Retd. IFS), discussed the diversity of forests in India. He spoke about the floral and faunal diversity in forests. He delineated the different forest zones present on Earth. India's temperate and alpine

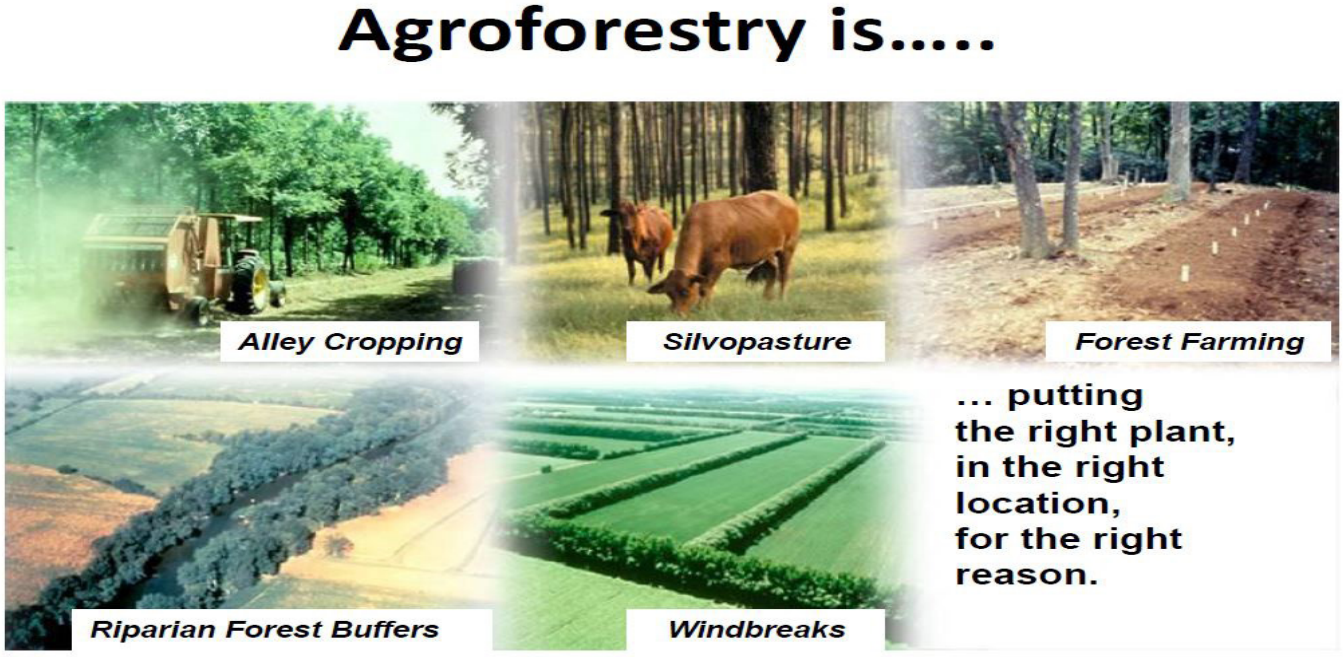
forests, primarily in the Himalayas, feature dominant conifers like Pinus (Pine), Cedrus (Deodar), Picea (Spruce), and Abies (Fir) at varying altitudes. Prof. Dr. H. Paramesh, Visiting scientist, DCCC, talked about "Climate change, health and forestry – The interlinkages". Forests significantly boost human health and well-being by providing clean air, fresh water, and food, reducing stress, offering medicinal resources, and acting as natural buffers against climate hazards. Trees filter pollutants, providing cleaner air, which is vital for respiratory health.

Mr. Basavaraj gave a brief overview of the Karnataka forest act of 1963 and Karnataka Trees Act 1976. This law was passed to protect and increase tree cover in Karnataka by regulating tree felling, requiring permits, establishing Tree Authorities and Officers, mandating replanting, and penalizing violations, aiming to restore ecological balance, especially in urban areas facing deforestation due to growth. The Karnataka Preservation of Trees Amendment Act, 2014 (KPTAA 2014) was a significant law that eased restrictions on tree felling for domestic/public use, increased felling allowances (timber, poles, bamboo), exempted certain species. Mr. B. K. Singh, IFS (Retd.), spoke on the evolution of Forest Policy in India. and The National Forest Policy 1952 was India's first post-independence forest framework. REDD+ (Reducing Emissions from Deforestation and Forest Degradation Plus) is an UN-backed framework that pays developing countries to protect their forests, reducing emissions from deforestation and promoting conservation, sustainable forest management, and enhanced carbon stocks. It works by creating financial incentives, often through carbon credits, for local communities and governments to keep forests standing, providing sustainable development, biodiversity benefits, and climate mitigation by valuing forests for the carbon they store. Mr. Raj K. Singh, Visiting Scientist, DCCC, discussed the changing expectations from forests and forests as carbon sinks. Forest carbon sequestration is nature's way of fighting climate change, where trees and forests absorb atmospheric carbon dioxide (CO_2) through photosynthesis and store it long-term in their wood, leaves, roots, and soils, acting as massive "carbon sinks" that reduce greenhouse gases.

Sruthi Subbanna, Project Scientist III, DCCC, talked about on Ecosystem Services. The Millennium Ecosystem Assessment work (MEA; Millennium Ecosystem Assessment, 2003) provides a framework for analysing coupled social-ecological systems. Within this framework the Ecosystem services

are classified into provisioning and supporting roles. These natural processes provide clean air, water, food, and resources but are threatened by degradation. Dr. Sruthi concluded her talk by outlining the main threats to ecosystem services which are habitat loss/land-use change, climate change, pollution (and invasive species, all driven largely by human activities leading to reduced biodiversity and ecosystem resilience.

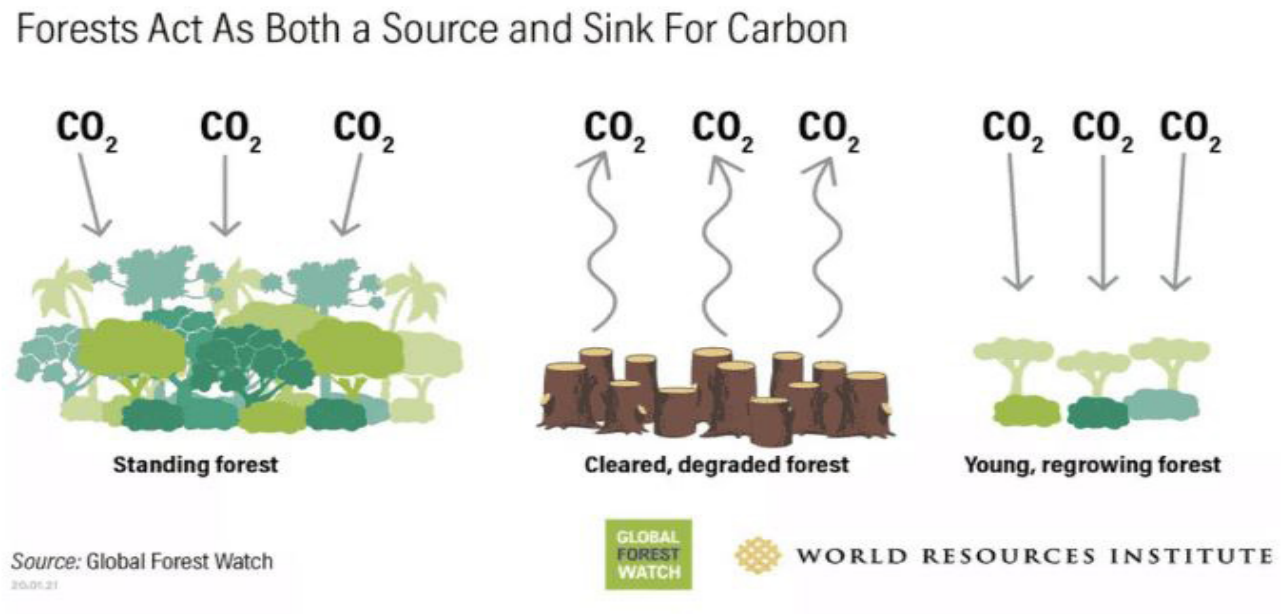
Dr. Syam Viswanath, Former Director, KFRI, talked on "Agroforestry" and "Food Forests: A way to combat malnutrition and enhance food security". Agroforestry is a sustainable land management system that intentionally integrates trees and shrubs with crops and/or livestock on the same land to create diverse, productive, and healthier ecosystems, offering economic, environmental, and social benefits, combining agriculture and forestry for more resilient farming. Agroforestry systems are classified based on several criteria, primarily structural (components like crops, trees, animals, and their arrangement), functional (productive vs. protective roles), socio-economic (subsistence, intermediate, or commercial), and ecological (climate zones like humid tropics, arid/semi-arid). Dr. Viswanath concluded his talk by outlining future directions in Agroforestry with focus on integrating technology with science, enhancing climate resilience, scaling up adoption through better policies and market access, and leveraging it for biodiversity, carbon sequestration, and SDGs, moving towards a more productive, and sustainable. Food forests are ecologically sustainable systems that mimic natural forests by integrating diverse fruit trees with annual and perennial food crops. Dr. Viswanath presented a case study on food forests in Vanasree farms, Thenkurissi, Palakkad, Kerala.



Mr. Vinay Luthra, IFS (Retd.), talked about “Ecotourism and Biodiversity Conservation”. Ecotourism connects travel to nature with conservation, aiming to protect biodiversity by providing economic incentives for local communities to preserve ecosystems, raising visitor awareness, and deterring destructive activities like logging or poaching. When done right, it creates sustainable livelihoods, educates people on conservation, and serves as a “human shield” for fragile environments, making biodiversity a valuable asset rather than a resource to exploit. He presented a few international case studies on direct revenues obtained from forestry conservation such as The volcanic range which spans Rwanda, Uganda and the Democratic Republic of the Congo, Forest area in Bhutan, Costa Rica’s forest conservation area, Galápagos National Park which is Ecuador’s first national park and a UNESCO World Heritage Site, and Maasai Mara National Reserve in Kenya. He also spoke about the Australian wildlife conservation and large national parks, and protected areas are in Savanna. He presented the nine crucial elephant corridors vital for elephant movement, with efforts focusing on securing these routes through land acquisition and policy development, including a new corridor policy and the state’s first elephant overpass to mitigate human-wildlife conflict. He concluded his talk by stating that the Karnataka state is acquiring private lands within corridors to create contiguous habitats. Prof. Krishnaraj, Institute for social and economic change, Bengaluru, delivered a talk on “Carbon Markets in India: Capture and Trading”. Economic growth often leads to climate change because producing more goods and services usually requires more energy, much of which still comes from burning fossil fuels like coal, oil, and gas. As economies grow, factories, power plants, and transportation systems expand, releasing larger amounts of greenhouse gases such as carbon dioxide into the atmosphere. Economic growth also increases consumption, meaning more natural resources are extracted and more waste is produced, which can lead to deforestation and higher emissions. Prof. Krishnaraj listed some of the low carbon development policies of India. India’s Long-Term Low Carbon Development Strategy (LT-LEDS) aims for net-zero emissions by 2070, balancing economic growth with climate action through key transitions in power, transport, industry, urban areas, and carbon removal, focusing on decoupling growth from emissions while addressing development Prof. Krishnaraj presented two case studies, one on Tata Steel Jamshedpur CCUS Plant and the second one on Adani Power. He concluded his talk by asserting that India’s Net Zero 2070 vision balances development priorities with global climate

commitments through phased, technology-led action.

Prof. J. Srinivasan discussed the impact of climate change on forests. Forests provide a "carbon sink" that absorbs a net 7.6 billion metric tonnes of CO_2 per year, 1.5 times more carbon than the United States emits annually. Forests absorb CO_2 when standing or regrowing and releasing it when cleared or degraded. Tropical rainforests are far and away the most important ecosystems for mitigating climate change. Tropical rainforests collectively sequester more carbon from the atmosphere than temperate or boreal forests, but they're also increasingly destroyed for agricultural expansion. The world's three largest tropical rainforests are located in the Amazon, Congo River basin and Southeast Asia. Over the past 20 years, forests across Southeast Asia have collectively become a net source of carbon emissions due to clearing for plantations, uncontrolled fires and drainage of peat soils. The Amazon River basin, which stretches across nine countries in South America, is still a net carbon sink, but teeters on the edge of becoming a net source if forest loss continues at current rates. The Amazon basin has experienced heightened deforestation in the last four years due to clearing for cattle pasture and degradation from fires. Of the world's three largest tropical rainforests, only the Congo has enough standing forest left to remain a strong net carbon sink. The Congo's tropical rainforest sequesters 600 million metric tonnes more carbon dioxide per year than it emits, equivalent to about one-third of the CO_2 emissions from all U.S. transportation. Protecting the remaining forests in all three regions is critical to mitigating climate change. According to findings from the Intergovernmental Panel on Climate Change (IPCC), the agriculture,



Forests are capable of both producing and absorbing carbon. World Resources Institute

forestry, and other land use (AFOLU) sector can provide up to 30 percent of the GHG emissions reductions needed to limit global warming to 2°C, at a relatively low cost Deforestation and forest degradation currently account for up to a fifth of global greenhouse gas emissions. Tropical forests alone are responsible for holding back more than 1°C of atmospheric warming. 75% of that is due simply to the amount of carbon they store. The other 25% comes from the cooling effects of shading, pumping water into the atmosphere and creating clouds. As global temperatures keep rising, forests become increasingly susceptible to drought, wildfires, pests, and disease. The global demand for commodities such as soy, palm oil, beef, and timber fuels deforestation. In the Amazon rainforest, land grabbing for commodity uses like cattle ranching or soy farming has advanced deforestation. Increasing protected forest areas and strengthening the rights of Indigenous communities to manage their own territories has proven effective at reducing deforestation and its associated emissions in Brazil. In boreal forests, the real wealth of carbon is below the ground. In colder climates, the processes of decay that result in emissions tend to lag behind the process of photosynthesis which locks away carbon in organic matter. Lack of precipitation and high temperatures dry out vegetation and organic matter (fuels), making them more flammable and easier to ignite. Wind significantly affects the spread of fire and direction of spread, often making large fires difficult or impossible to control. Higher temperatures reduce soil and fuel moisture, making forests more combustible. Prof. J. Srinivasan presented different case studies of forest fire occurrences in the Amazon, in Brazil, Siberia, Russia, France, and California. Australian wildfires cause the largest stratospheric warming since Pinatubo and extend the lifetime of the Antarctic ozone hole. He showed that climate change allows forest-damaging insects and diseases occur more frequently. Extreme weather episodes related to anthropogenic climate change have enhanced the frequency and magnitude of bark beetle disturbance, causing worldwide mortality of forests in the last few decades. He concluded his talk by presenting a case study of sustainable development of rubber plantations Tropical Forest Forever Facility (TFFF) is a major initiative launched at the November 2025 COP30 climate summit in Belém, Brazil, designed to raise $125 billion for tropical forest conservation by paying countries for maintaining forest cover.

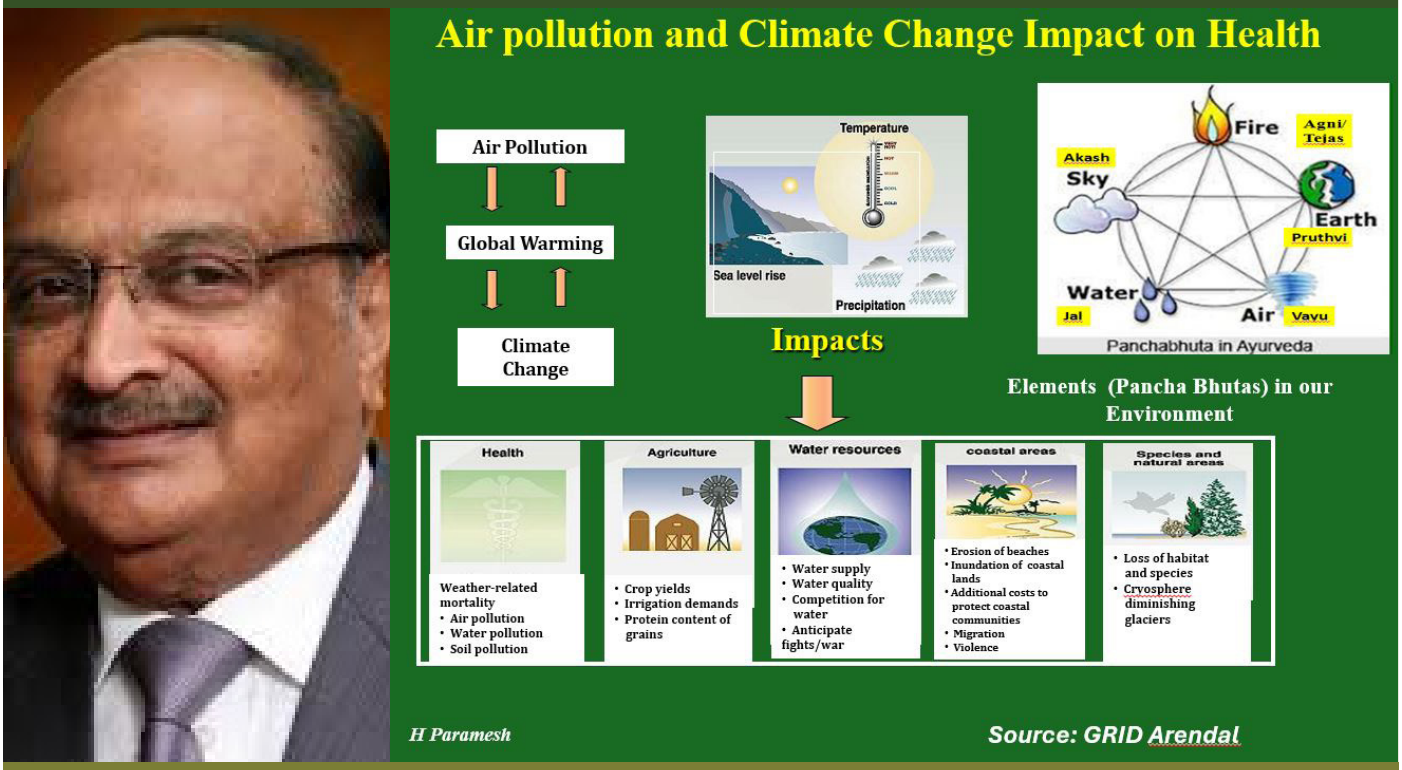
Mr. Vasantha Reddy, IFS, Dharwad, Karnataka, spoke on “Mangroves and their significance”. A mangrove forest is a unique coastal ecosystem

of salt-tolerant trees and shrubs in tropical/subtropical intertidal zones, recognized by their stilt-like roots that thrive in low-oxygen, salty, muddy soils where fresh and saltwater mix. These vital forests act as natural barriers against erosion, storms, and floods, while serving as critical nurseries for marine life, improving water quality, and storing large amounts of "blue carbon," though they face significant threats from coastal development and climate change. Mr. Vasantha Reddy concluded his talk by emphasizing the need to strengthen mangrove conservation efforts that is imperative for enhancing India's resilience to cyclones and safeguarding coastal communities.

Many other talks were on biodiversity, conservation, policies and use of GIS, Drones and other technological solutions in forestry, and its potential uses and limitations. Many case studies were also conducted by various speakers. The participants were assigned many assignments to work on. They also went for field visits to Institute of Wood Science and Technology (IWST), Karnataka Forest Department (KFD), a day trip to Bannerghatta National Park, and a visit to see the flora and fauna in IISc campus. On the concluding day participants gave group presentations. Prof. S. K. Satheesh, Chair, DCCC, and Director, Future Earth South Asia Hub, distributed the certificates to the participants.

Participants of the training programme on Climate Change and Forests at the Divecha Centre for Climate Change, IISc, held from 8-19 December 2025.

AIR POLLUTION AND CLIMATE CHANGE IMPACT ON HEALTH



Prof. Dr. H. Paramesh, Visiting Professor, DCCC, delivering his talk on "Climate Change and Air pollution on Children's Health", on 17th December 2025.

Child Health Division, Ministry of Health and Family Welfare (MoHFW) and UNICEF organised a webinar on "Optimizing Care for Acute Respiratory Illness in Children" on 17th December 2025. About 1900 doctors participated in this event. Prof. Dr. H. Paramesh, Visiting Professor, DCCC, IISc., gave talk on "Climate Change and Air pollution on Children's Health", at this event.

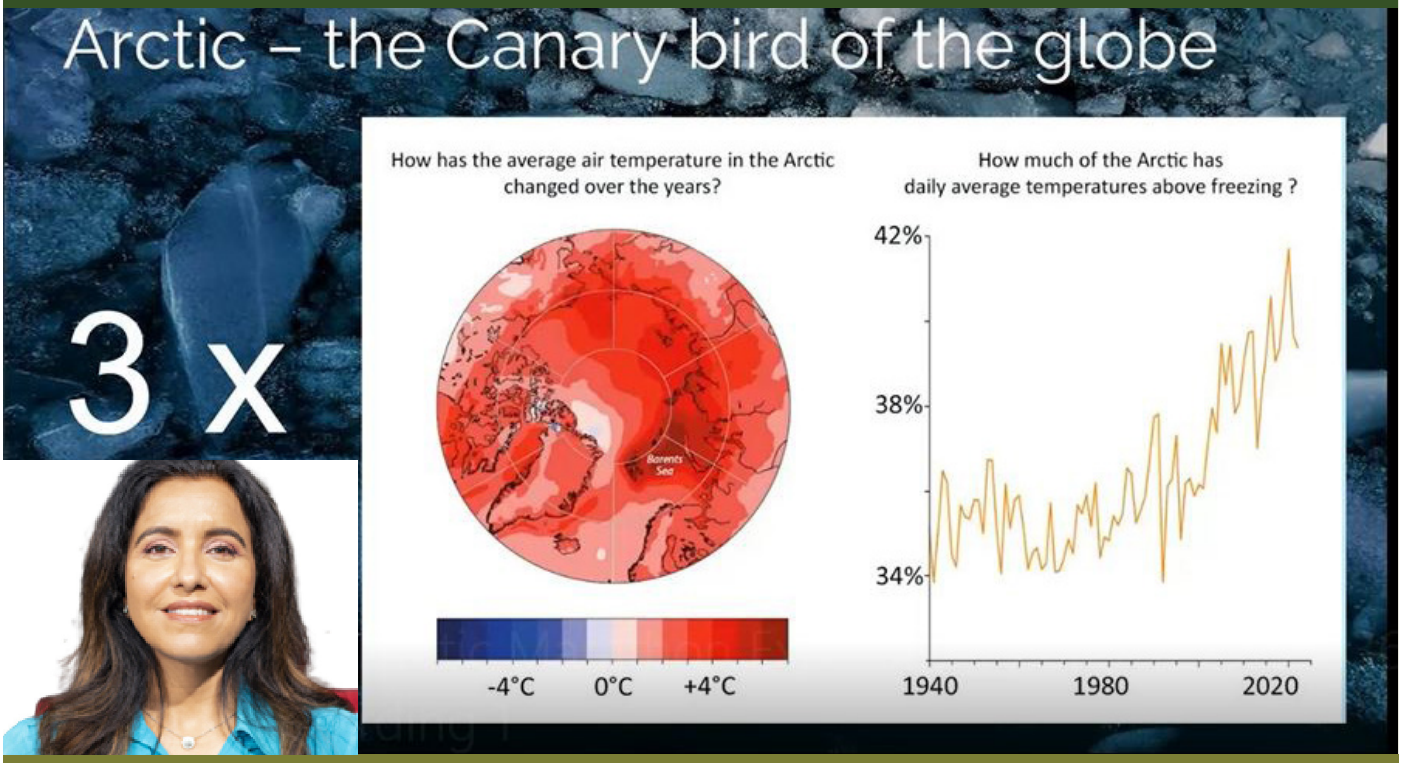
Environmental air pollution is a major risk factor for morbidity and mortality. Environmental air pollution has a direct impact on human health and is responsible for an increase in number of deaths due to cardiopulmonary, neoplastic, and metabolic diseases. Environment and climate change with air pollution have significant impact from womb to tomb on child development in particular congenital disorders. Exposure to air pollutants during pregnancy can compromise fetal development and cause intrauterine growth restriction, prematurity, low birth weight, congenital anomalies, and intrauterine and perinatal death. As of report from W.H.O in 2023 the mortality from Congenital anomalies is 2,40,000 in neonates and 1,70,000 in 1 month to 5 years age globally. The long-term disability with psycho-socio-economic burden will be on low and middle-

income countries. About 70% of diseases are non-communicable diseases. Some sources of outdoor air pollution include burning of solid waste, power plant emission, industrial emission, construction, vehicles emission. Indoor pollution includes dust mite, cockroaches, pollen, fungus and molds, and pets dander. Cooking fuels such as coal, firewood, kerosene, and biogas cause indoor air pollution. Urban children suffer more asthma than rural due to high vehicular pollution in the cities. Air pollution severely impacts the respiratory system by causing inflammation, triggering asthma, worsening chronic obstructive pulmonary disease, increasing infections like pneumonia, and raising the risk for lung cancer, with effects ranging from short-term irritation (coughing, wheezing, shortness of breath) to long-term, chronic diseases and reduced lung function, especially in vulnerable groups like children and the elderly. Fine particulate matter can penetrate deep into the lungs, even entering the bloodstream, leading to widespread damage and systemic issues.

Climate change intensifies air pollution increasing respiratory complications and hospitalizations. Air pollution significantly harms the Central Nervous System (CNS) by causing neuroinflammation, oxidative stress, and damage through fine particulate matter (PM) that can directly enter the brain, increasing risks for neurodegenerative diseases (Alzheimer's, Parkinson's), stroke, developmental disorders (Autism), and mental health issues (anxiety, depression). These microscopic pollutants trigger immune responses, disrupt the blood-brain barrier, damage neurons, and impair cognitive functions like memory and decision-making, affecting all ages from children to the elderly. Heavy school bags add burden to obstructive airway disease from air pollution by compressing the spine, reducing lung capacity, and affecting gait.

Increasing greenery through urban parks, vertical gardens, and community plots helps reduce CO_2 by photosynthesis, cooling cities, filtering pollution, managing stormwater, and boosting health by encouraging walking, while also providing vital habitat and lowering energy use for cooling buildings. Green spaces act as natural carbon sinks, absorbing CO_2 and storing it, but must be part of broader emission cuts, integrating sustainable practices like using native plants and managing water efficiently. Prof. Dr. H. Paramesh concluded his talk by highlighting the importance of mitigating air pollution.

ARCTIC MARATHON EXPEDITION



Dr. Gurmeet Soni Bhalla, Pediatrician, Allergist & Longevity Specialist, delivering her talk on 27th November 2025 at DCCC auditorium.

Divecha Centre for Climate Change organised a seminar on "Experience of Arctic Marathon Expedition" on 27th November 2025 by Dr. Gurmeet Soni Bhalla, Pediatrician, Allergist & Longevity Specialist. She had recently completed the North Pole Marathon at running on the frozen Arctic Ocean in sub-zero conditions. A marathoner on all seven continents, Dr. Bhalla integrates lessons from extreme endurance and human resilience into her longevity work while also advocating for awareness of the fragile Arctic environment and it's impacts on climate change around the globe.

The Arctic climate system has undergone profound physical changes since the mid-1980s. The Arctic has warmed about three times as fast as that of the global average since 1979 owing to amplifying feedback in the climate system. The occurrence and impacts of wildfires in the Arctic reflect the culmination of many complex interactions between human, biogeographical, and hydrometeorological factors. Areas with wildfire and permafrost degradation are sources of increased carbon emissions to the atmosphere. Observation data showcase evidence of widespread loss of the Arctic cryosphere in all its forms (spring snow-cover extent, land ice, sea ice) as well as warming and thawing of permafrost. The Arctic is becoming wetter, with more precipitation falling as rainfall rather than

snowfall, with an overall increase in precipitation totals.

The Arctic Ocean acidification rate has been three to four times higher than in other ocean basins over the past three decades. The Arctic Ocean is acidifying in response to CO_2 uptake, loss of sea-ice cover, ocean freshening and warming, and contributions of organic carbon from terrestrial sources. Ocean acidification negatively impacts marine life and activities, and the wellbeing on the Arctic food webs. Many marine species such as king crab, snow crab, northern shrimp and cod will experience adverse impacts, including mortality and possibly even extinction. Arctic marine mammals such as sea mammals, seabirds, and fish are of great cultural and subsistence importance within Inuit culture, as integral food and spiritual components of the way of life, but also co-stewarded and observed for impacts of changing conditions in the Arctic.

The Arctic is responding to changes in the climate system much more rapidly than any other region on Earth, and the changes in the far north are being felt far beyond the Arctic. The latest future Arctic climate projections suggest a more rapid Arctic warming and sea-ice loss by 2100 than previous projections, and consequently, greater and faster changes in the hydrological cycle, including Arctic glacier reduction and global sea-level rise. Future climate projections indicate continued Arctic warming with amplified impacts on sea-ice decline, rainfall increase, permafrost thaw, and the likelihood for increased terrestrial carbon release to the atmosphere, driven by this warming.

India has recognised the significance of the Arctic connection through its research station Himadri, established in 2008 at Svalbard, Norway. The purpose of this outpost is to monitor changes in sea-ice extent, atmospheric circulation, and their global teleconnections. The data from Himadri is valuable not only for understanding climate shifts but also for refining India's own flood forecasting and disaster management. Arctic ice melt is linked to India floods by disrupting atmospheric patterns, particularly the jet stream and Rossby waves, which alters the Indian Monsoon, causing extreme rain events like cloudbursts and intense monsoons, leading to devastating floods in regions like the Himalayas and Central/Northern India. Dr. Gurmeet concluded her talk by pointing out that curbing greenhouse gas emissions is as much a local necessity as a global responsibility.

CAPACITY BUILDING

Dr. Rayees Ahmed, Project Scientist at the Divecha Centre for Climate Change, IISc, recently participated in an international exposure visit to China organized by ICIMOD as part of a prestigious capacity-building programme on Integrated River Basin Management. During the visit, he engaged with leading research institutions, policy experts, and field sites across the Yangtze River Basin, gaining firsthand insights into China's large-scale climate adaptation, flood management, and ecological restoration initiatives. His participation strengthens IISc's collaboration with ICIMOD and enhances international knowledge exchange on climate resilience and sustainable water management.

Dr. S A Pandit, Senior Researcher, DCCC, IISc addressing the panel discussion on India's Critical and Strategic Minerals strategy: Policy, Progress, and Path Ahead, held from 4-5 Dec, 2025, at Kochi, Kerala State.

RESEARCH HIGHLIGHTS

OBSERVATIONALLY CONSTRAINED WINTERTIME EMISSION FLUXES AND ATMOSPHERIC LIFETIME OF BLACK CARBON IN SOUTH ASIA

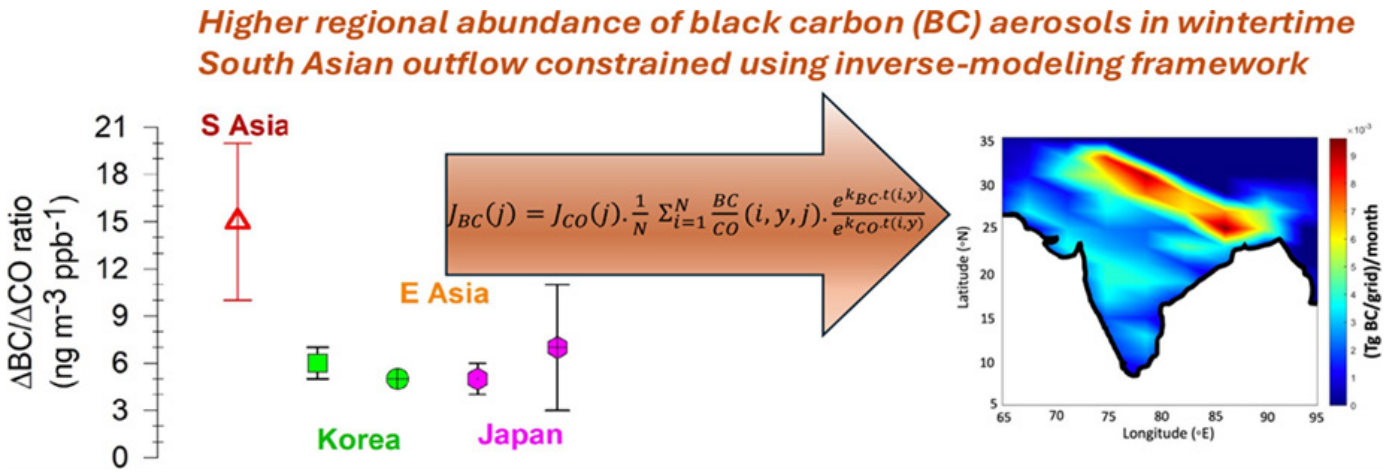


Fig: This figure shows that wintertime air pollution from South Asia contains much higher levels of black carbon than pollution from other parts of East Asia. The comparison highlights stronger black carbon emissions from South Asia and shows how observations are used to estimate where these emissions originate, with the map indicating regions of highest pollution.

Black carbon (BC) is a major air pollutant that warms the climate and harms human health, especially in densely populated regions like South Asia. However, climate models have underestimated the atmospheric residence time of BC in this region during winter. Researchers analyzed three winters (2018–2020) of air quality data collected at a remote observatory in the Maldives, which lies directly in the path of pollution carried from South Asia over the Indian Ocean. By comparing BC with carbon monoxide—two pollutants that often come from the same sources—the study shows that South Asia releases more black carbon in winter than previously thought. The researchers also found that BC remains in the atmosphere longer than previously assumed, surviving for about eight days rather than the five days typically used in models. Dry winter conditions and limited rainfall allow the particles to travel long distances without being washed out of the air. Overall, the study estimates that wintertime black carbon emissions from South Asia are about 50% higher than earlier estimates based on emission inventories. These findings help explain why models underestimate pollution levels and highlight the need to update climate and air quality models to represent regional conditions better.

Reference: Dasari, S., Andersson, A., Kim, S. W., Holmstrand, H., Budhavant, K., & Gustafsson, Ö. (2025). Environmental Science & Technology Letters. https://doi.org/10.1021/acs.estlett.5c00079

LONG-TERM INFLUENCE OF BAY OF BENGAL SEA SURFACE TEMPERATURE ON SOUTH ASIAN SUMMER MONSOON VARIABILITY

Sea surface temperature of Bay of Bengal was reconstructed 31,000 years using "Clumped isotope thermometry". The traditional isotope thermometry has the heavier isotope of Oxygen to infer past temperatures and rainfall. Here carbonate clumped-isotope thermometry, together with oxygen-isotope analysis has been used. The term "clumped isotope" refers to carbonates having the heavier isotope of carbon and oxygen. The "clumped isotopes" are more sensitive to temperature than the traditional isotopes. The analysis was performed with planktic foraminifer Globigerinoides ruber, from a sediment core collected in the Central-Western BoB. Their reconstruction of past sea-surface temperatures (SSTs) and seawater oxygen-isotope composition (used to infer salinity) has revealed SST variations over glacial–interglacial timescales are largely driven by changes in atmospheric CO_2. A key outcome is a quantitative estimate of monsoon sensitivity: The study concludes that the Late Holocene (0 to 4000 years before present) experienced stronger monsoon rainfall and higher river discharge, whereas the Last Glacial Maximum (19 to 23,000 years before present) was characterised by reduced runoff and drier regional conditions.

Reference: Barnita Banerjee et al., (2025), Paleo-productivity reconstruction in Bay of Bengal during the past 1.3 Ma: Implications for glacial-interglacial dynamics and southern hemispheric processes. In: Palaeogeography, Palaeoclimatology, Palaeoecology ,Volume 672, 15 August 2025, 113004

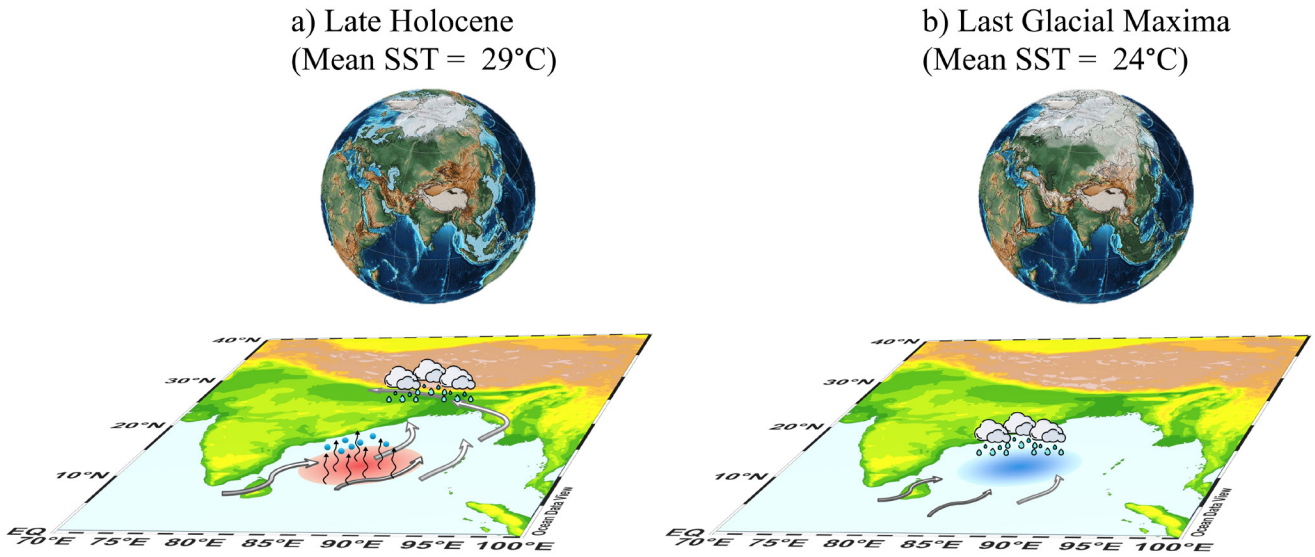


Fig: Schematic depicting the influence of Bay of Bengal SST on South Asian Summer Monsoon rainfall during (a) the Late Holocene (0–4 kyr BP) and (b) the Last Glacial Maximum (19–23 kyr BP). Paleo–digital elevation model adapted from Scotese et al., 2016.

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