

Earth System Science Panorama

(The News, Events, Discoveries Awareness and Researches on Earth, Climate, and Environmental Sciences)

Prologue

The modern world faces multiple environmental crises that threaten ecosystems, biodiversity, and human health. Key concerns include air, water, and land pollution, loss of biodiversity, and plastic pollution. An overview of these challenges and the measures required to address them are explained below. Industrial emissions release pollutants like sulfur dioxide, nitrogen oxides, and particulate matter. Vehicle exhaust emit carbon monoxide, hydrocarbons, and nitrogen oxides. Agricultural activities include mainly methane emissions from livestock and ammonia from fertilizers. Burning of fossil fuels for generation of electricity, heating, and transportation pollutes the atmosphere with greenhouse gases. Natural and human-induced wild fires release significant pollutants. Consequent health impacts are Respiratory issues, cardiovascular diseases, and lung cancer. Increased greenhouse gas concentrations lead to global warming. Acid rains harms forests, soils, and aquatic systems. Pollutants affect plants and animals, disrupting ecosystems. Some remedial measures include transition to renewable energy sources like solar, wind, and hydro; implementation of clean transportation solutions, such as electric vehicles and public transit, enforcement of strict air quality standards and emission regulations, promotion of energy efficiency in industries and homes, encouragement for afforestation and urban green spaces to act as carbon sinks. Dumping untreated chemicals and heavy metals into water bodies by industries creates water pollution. Excessive use of fertilizers and pesticides contaminates rivers and groundwater. Plastic waste pollutes oceans and harms marine life. Release of untreated wastewater to rivers cause water pollution. Toxic substances reduce oxygen levels affecting aquatic organisms. Contaminated water causes diseases like cholera, dysentery, and hepatitis. Changes in water chemistry affect biodiversity. Enforcement of wastewater treatment plants, adoption of sustainable agriculture practices to minimize runoff, ban or reduce the use of single-use plastics, conduct of regular water quality monitoring, engagement in river and ocean clean-up drives are some remedial measures. Deforestation leads to soil erosion and habitat destruction. Improper waste disposal includes municipal solid waste, hazardous waste, and electronic waste. Overuse of chemicals and monoculture farming degrade soil. Mining activities leave behind toxic waste and barren lands. The impacts include reduced agricultural productivity, endangers of wildlife and plants. Remedial Measures include promotion of composting and recycling to reduce landfill waste. implementation of reforestation and afforestation programs, use of organic farming techniques to maintain soil health, enforcement of regulations on waste management and sustainable mining, Loss of Biodiversity is through deforestation, urbanization, and agriculture. Air, water, and land pollution degrade ecosystems. Climate change alters habitats, causing species migration or extinction. Non-native species disrupt local ecosystem. Loss of species disrupts food chains and ecological services. Biodiversity supports industries like agriculture, fishing, and tourism. Ecosystems become less capable of adapting to environmental changes. Remedial measures include establishment and expansion of protected areas like national parks and wildlife reserves, promotion of sustainable resource use in agriculture and forestry, Restoration of degraded ecosystems through reforestation and wetland restoration. Address of climate change can be done through enforcement of strict laws to prevent poaching and illegal trade of wildlife, excessive use of single-use plastics in packaging, bottles, and bags, improper disposal and lack of recycling infrastructure. Microplastics contaminate food chains affecting human health. Plastic waste affects soil quality and water systems. Beaches and landscapes are littered with plastics impacting tourism. Promotion of biodegradable alternatives like paper, jute, and bamboo, investment in recycling infrastructure and waste-to-energy technologies, raising of awareness about the 3Rs (Reduce, Reuse, Recycle), conduct of community-based clean-up campaigns are some remedial measures. Addressing pollution, biodiversity loss, and plastic waste requires a multi-faceted approach combining policy, technology, community participation, and global cooperation.

Elucidation

Some examples of recent climate events and research findings are mentioned below for critical reading and review.

Alarming Air pollution with AQI 500 and introduction of GRAP

Recently, north India, including Delhi-NCR, faced severe air pollution with AQI levels reaching 500, triggering health emergencies, school closures, and work-from-home advisories. Hospitals reported a surge in heart attacks and asthma cases due to toxic air quality. Major cities like Patna, Lucknow, and Chandigarh also experienced hazardous air. The Delhi government-imposed stage 4 restrictions under the Graded Response Action Plan, grounding flights and affecting daily life. **The alarming air quality in Delhi has reached nearly 'Severe plus' levels prompting the implementation of Stage IV measures under the Graded Response Action Plan (GRAP).** These measures aim to mitigate pollution and safeguard public health. Key steps include; Truck Restrictions: Non-essential trucks are prohibited from entering Delhi. All non-essential construction and demolition activities are suspended to limit dust and particulate emissions. Non-essential vehicles are barred, encouraging reduced vehicular pollution. Offices are advised to implement remote working to curb commuting-related emissions. Schools were shifted to virtual classes to protect students from exposure. Authorities issued warnings, especially targeting vulnerable groups like children, the elderly, and those with pre-existing conditions. The Commission for Air Quality Management (CAQM) actively oversees compliance with these measures. State authorities are tasked with ensuring enforcement to address the crisis effectively. **These emergency actions aim to provide immediate relief, though long-term strategies are crucial to prevent recurring pollution episodes.**

Hazards of Microplastics

Microplastics are tiny pieces of plastics, smaller than five millimetres (0.2 inches), which form as larger plastics break down, either by chemically degrading or physically wearing down into smaller pieces. The discovery of microplastics in human brain tissue and other vital organs raises significant health concerns. This research highlights how pervasive plastic pollution has become and its potential impacts on human health. Microplastics, ranging from 5.5 to 26.4 micrometers, were found in the olfactory bulb of cadavers. The most common types detected were polypropylene, polyamide (nylon), and polyethylene vinyl acetate. The olfactory nerve, which connects the nasal cavity to the brain, may serve as a route for microplastics, similar to how some bacteria enter. Microplastics can also potentially reach the brain via the bloodstream, although the blood-brain barrier limits most material from entry. Microplastics have been linked to inflammatory reactions in lab studies. Animal research suggests they can cross the blood-brain barrier, potentially causing cognitive changes. Additives in plastics, some known to be toxic, may further exacerbate health risks. Microplastics were also found in other critical organs, including lungs, liver, kidneys, and blood vessels. Higher levels of microplastics in arterial plaque have been associated with increased mortality risks. Could microplastics contribute to neurological diseases like dementia? What role do the chemicals used in plastics play in their potential toxicity? These are important questions regarding microplastics. With indoor environments being major sources of polypropylene and other plastics, how can exposure be minimized? **The findings reinforce the urgency of addressing plastic pollution through: Reducing plastic production and use, particularly in everyday items. Strengthening regulations to limit plastic additives known to be harmful. Advancing research into the health effects of micro- and nanoplastics.** This growing body of evidence suggests that microplastics are more than an environmental issue; they are a pressing human health concern, demanding collaborative global efforts for mitigation. Courtesy: Kaitlin Sullivan is a contributor for NBCNews.com who has worked with NBC News Investigations. She reports on health, science and the environment and is a graduate of the Craig Newmark Graduate School of Journalism at City University of New York. Edited By: Anamica Singh Updated: Aug 23, 2024

Amazon faces another consecutive year of drought as wildfires reach 20-year high

The Amazon Basin, a lifeline for millions across South America, faces a catastrophic environmental crisis as prolonged drought, record-breaking fires, and diminished river levels converge. **Since 2023, the region has seen water levels of major rivers like the Solimões, Purus, Acre, and Rio Negro drop to historic lows, severely impacting the local biodiversity and communities who depend on these waterways for transportation, food, and water. In Porto Velho, Brazil, the Madeira River's water level fell to a mere 48 cm, starkly below the usual 332 cm, prompting the Brazilian government to declare a state of emergency in multiple cities in Amazonas. Accompanying the drought are unprecedented wildfires, with Brazil logging over 38,000 fires in August 2024 alone—the highest in two decades. The fires have unleashed the largest carbon emissions in nearly two decades from the Amazon and Pantanal regions, further exacerbating global warming.** In neighbouring Peru and Bolivia, fire alerts and wildfire incidents also reached new highs, intensifying ecological strain across the Amazon. Experts attribute the prolonged drought to a combination of global warming and shifting ocean temperatures, which have affected rainfall in the Amazon. **The World Weather Attribution team's studies link the drought's intensity to climate change, compounded by the El Niño phenomenon that diminished rainfall.** According to José A. Marengo, director at Brazil's National Centre for Monitoring and Early Warning of Natural Disasters, a weakened rainy season in 2024 and successive heatwaves worsened soil and river conditions, leaving communities increasingly isolated due to inaccessible rivers. **The crisis in the Amazon highlights how climate change and deforestation are driving increased drought frequency. The basin's ecosystems, already affected by human activity, are now at greater risk, with a diminished capacity to capture carbon and support the vital biodiversity that maintains ecological balance in the region.**

Nepal floods: 112 dead, 64 missing as intense downpour continues

Kathmandu recorded the highest rainfall since 1970 in the past 24 hours of 28th September 2024 as the nation reels from devastating floods and landslides. Torrential rainfall in Nepal has triggered rainfall and landslides in the country, causing 112 deaths and 64 people reported missing in a boat in Kathmandu at a flood-affected area following Nepal has been dealing with heavy rainfall since 27th September which led to inundation in several low-lying areas as well as rising levels of water in rivers that resulted in flash floods. Several roads have been flooded or blocked due to landslides, as rivers such as the Bagmati have broken their banks and water levels have risen above danger marks. Around eight different roads have been blocked due to landslides. The country's weather bureau told the *Kathmandu Post*, that this was the highest recorded rainfall in the country's capital since 1970. In the 24 hours, leading upto 29th morning, Kathmandu had recorded 240 mm of rain. Some parts of the capital reported 322 mm of rain, reported *Reuters*. As of 29th Sept. morning, 3,300 people have been rescued by relief teams. More than 3,000 security personnel are working towards assisting rescue efforts with helicopters, rafts and motorboats. Domestic flights in and out of Kathmandu have resumed on 30th after being temporarily suspended 28th onwards, with close to 150 departures cancelled. **Climate Change One of the main causes for the increasing risk of floods and landslides in Nepal can be attributed to climate change and the lack of adapting to environmental risk. Arun Bhakta Shrestha, a climate scientist at the International Centre for Integrated Mountain Development (ICIMOD), said that "haphazard development" had also increased risks in Nepal. "I've never before seen flooding on this scale in Kathmandu," said Srestha. The ICIMOD has urged the government to improve infrastructure and invest in underground stormwater and sewage systems. According to ICIMOD, flooding was made worse due to poor drainage that is caused by unplanned settlement and urbanisation efforts, construction on floodplains, lack of areas for water retention, and encroachment on the Bagmati river.** Courtesy:Hindustan Times News Desk, Sep 29,2024

State-of-the-art facility at Cacora , an integrated approach to tackle South Goa's waste challenges. Goa's path to sustainable waste solutions: Innovations and progress

The Cacora Integrated Solid Waste Management Plant represents a significant forward step in sustainable waste management for South Goa.

The Goa Waste Management Corporation (GWMC) has reached a significant milestone with the establishment of a 100 tonnes per day (TPD) Integrated Solid Waste Management Plant in Cacora, South Goa. The facility is designed to manage municipal solid waste from both municipalities and panchayats in the region. **The plant is located on a site that was previously an open dumping ground, which**

has since been remediated and transformed into a modern waste management facility. The state-of-the-art facility was inaugurated by Prime Minister Narendra Modi February 6, 2024. The Cacora plant is a brownfield project, meaning it was developed on a previously used site. The legacy waste at this location was remediated to recover the land for the new facility.

The Goa Waste Management Corporation (GWMC), established on October 2, 2016, has been pivotal in revolutionizing waste management in Goa. This Special Purpose Vehicle (SPV) under the Department of Science, Technology and Waste Management and also of Village Panchayat **are tasked with the scientific collection, segregation, treatment, and disposal of solid and other waste.** With a mission to address waste issues comprehensively, GWMC has launched several centralized and decentralized facilities that have been set up under 14th/15th FC Grants and SBM-G Funds at Village Panchayat/Block level to manage various waste types, **including municipal, biomedical, hazardous, construction and demolition, and e-waste. Centralized Waste Management Facilities GWMC has set up integrated waste management facilities through a Public-Private Partnership (PPP) model, ensuring efficient and sustainable waste treatment.** Key facilities include: • Saligao, North Goa: Integrated 250 TPD + 20% Solid Waste Management Facility • Cacora, South Goa: Integrated 100 TPD + 25% Solid Waste Management Facility • Kundaim IDC, Ponda Goa: Common Biomedical Waste Treatment Facility • Pissurlem, Goa: Common Hazardous Waste Treatment Storage Disposal Facility • Bainguinim, Goa: Proposed Integrated 100 TPD Solid Waste Management Facility • Verna IDC, Goa: Proposed Integrated 250 TPD Solid Waste Management Facility and 250 TPD Waste to Energy Facility • Pissurlem, Goa: Proposed E-waste Management Facility • Proposed: Construction and Demolition Waste Management Facility Common Biomedical Waste Treatment Facility (CBWTF), Kundaim In October 2021, the GWMC commenced operations at the state-of-the-art CBWTF in Kundaim. Managed by M/s Biotic Waste Solutions Pvt Ltd, this facility operates under a PPP model on a 10,000 sq.m. plot provided by GWMC. It is designed to collect, transport, treat, and dispose of biomedical waste for 20 years. **The CBWTF has a total treatment capacity of 28 tonnes per day and is equipped with cutting-edge technology, including a Rotary Incinerator, Autoclave, Boiler, Shredder, Effluent Treatment Plant (ETP), and a Plastic Recycling plant. This facility has treated 3,500 tonnes of biomedical waste since its inception, serving over 1,500 healthcare facilities across Goa. The facility's Rotary Incinerator, a first in West India, processes 300 kg of waste per hour, featuring a 6-Step Dry Air Pollution Control Device. This ensures smokeless emissions and captures all particulate matter. The installed 15 KLD ETP guarantees the complete treatment of wastewater, adhering to international safety standards. GWMC's collaboration with SINTEF, a Norwegian scientific research organization, aims to establish a modern Construction & Demolition (C&D) Waste Management Facility in Curchirem Village, Bicholim Taluka. This facility will recycle C&D waste through wet and dry processes, leveraging SINTEF's expertise and insights from international visits.** The GWMC has acquired 44,478 sq.m. of land for the facility, which will be developed through a PPP model. Meanwhile, a temporary provision for C&D waste disposal is in place at Tuem, identified by the District Magistrate of North Goa. Common E-Waste Management Facility at Pissurlem To tackle the rising challenge of electronic waste, the GWMC is setting up an E-Waste Management Facility at Pissurlem Industrial Estate. The facility, which spans 4,000 sq.m., is currently under construction. **It will focus on dismantling e-waste for downstream recycling, supported by robust collection and transportation mechanisms as per relevant guidelines.** The operator has already begun collecting e-waste from urban and rural local bodies, ensuring scientific disposal to authorized recyclers. This initiative aims to create awareness among stakeholders and promote sustainable e-waste management practices. **The GWMC's initiatives reflect a significant step towards sustainable waste management in Goa. By setting up advanced facilities and leveraging international collaborations, the GWMC is not only addressing current waste management challenges but also paving the way for a cleaner, greener future.** These efforts underscore the importance of scientific and efficient waste treatment and disposal, ensuring environmental sustainability for generations to come. It is based on a public-private partnership model, with the state providing 75 per cent of the funding, supported by a National Bank for Agriculture and Rural Development loan under the Rural Infrastructure Development Fund and the concessionaire providing the remaining through equity. The GWMC has also provided essential infrastructure, including land, access roads, electricity and water connections. The plant is the second of its kind established by the corporation in Goa, after a solid waste management facility in Saligao, said Ankit Yadav, managing

director of GWMC. “The Cacora facility incorporates similar technology and builds on the operational experience of the Saligao plant. The facility adheres to the Solid Waste Management Rules, 2016 and employs a comprehensive approach, including recycling and sorting lines, segregation, bio methanation and composting,” he added. The operations of the facility are overseen by an expert committee led by Padmashree Sharad Kale, a former Bhabha Atomic Research Centre scientist, with contributions from the National Environmental Engineering Research Institute, Indian Institute of Technology Bombay, Birla Institute of Technology and Science, Pilani and other waste management experts from Goa. Shri Prasiddh P. Naik, Dy Director of Panchayat, Govt of Goa/State Coordinator SBM-G Goa state, M.No-9923274585. Email- dydir-panc.goa@nic.in • Shri Shashank Dessai, Dy. Manager Goa Waste Management Corporation M.No- 9923326872 Email Shashank.dessai@zerowastegoa.com Courtesy: [Kaifee Jawed https://www.downtoearth.org.in](https://www.downtoearth.org.in)

Epilogue

The CEHESH TRUST OF INDIA is an organization committed to addressing some of the most critical environmental challenges facing our planet today. The trust focuses on the interconnected themes of climate change, global warming, pollution, and loss of biodiversity, advocating for sustainable development and ecological balance. Key themes and objectives are: a. CEHESH TRUST aims to educate communities and policymakers about the urgent need to reduce greenhouse gas emissions. b. advocates renewable energy adoption, afforestation, and sustainable practices to minimize the impact of rising global temperatures. The trust emphasizes the consequences of global warming, such as rising sea levels, melting glaciers, and extreme weather patterns. It works on strategies to enhance carbon sequestration and reduce reliance on fossil fuels. It conducts seminar on air, water, and soil pollution through advocacy for stricter environmental regulations. We encourage waste management initiatives, including recycling and reducing single-use plastics. We focus on protecting endangered species and restoring degraded habitats We collaborate with local communities to promote the coexistence of human development and ecological conservation. The school initiatives are taken to spread awareness about environmental sustainability. Local stakeholders are involved in projects such as tree plantation drives, clean-up campaigns, and wildlife conservation. **The CEHESH TRUST OF INDIA strives to inspire a collective effort to safeguard the planet for future generations, emphasizing the urgent need to balance development with ecological stewardship.**

By adopting sustainable practices and fostering awareness, we can restore ecosystems, improve environmental health, and secure a sustainable future for all.

Every climate action, no matter how small, contributes to the larger goal.

Compilation and Revamping
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