# Environmental Science & Other Innovations:

## I. Environmental Science & Sustainability

**Genetic Breakthrough for Extinction Prevention:** Scientists have proposed a visionary framework to rescue endangered species by restoring their lost genetic diversity using gene editing. This involves utilizing DNA from museum specimens and related species to reverse "genomic erosion" and help species adapt to challenges like climate change and disease. (ScienceDaily, July 21, 2025; TS2 Space, July 21, 2025)

**Impact of Clear-Cutting on Floods:** New research from the University of British Columbia found that clear-cutting forests can significantly increase flood risk. In some watersheds, floods became up to 18 times more frequent and over twice as severe after clear-cutting, with these effects lasting for years. (ScienceDaily, July 19, 2025)

**Canine Allies Against Invasive Species:** A study has shown that dogs trained by everyday pet owners are proving to be effective in detecting the invasive spotted lanternfly, demonstrating a new approach to combating invasive species. (ScienceDaily, July 17, 2025)

**Ocean Acidification Threat to Hawaiian Reefs:** A University of Hawai'i study predicts that Hawaiian coral reefs could face unprecedented ocean acidification within 30 years due to carbon emissions, even under conservative climate scenarios. (ScienceDaily, July 16, 2025)

**Ancient Ice Core Reveals Climate History:** An ice core from the French Alps, dating back over 12,000 years to the last Ice Age, has been meticulously analyzed. This "frozen archive" captures insights into past climate conditions and the rise of civilization. (ScienceDaily, July 16, 2025)

**Climate Change's Impact on Crop Nutrients:** A pioneering study indicates that rising CO2 and higher temperatures are not only altering crop growth but also degrading the nutritional value of food, particularly in leafy greens. (ScienceDaily, July 10, 2025)

**Green Nitrogen Fixation:** The World Economic Forum has highlighted "Green Nitrogen Fixation" as a top emerging technology for 2025. This involves new methods like engineered bacteria and enzymes, or using sunlight/green electricity, to fix nitrogen, aiming to significantly cut the enormous environmental impact and energy consumption of current fertilizer production. (World Economic Forum, June 24, 2025)

**Biobased and Biodegradable Plastics:** The ANIPH project is pioneering the development of safe and sustainable biobased and biodegradable plastics for a circular future, aiming to avoid the negative impacts of plastic materials, especially in humanitarian contexts. Research is also ongoing into how biodegradable microplastics affect agricultural ecosystems. (Innovation News Network, July 18, 2025; July 17, 2025)



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**PFAS Degradation:** Researchers at Goethe University have developed a metal-free, boron-based catalyst for efficient degradation of PFAS (Per- and Polyfluoroalkyl Substances), offering a promising solution to this widespread environmental pollutant. (Innovation News Network, July 17, 2025)

**Seaweed for Methane Reduction:** Farmers are adopting seaweed-based food supplements like CH4 Global's Methane Tamer to significantly slash cattle methane emissions, contributing to climate change mitigation. (Innovation News Network, July 16, 2025)

**Agricultural Liming as a CO2 Sink:** New research suggests that agricultural liming in the US can act as a significant CO2 sink, removing carbon dioxide from the atmosphere. (Innovation News Network, July 11, 2025)

**Marine Forest Restoration:** EU-funded researchers are involving local communities in efforts to restore marine forests, turning citizens into "ocean stewards." (Innovation News Network, July 11, 2025)

**Microplastic Pollution from Sewage and Winds:** A study from Plymouth has revealed that sewage spills and coastal winds are fueling microplastic pollution. (Innovation News Network, July 10, 2025)

**Just Transition in Global Plastics Treaty:** Negotiations for the Global Plastics Treaty are emphasizing the need for a "Just Transition," ensuring that efforts to end plastic pollution are both environmentally sound and socially equitable. (CrackitToday, July 19, 2025)

**Exemption for Indian Thermal Power Plants:** India's Union Environment Ministry has exempted 78% of the country's thermal power plant units from installing Flue Gas Desulphurisation (FGD) systems, which are meant to reduce $SO_2$ emissions. (CrackitToday, July 16, 2025)

**First Wildlife Corridor on Delhi-Mumbai Expressway:** India's first wildlife corridor is being built on the Delhi-Mumbai Expressway to facilitate animal movement, showcasing a commitment to balancing infrastructure development with environmental protection. (Jagran Josh, July 2, 2025)

## II. Other Innovations & Technologies

**Photon-Powered Alchemy:** A new technique is "rewriting fossil fuel chemistry" using light, indicating advancements in sustainable chemical processes. (ScienceDaily, June 20, 2025)

**AI for Climate-Friendly Cement:** An AI system has been developed that can write "climate-friendly cement recipes in seconds," accelerating the development of sustainable building materials. (ScienceDaily, June 19, 2025)

**Recyclable, Healable Electronics:** Researchers have developed electronics that are both recyclable and capable of healing themselves, promising more sustainable and durable electronic devices. (ScienceDaily, June 2, 2025)

**Gene Therapy for Drug-Resistant Epilepsy:** Researchers at University College London are developing a gene therapy to treat drug-resistant focal epilepsy by delivering the LGI1



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gene to the brain to regulate cell excitability. (Inpart, January 8, 2025)

**AI in Drug Discovery:** The Conditional Randomized Transformer (CRT), an AI model, has been developed to enhance the efficiency of drug discovery by enabling faster and more diverse generation of target molecules. (Inpart, January 8, 2025)

**Edible Coatings for Food Safety and Sustainability:** Derived from algae and bacterial cell components, new edible coatings address consumer concerns about food safety and sustainability while promoting the consumption of healthy fresh food products. (Inpart, January 8, 2025)

**Plant-Boosting Compositions (Biopesticides):** Researchers have developed compositions that boost the innate immunity of plants, with promising results for reducing pathogen propagation and infection symptoms, potentially leading to new biopesticides. (Inpart, January 8, 2025)

**Seaweed Integration into Food:** Beyond animal feed, researchers are exploring ways to integrate dulse, a protein-rich red seaweed, into human foods like cheese and yogurt as a natural, eco-friendly protein alternative. (Inpart, January 8, 2025)

**AI-Powered "Electric Salt Spoon":** A spoon using tiny electrodes makes food taste saltier and more umami, aiming to help people reduce salt intake. (Smithsonian Magazine, January 10, 2025)

**Laser-Powered Injections (BoldJet):** A new injection system by FlowBeams uses a laser to propel liquid microjets through the skin, making injections less painful and reducing biowaste. (Smithsonian Magazine, January 10, 2025)

**AI Bug-Watching Camera (Petal):** A flower-bright orange camera on a plant-like stalk uses AI to identify and track insects and observe other living species in gardens. (Smithsonian Magazine, January 10, 2025)

**AI-Powered Smart Lipstick:** A prototype AI-powered lipstick from Boticário uses a sensor to identify lip outlines and a robot arm for application, making makeup accessible to people with visual impairments or mobility limitations. (Smithsonian Magazine, January 10, 2025)

**Air-to-Water Coffee Maker (Kara Pod):** This machine turns atmospheric humidity into clean water for brewing coffee, inspired by the Namibian desert beetle. (Smithsonian Magazine, January 10, 2025)

**Neural Earbuds for Device Control:** NAQI Neural Earbuds use small face and eye movements, along with gyroscopic technology, to control computers, wheelchairs, and other tech. (Smithsonian Magazine, January 10, 2025)

**AI in Agriculture (Kubota):** AI technology detects crop diseases and targets pest-affected areas, enhancing crop quality, reducing chemical use, and optimizing land use. (Global-imi, February 11, 2025)

**Structural Battery Composites (SBCs):** These are weight-bearing materials (like carbon fibre) that can also store electrical energy, allowing for more integrated and efficient power solutions. (World Economic Forum, June 24, 2025)



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**Osmotic Power Systems:** These systems generate electricity by leveraging differences in salinity, offering new renewable energy solutions. (World Economic Forum, June 24, 2025)

**Advanced Nuclear Technologies:** A "renewed wave of technological innovation" in nuclear energy includes Small Modular Reactors (SMRs) and efforts towards nuclear fusion for a transformative energy solution. (World Economic Forum, June 24, 2025)

**Engineered Living Therapeutics:** This involves introducing genetic code into living probiotic systems (microbes, cells, fungi) to produce therapeutics on demand. (World Economic Forum, June 24, 2025)

**Nanozymes:** Lab-produced nanomaterials with enzyme-like properties, offering a more stable, cheaper, and simpler alternative to natural enzymes. (World Economic Forum, June 24, 2025)

**Collaborative Sensing:** Networked sensors, enhanced by AI, can transform urban operations, traffic management, pollution control, and environmental monitoring. (World Economic Forum, June 24, 2025)

**Generative Watermarking:** A technology for watermarking generative AI content, enhancing trust and safety in AI systems. (World Economic Forum, June 24, 2025)

**Kerala Innovation Festival (KIF-2025):** Scheduled for July 25-26, this event will showcase over 100 product innovations, tech demonstrations, and prototypes, featuring segments like a "She Leads Summit" and "SDG & Sustainability Tracks." (Times of India, July 17, 2025)

## MCQS

**1.What is the main technique proposed by scientists to rescue endangered species by restoring lost genetic diversity?**
a) Artificial insemination
b) Habitat relocation
c) Gene editing using DNA from museum specimens and related species
d) Cloning of individual animals

**Answer:** c) Gene editing using DNA from museum specimens and related species
The text states, "Scientists have proposed a visionary framework to rescue endangered species by restoring their lost genetic diversity using gene editing. This involves utilizing DNA from museum specimens and related species..."

**2.According to new research from the University of British Columbia, what significant impact can clear-cutting forests have?**
a) Increased biodiversity in the area.
b) Decreased average temperature in the watershed.
c) Significantly increased flood risk.
d) Improved soil fertility.

**Answer:** c) Significantly increased flood risk.
The text states, "New research from the University of British Columbia found that clear-cutting forests can significantly increase flood risk."

**3.What invasive species are dogs, trained by everyday pet owners, proving effective in detecting?**
a) Asian carp
b) Emerald ash borer
c) Spotted lanternfly



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d) Zebra mussels

**Answer:** c) Spotted lanternfly
The text highlights, "A study has shown that dogs trained by everyday pet owners are proving to be effective in detecting the invasive spotted lanternfly..."

**4.What is "Green Nitrogen Fixation" aiming to significantly cut?**
a) Water consumption in agriculture
b) The environmental impact and energy consumption of current fertilizer production
c) The need for genetically modified crops
d) Soil erosion

**Answer:** b) The environmental impact and energy consumption of current fertilizer production
The text explains, "This involves new methods... aiming to significantly cut the enormous environmental impact and energy consumption of current fertilizer production."

**5.Researchers at Goethe University have developed a metal-free, boron-based catalyst for the efficient degradation of which widespread environmental pollutant?**
a) Microplastics
b) Heavy metals
c) PFAS (Per- and Polyfluoroalkyl Substances)
d) Oil spills

**Answer:** c) PFAS (Per- and Polyfluoroalkyl Substances)
The text mentions, "Researchers at Goethe University have developed a metal-free, boron-based catalyst for efficient degradation of PFAS (Per- and Polyfluoroalkyl Substances)..."

**6.How much of India's thermal power plant units has the Union Environment Ministry exempted from installing Flue Gas Desulphurisation (FGD) systems?**
a) 22%
b) 50%
c) 78%
d) 100%

**Answer:** c) 78%
The text states, "India's Union Environment Ministry has exempted 78% of the country's thermal power plant units from installing Flue Gas Desulphurisation (FGD) systems..."

**7.What kind of electronics have researchers developed that are both recyclable and capable of healing themselves?**
a) Quantum electronics
b) Flexible circuit boards
c) Recyclable, healable electronics
d) Self-assembling robots

**Answer:** c) Recyclable, healable electronics
The text states, "Researchers have developed electronics that are both recyclable and capable of healing themselves..."

**8.What type of medical condition is the gene therapy being developed by University College London researchers aimed at treating?**
a) Alzheimer's disease
b) Drug-resistant focal epilepsy
c) Parkinson's disease
d) Type 2 diabetes

**Answer:** b) Drug-resistant focal epilepsy
The text specifies, "Researchers at University College London are developing a gene therapy to treat drug-resistant focal epilepsy..."

**9.What is the AI-powered "Electric Salt Spoon" designed to help people do?**



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a) Measure precise amounts of salt for cooking.
b) Make food taste saltier and more umami to reduce actual salt intake.
c) Preserve food longer with salt.
d) Detect excess salt in processed foods.

**Answer:** b) Make food taste saltier and more umami to reduce actual salt intake.
The text describes it as "A spoon using tiny electrodes makes food taste saltier and more umami, aiming to help people reduce salt intake."

**10.What are Structural Battery Composites (SBCs)?**
a) New types of solar panels for buildings.
b) Materials that can generate electricity from vibrations.
c) Weight-bearing materials that can also store electrical energy.
d) Advanced insulation materials for energy efficiency.

**Answer:** c) Weight-bearing materials that can also store electrical energy.
The text defines them as "These are weight-bearing materials (like carbon fibre) that can also store electrical energy, allowing for more integrated and efficient power solutions."

**11.What is the primary focus of "Nanozymes"?**
a) Creating microscopic robots for surgery.
b) Lab-produced nanomaterials with enzyme-like properties.
c) Developing new types of energy storage.
d) Designing advanced water purification filters.

**Answer:** b) Lab-produced nanomaterials with enzyme-like properties.
The text describes them as "Lab-produced nanomaterials with enzyme-like properties, offering a more stable, cheaper, and simpler alternative to natural enzymes."

**12.What is the Kerala Innovation Festival (KIF-2025) scheduled to showcase?**
a) Agricultural produce and farming techniques.
b) Over 100 product innovations, tech demonstrations, and prototypes.
c) Traditional art and cultural performances.
d) Tourism initiatives in Kerala.

**Answer:** b) Over 100 product innovations, tech demonstrations, and prototypes.
The text states, "Scheduled for July 25-26, this event will showcase over 100 product innovations, tech demonstrations, and prototypes..."





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