



PROCEEDINGS OF

National Conference on

FRONTIERS IN ENVIRONMENTAL SUSTAINABILITY,
CLIMATE STEWARDSHIP, AND BIOTECHNOLOGY
(FESCBT-2026): COMMEMORATING EARTH DAY –
“Our Power, Our Planet”

April 22-23, 2026, hybrid mode

ORGANIZED BY

ICAR-Central Agroforestry Research Institute (CAFRI) Jhansi, Uttar Pradesh, INDIA
Save The Environment (STE) Kolkata, West Bengal, INDIA

IN ASSOCIATION WITH

Indian Society of Agroforestry (ISAF) Jhansi, Uttar Pradesh, INDIA
The Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi, INDIA

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ICAR-Central Agroforestry Research Institute (CAFRI) Jhansi, Uttar Pradesh, INDIA



EDITOR
GAURAV SAXENA

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SAVE THE ENVIRONMENT (STE)

(A SOCIETY FOR RESEARCH, AWARENESS, AND SOCIAL DEVELOPMENT)

KOLKATA, WEST BENGAL, INDIA

**Proceedings of National Conference on
FRONTIERS IN ENVIRONMENTAL
SUSTAINABILITY, CLIMATE STEWARDSHIP, AND
BIOTECHNOLOGY (FESCBT-2026):
COMMEMORATING EARTH DAY – “Our Power,
Our Planet”**

Editor

Dr. Gaurav Saxena

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Department of Life Science
Mandsaur University
Mandsaur, Madhya Pradesh, India



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PREFACE

The Proceedings of the National Conference on “Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026): Commemorating Earth Day - ‘Our Power, Our Planet’” represents a collective scholarly effort to address some of the most pressing environmental challenges of our time. Organized on April 22-23, 2026, in hybrid mode, this conference brought together researchers, academicians, policymakers, industry experts, and young scholars from diverse disciplines to deliberate on sustainable solutions for a rapidly changing planet.

Earth Day serves as a global reminder of our shared responsibility toward environmental conservation and sustainable development. The theme “Our Power, Our Planet” emphasizes the collective strength of individuals, institutions, and nations in driving transformative change. In this context, the conference aimed to foster interdisciplinary dialogue and promote innovative research at the interface of environmental science, climate change, and biotechnology.

This volume compiles peer-reviewed abstracts presented during the conference, covering a broad spectrum of themes including climate resilience, biodiversity conservation, waste management, bioremediation, sustainable agriculture, environmental biotechnology, renewable energy, and policy frameworks for climate governance. The contributions reflect cutting-edge research, practical insights, and emerging technologies that have the potential to contribute significantly to environmental sustainability and climate stewardship.

The editors have made every effort to ensure the quality, coherence, and scientific integrity of the contents included in this proceedings volume. Each submission was reviewed and curated to maintain academic rigor and relevance. However, the responsibility for the originality and viewpoints expressed in individual papers rests solely with the respective authors.

We express our sincere gratitude to all contributing authors for their valuable research contributions and to the reviewers for their critical evaluation and constructive feedback. We are deeply thankful to the organizing institutions, ICAR-Central Agroforestry Research Institute (ICAR-CAFRI) and Save The Environment (STE), for their vision and commitment to advancing environmental research. We also acknowledge the support of the Indian Society of Agroforestry and the Society for Science of Climate Change and Sustainable Environment for their collaboration in making this event successful.

Special appreciation is extended to the President of STE, the Director of ICAR-CAFRI, the Organizing Secretaries, Convenors, and the entire organizing team for their dedicated efforts in planning and executing this conference. We also thank the distinguished speakers and participants whose engagement enriched the scientific discourse.

We hope that this proceedings volume will serve as a valuable resource for researchers, students, and practitioners, and will inspire further research, innovation, and collaborative action toward building a sustainable and climate-resilient future.

EDITOR



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ACKNOWLEDGEMENTS

The successful organization of the National Conference on “Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026): Commemorating Earth Day - ”Our Power, Our Planet” and the publication of its proceedings have been made possible through the collective efforts, guidance, and support of many individuals and institutions.

I express my deepest sense of gratitude to the president of Save The Environment (STE) for visionary leadership, constant encouragement, and unwavering support in conceptualizing and promoting this important academic initiative. I am equally indebted to the Director of ICAR-Central Agroforestry Research Institute (ICAR-CAFRI) for providing institutional support, valuable guidance, and encouragement throughout the planning and execution of the conference.

I want to acknowledge the contributions of the organizing secretaries and convenors, whose dedication, meticulous planning, and tireless efforts ensured the conference ran smoothly in hybrid mode. Their commitment to academic excellence and attention to detail played a crucial role in the success of this event.

My heartfelt appreciation goes to all members of the organizing and technical committees, volunteers, and supporting staff for their coordinated efforts in managing various aspects of the conference, including scientific sessions, logistics, communication, and technical support.

Thank you to all the keynote speakers, invited speakers, and session chairs for your insights and contributions, which enriched the academic discourse and inspired participants. I am equally grateful to all authors and participants for their enthusiastic involvement and for contributing high-quality research papers that form the core of this proceedings volume.

I also acknowledge the support and collaboration of the Indian Society of Agroforestry and the Society for Science of Climate Change and Sustainable Environment for their valuable association in organizing this conference and promoting interdisciplinary research.

I place on record our appreciation for the reviewers and editorial team, whose critical evaluation, constructive suggestions, and editorial efforts helped maintain the academic rigor, quality, and integrity of this publication. Finally, I thank all individuals and organizations who, directly or indirectly, contributed to the success of this conference and the publication of this proceedings volume. Their support and cooperation have been instrumental in making this endeavor meaningful and impactful.

EDITOR



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ABOUT THE EDITOR

Dr. Gaurav Saxena is an accomplished environmental microbiologist driven by passion, exploring the microbial world to advance bioremediation, wastewater treatment, and metagenomics for a sustainable future. He is currently an Assistant Professor in the Department of Life Science at the Faculty of Life Sciences, Mandsaur University, Madhya Pradesh, India. Alongside his academic responsibilities, Dr. Saxena serves as the Placement Coordinator and the Innovation Activity Coordinator for the Institutional Innovation Council (IIC) at Mandsaur University. He also holds the role of Feedback and Internship Coordinator in the Department of Life Science at the same university. His expertise lies in microbial ecology, bioremediation, wastewater treatment, and metagenomics, with a strong focus on harnessing the potential of microbes to address critical environmental challenges. He has authored many scientific papers, book reviews, chapters, popular science articles, conference papers, conference proceedings, and books. His publications have garnered over 4,400 citations with an h-index of 28. Dr. Saxena has made significant contributions in the national and international arena and has received several awards and honors for scientific research from several scientific organizations including “STE Water Award-2023”, dual “Young Scientist Award-2021, 2020”, “Young Achiever Award-2019”, and “Young Environmentalist Award-2018”.

He is the editor of several books including “Bioremediation of Industrial Pollutants” (Write and Print Publication, New Delhi-India), “Bioremediation of Industrial Waste for Environmental Safety: Industrial Waste and Its Management (Vol. I) (Springer Nature, Singapore)”, “Bioremediation of Industrial Waste for Environmental Safety: Biological Agents and Industrial Waste Management (Vol. II) (Springer Nature, Singapore)”, Bioremediation for Environmental Sustainability: Toxicity, Mechanisms of Contaminants Degradation, Detoxification and Challenges (Elsevier, USA), and Bioremediation of Environmental sustainability: Approaches to Tackle Pollution for Cleaner and Greener Society (Elsevier, The Netherlands) and author of the one book, Microbe-Assisted Phytoremediation of Environmental Pollutants: Recent Advances and Challenges (CRC Press, T&F, USA). Additionally, to his roles as an environmental consultant to industries and editor of "PLOS Water" USA, Frontiers in Microbiology, Switzerland, and "Journal of Applied Biology and Biotechnology (JABB)," Dr. Saxena is serving as an invited reviewer in many scientific journals in his areas of expertise. As an academician and researcher, Dr. Saxena has supervised over nineteen master's and five PhD theses, appointed as external examiner for setting question papers at many universities, organized several national/international conferences, trainings, workshops, and other academic and scientific activities, presented his research works as oral and poster presentation and delivered several invited talks at many scientific conferences, supervised various consulting projects, and served as a member of several university-level committees.

He is currently serving as “Joint Secretary” of the executive council of the National Environmental Science Academy (NESA), New Delhi, India. Earlier, Dr. Saxena served as President of the Microbiologists Society (MBSI), Himachal Chapter, Himachal Pradesh, India. As a member, Dr. Saxena is affiliated with multiple scientific societies, notably the Association of Microbiologists of India (AMI), American Society of Microbiology (ASM), USA, Indian Science Congress Association (ISCA), Microbiology Society (MicroSoc), London, British Ecological Society (BES), London, American Chemical Society (ACS), USA, and International Society for Development and Sustainability (ISDS), Japan. He loves to travel and explore diverse cultures and cuisines, always seeking new experiences and culinary adventures. His wide-ranging interests inspire his creativity and strengthen his commitment to developing innovative solutions to environmental challenges. Feel free to connect and collaborate with Dr. Saxena (gaurav10saxena@gmail.com) on projects that advance environmental sustainability and drive meaningful change!



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FRONTIERS IN ENVIRONMENTAL SUSTAINABILITY, CLIMATE STEWARDSHIP, AND BIOTECHNOLOGY (FESCBT-2026): COMMEMORATING EARTH DAY – "Our Power, Our Planet,"

Date: 22-23 April, 2026 • Venue: CAFRI-JHANSI, U.P.

Organized by



SAVE THE ENVIRONMENT
KOLKATA / GURUGRAM



ICAR-Central Agroforestry Research Institute
Jhansi, Uttar Pradesh



Technical Partners



Indian Society of Agroforestry
Jhansi, Uttar Pradesh



The Society for Science of Climate Change and
Sustainable Environment (SSCE), New Delhi

Themes

- ❖ Theme 1: Agricultural Biotechnology and Sustainable Food Systems
- ❖ Theme 2: Biodiversity Conservation and Ecosystem Restoration
- ❖ Theme 3: Education, Awareness, and Policy for Sustainable Future
- ❖ Theme 4: Emerging Biotechnologies for Environmental and Health Sustainability
- ❖ Theme 5: Environmental Biotechnology and Pollution Management
- ❖ Theme 6: Environmental Sustainability and Climate Change Mitigation
- ❖ Theme 7: Plastic Pollution, Bioplastics, and Circular Bio-economy

❖ Theme 8: Water, Soil, and Waste Management

❖ Special session of earth day to: Our Power, Our Planet and include following:

- Renewable Energy for a Sustainable Future
- Climate Action and Carbon Neutrality
- Biodiversity Conservation and Ecosystem Restoration
- Circular Economy and Sustainable Resource Management
- Community Empowerment and Environmental Stewardship

REGISTRATION

Category	Regular Registration (31.03.2026)	Late & On-Spot Registration* (31.03.2026)
Faculties/ Delegates/ Scientists/Academicians Scientists	Rs. 3000.00	Rs. 3500.00
Research Scholars/ Junior Resident/ Senior Resident	Rs. 2000.00	Rs. 2500.00
Students (Graduate/PG)	Rs. 1500.00	Rs. 2000.00
Online Participants	Rs. 1000.00	Rs. 1500.00
Corporate / Industry Delegates	Rs. 5000.00	Rs. 5500.00

IMPORTANT DATES

Conference Dates	22-23 April, 2026
Registration and Abstract Submission Starts	15.02.2026
Last Date of Registration without late payment	31.03.2026
Last Date of Registration with late fees	12.04.2026
Abstract submission Deadline	31.03.2026

Note: The above dates are mandatory and strictly followed by Organizing and Publication Committee.

PAYMENT

Bank details for Electronic Transfer
Account Name: Save The Environment
Account Number: 60475457174
Bank and Branch: Bank of Maharashtra,
Kalkaji, New Delhi-110019
IFSC Code: MAHB0000974
Google Pay to: Mrs. Chhanda Basu; Mobile No. 9830779260



Link Conference Registration:

<https://docs.google.com/forms/d/e/1FAIpQLSdbSLLwOTHBdUJYCcs2U0DUOcVq8rBNDLLZhQKWLNIrrNiLw/viewform?usp=header>

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Dr. K. Rajarajan, ICAR-CAFRI, Jhansi, U.P. (+91 +91 98945 99172)

Dr. Kshipra Misra, STE (+91 98713 72350)



केन्द्रीय कृषिवानिकी अनुसंधान संस्थान
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Central Agroforestry Research Institute



डा. अ. अरुणाचलम / A. Arunachalam PhD., D.Sc.

निदेशक / Director



Message

It gives me great pleasure to extend my warm greetings on the occasion of the National Conference on “Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026): Commemorating Earth Day – ‘Our Power, Our Planet.’” In the face of escalating environmental challenges and climate uncertainties, scientific communities must come together to explore innovative, sustainable, and practical solutions. This conference provides an excellent platform for researchers, academicians, and professionals to exchange knowledge, share insights, and foster collaborations in the vital areas of environmental sustainability, climate stewardship, and biotechnology.

The theme “Our Power, Our Planet” is both timely and inspiring, emphasizing our collective responsibility and capacity to protect and preserve our natural resources. I am confident that the deliberations and outcomes of this conference will contribute significantly toward advancing research, policy, and practice in these critical domains. I commend the whole team of FESCBT-2026 for their dedicated efforts in successfully conducting this conference and bringing together a diverse group of experts and young minds. I also appreciate the contributors whose scholarly work forms an important part of this proceedings volume. I extend my best wishes for the grand success of the conference and hope that it will inspire continued efforts toward building a sustainable and resilient future.

Date: 15-04-2026

Place: Jhansi, Uttar Pradesh

(A. Arunachalam)

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MESSAGE BY PATRON



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Message

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Date: 16-04-2026

Place: Jhansi, Uttar Pradesh

Dr. Kshipra Misra
President - STE

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MESSAGE BY CO-PATRON



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Central Agroforestry Research Institute



Dr. K. Rajarajan

Senior Scientist
Ph.D, M.Sc.(Ag.),
Plant Genetics

✉ Rajaran.K@icar.org.in



Message

It is a matter of great privilege and satisfaction to welcome you to the National Conference on “Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026): Commemorating Earth Day – ‘Our Power, Our Planet’.” The growing challenges of environmental degradation, climate change, and resource depletion call for urgent, innovative, and collaborative solutions. This conference has been conceived as a platform to bring together scientists, academicians, industry experts, policymakers, and young researchers to exchange ideas, present their research, and deliberate on sustainable pathways for the future.

I extend my sincere gratitude to the Director, ICAR–Central Agroforestry Research Institute, the President of Save The Environment (STE), our collaborating societies, and all members of the organizing and technical committees for their constant guidance and support. I also thank the keynote speakers, session chairs, authors, and participants for their valuable contributions that have enriched this conference. I hope that the outcomes of this conference and the knowledge shared through these proceedings will inspire further research, innovation, and collaboration toward building a sustainable and climate-resilient future. I wish the conference a great success and thank you all for your participation and support.

Date: 15-08-2026

Place: Jhansi, Uttar Pradesh

DR. K. RAJARAJAN

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MESSAGE BY ORGANIZING SECRETARY



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डॉ. गौरव सक्सेना, एमएससी, नेट, पीएचडी (पर्यावरणीय सूक्ष्मजीवविज्ञान)

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Member Executive Council MASTD, Uttar Pradesh, IN

Review Editor, Frontiers in Environmental Sciences, CH

Section Editor, Journal of Applied Biology & Biotechnology, IN

Review Editor, Frontiers in Microbiology, CH

Editorial Board Member, PLOS Water, USA



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DREAM. LEARN. LEAD.

Ref. No. MU/FLS/04-01/2026
April 15, 2026



MESSAGE

It gives me immense pleasure to welcome you to the National Conference on Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026), being organized on April 22–23, 2026, in hybrid mode, commemorating Earth Day with the theme “Our Power, Our Planet”. This conference brings together leading scientists, academicians, researchers, policymakers, and industry experts to deliberate on pressing environmental challenges and explore innovative, science-driven solutions. The theme underscores the urgent need to address plastic pollution while advancing sustainable practices through biotechnology, climate stewardship, and agroforestry interventions.

FESCBT-2026 aims to foster knowledge sharing, promote cutting-edge research, and encourage collaborative efforts toward environmental sustainability and climate resilience. We have curated a comprehensive program featuring keynote lectures, technical sessions, and interactive discussions that will enrich participants and inspire actionable outcomes. I sincerely thank all our distinguished speakers, contributors, and participants for their valuable support and engagement. I also extend my gratitude to the organizing team and partner institutions for their dedication and efforts in making this conference a success.

I wish all participants a highly enriching and productive experience.

With regards,

Dr. Gaurav Saxena

Organizing Secretary

FESCBT-2026

मंदसौर विश्वविद्यालय, उपमार्ग चौराहा, रेवास देवडा रोड, एस. एच. - 31, मंदसौर, मध्य प्रदेश, भारत ४५८००१ | Mandsaur University, Bypass Square, Revas Devda Road, S.H. - 31, Mandsaur, Madhya Pradesh, India 458 001
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PROTECT x CHANGE



SPONSORSHIP ACKNOWLEDGEMENT

The Organizing Committee of the National Conference on *FRONTIERS IN ENVIRONMENTAL SUSTAINABILITY, CLIMATE STEWARDSHIP, AND BIOTECHNOLOGY (FESCBT-2026): COMMEMORATING EARTH DAY* - "Our Power, Our Planet" sincerely acknowledges and expresses its deep gratitude to **Daiki Axis India Pvt Ltd., Faridabad, Haryana, India (a subsidiary of Daiki Axis Co., Ltd., Japan)**, for the generous sponsorship and valuable support extended toward the successful organization of this conference. Their commitment to academic excellence, scientific innovation, and sustainable research initiatives helped ensure the conference and its activities ran smoothly. We highly appreciate Daiki for their support, cooperation, and encouragement, and we look forward to fostering continued academic-industrial collaborations in the future.

THE ORGANIZING COMMITTEE
FESCBT-2026



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CHANCE TO CHANGE



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Change Today for a Sustainable Tomorrow

Since time immemorial, human civilizations have thrived along the river banks. But focus on economic development has put pressure on our natural environment including, the water resources. Unfortunately, the water bodies today have been converted into dumping areas for human, animal and industrial wastes.

Water Recycling

The need of the hour with the ever-increasing population and the given limited water resources, water recycling becomes all the more important and urgent in order to reduce the high water stress in India. Thereby creating multiple water recycling opportunities that ease the acute pressure on our groundwater, which then can be used for drinking and other imperative usages.

Japan's Water Story

Japan is a nation richly endowed with clean water. Despite using the water resources optimally, rapid industrial development over the decades pushed it further to its limits, thereby giving birth to the need to recycle. Through a holistic approach involving law, policies, technology, execution framework and clear priorities, Japan was able to come out of this adversity and make their water and environment beautiful again.

Water Scenario in India

India is one of the most blessed countries in the world in terms of natural resources. However, the increasing demand for domestic, industrial and agriculture uses has put a strain on most of the river basins. While India is facing water scarcity, on one hand, it is battling with polluted water resources on the other across the country.

"We promote the conservation of water environment to the world"



**Daiki
AXIS**
Hiroshi Ogame
President & CEO

Message from the President

Having spent 60 years focusing on water and people's lives, our goal is to continue working towards becoming an 'eco-creation and development company' that provides greater support to humans and the natural environment. To realize this goal, we promote the conservation of the water environment to the world.

Company Profile:

Company Name: Daiki Axis Co., Ltd.
Date Founded: July 12, 1958
Listed: Tokyo Stock Exchange 1st Section
Turnover: INR. 3,200cr
Employees: 1100
Headquarter: Matsuyama & Tokyo
Group Turnover: Rs. 30 ,000cr

Daiki Axis is a pioneer in bringing state-of-the-art infrastructure across factories in Japan & overseas. The efficiency of this huge network is based on a high synchronization of 37 offices of Daiki Axis within Japan. Additionally, it is supported by 5 factories overseas and 7 subsidiaries that ensure a free-flowing system resulting in meeting ever-increasing demands.



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Clean and Water Positive India, Priority of the current time !

India, the most populous country in the world is aspiring to become a developed nation by 2047! This aspiration can only be met if India is able to clean its environment and sustain its water resources.

Treatment of used water before discharge to the environment is becoming mandatory in India. It also provides a great opportunity to reuse the treated water for many applications, reduce stress on freshwater resources to promote sustainable development.



India's Approach to Water Recycling

For almost two decades now, India has been grappling with water stress issues. In spite of the major investments in sanitation and wastewater treatment infrastructures, India still is on a quest of achieving clean rivers, oceans and even underground water resources.

Although the Swachh Bharat Mission and other initiatives have played a vital role in addressing the issue of sanitation coverage and awareness creation. We are yet to find an effective solution to recycle and clean our natural water resources.

India so far has been focussed on creating large city-level infrastructures for sewage treatment but it has its own limitations when it comes to large scale project planning and the final implementation procedures. Since the water recycling system is being constructed for one of the most populated countries in the world, huge financial budgets are required for the construction and maintenance of the same.

Johkasou Waste Water Treatment

Japan has developed Johkasou- A decentralized treatment approach and used this concept effectively for wastewater systems. These systems have been in use for over 4 decades in Japan and have shown great results in relieving the pressure on water resources.

Core Concept of Johkasou is "Treat at the Site, Reuse at the Site"

Johkasou-STP is the most suitable concept for Indian demand & circumstances for various reasons than any regular wastewater treatment system lacks. Johkasou is highly modular and scalable in nature, it can be easily installed block by block or building by building and it operates at a small CAPEX and a very low operational cost.

Application of the recycled water

Treated water by Johkasou-STP can be used for several applications without tertiary treatment



Key Users for Recycle water and Johkasou/DSTP Unauthorised colonies/slum



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Efficient production system for all type of Application.

The domestic production division has four plants in Japan with an international-standard, ISO 9001 in quality management. At these plants, various types of water treatment equipments including Johkasou (Domestic Wastewater Treatment System) are manufactured for meeting the domestic and overseas demands promptly.



Filament Winding Machine



Cylinder Moulding Machine



Automatic Opener



Quick Dry System



Spray Moulding



Product Assembly

Daiki Axis manufacturing units overseas other than India

Born in Japan to cater to the urgent needs of water resources, Daiki Axis is creating a network across the globe to give the world a fair chance to change our depleting water resources. Continuing with the policy of 'treat at site, reuse at site', Johkasou is a revolutionary solution to wastewater treatments across countries in the 21st century.



Matsuyama Factory



Shinshu Factory



Fukushima Factory



Tsushima Factory



Indonesia Factory



Srilanka Factory



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Johkasou (Domestic Wastewater Treatment System)

Advanced features and benefits:

- Easy to maintain, high-performance treatment system
- Removes nutrients efficiently
- A spacious separation box is given to separate & store the sludge. The sludge can be drawn at the time of maintenance, which is recommended once after 6 months
- Available in three different models catering to the varying output requirements
- Consumes low energy
- Lesser operating cost
- Highly modular and scalable
- Long plant life and consistently high performance

Performance of Johkasou-STP

Johkasou is capable of meeting the needs for output qualities expected by the government regulatory bodies or as per the application requirements.

Inlet	Parameter	AI-type Outflow	AIJ-type Outflow	AIA-type Outflow	AIM-type Outflow
6-8	pH	6-8	6-8	6-8	6-8
300	BOD	20 ^{*1}	10	10	5
450	COD	50	30	30	10
240	SS	30 ^{*3}	20 ^{*3}	10	5
40	Oil & Grease	10	10	10	5
50	T-N	45	20 ^{*2}	10	10 ^{*2}

*1 - With PSF Achieve BOD below 10

*2 - AIA & AIM can bring T-N below 10

*3 - AI & AIJ achieve SS below 10 with PSF

Images of Installation Johkasou-STP

APARTMENT COMPLEX
(60KLD)



INDIVIDUAL HOUSE
(1KLD)



FACTORY
(30KLD)



COMMERCIAL BUILDING
(40KLD)



INCREASED CAPACITY



INSTALL UNDER CAR PARKING



INSTALL UNDER GREEN



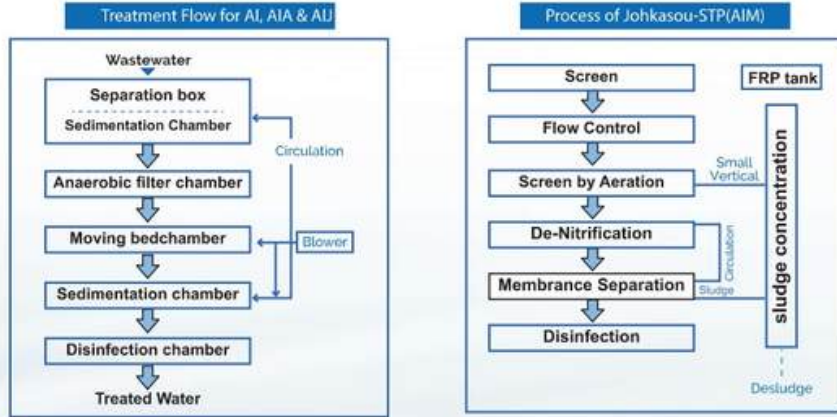
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High-Performance Johkasou Technology

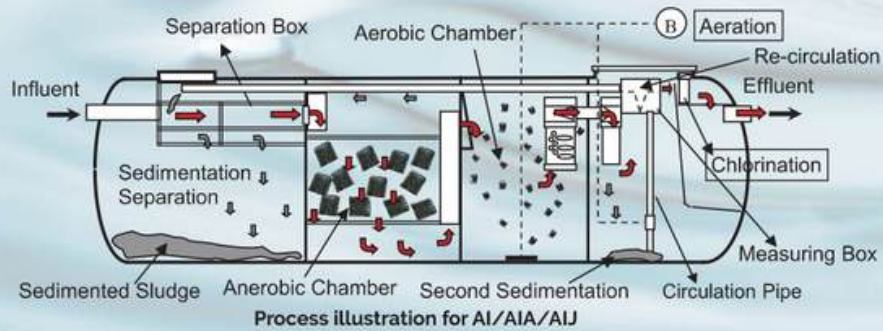
The process of effective decentralized treatment of water through Johkasou
(As explained in diagram below):



-Treatment Process are some for both AI, AIA and AIJ

-To remove T-N, in AIJ type chamber size, tank size ratio and capacity of blower are modified compared with AI Type

Re-Circulation system: This part ensures circulation in the sedimentation chamber for the re-treatment of water. Since it becomes like an anaerobic chamber, the process of denitrification is repeated for the second time in the final process.



Features of Johkasou-STP

Low energy consumption

No operator required (Automatic)

Quick Maintenance

Nitrogen & Phosphorous Treatment

No Leak Smell
No Noisy Sound

Equalization Tank not required (Shock Flow Control)

LOW Sludge Generation

Quick Installation

Highly Efficient Performance



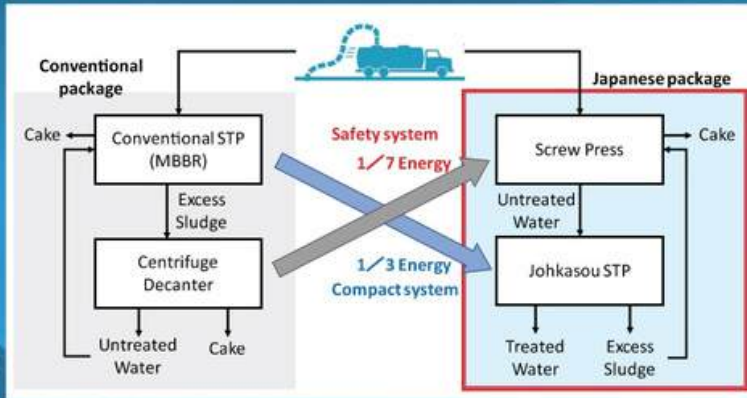
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Advance Treatment for Fecal Sludge

Fecal sludge treatment in India needs enough attention. The Japanese package makes the fecal treatment process more efficient, compact and energy-saving. In a conventional package, the excess sludge is treated with centrifugal and decantation procedures to separate water from the sludge, the end product being untreated water and sludge cake. In the Japanese package, on the other hand, water and sludge are bifurcated by screw-pressing the fecal sludge to be converted into cakes. The untreated water is then sent to Johkasou STP to be converted into the water which can be used for gardening, cleaning and other purposes.



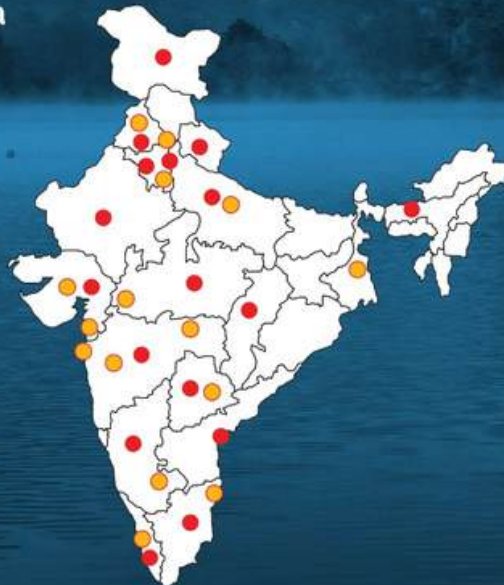
Network

Daiki Axis Group has offices and affiliated companies in major cities in Japan, as well as in China, India and Indonesia. Through this network of security and reliability that spreads across Japan, China and Southeast Asia, we cover every detail of our customer's requirements

Daiki Axis India has offices and partners in major cities of India. It has already installed decentralised system for water waste recycling in several cities and over 500 sites.

● Daiki Axis India

- Chandigarh
- Delhi
- Palwal
- Lucknow
- Ahmedabad
- Vapi
- Indore
- Kolkata
- Mumbai
- Pune
- Nagpur
- Hyderabad
- Bangalore
- Chennai
- Kochi



● PARTNERS

- J&K
- Punjab
- UK
- Delhi
- Haryana
- Rajasthan
- UP
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- Telangana
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Sales Partner



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PROTECT + CHANGE

Daiki
AXIS

JOHKASOU-STP

Japanese Domestic Wastewater Treatment System

CAPSULE TYPE



CYLINDER TYPE



UNDERGROUND



ABOVE GROUND



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REDUCE. RECYCLE. REUSE.

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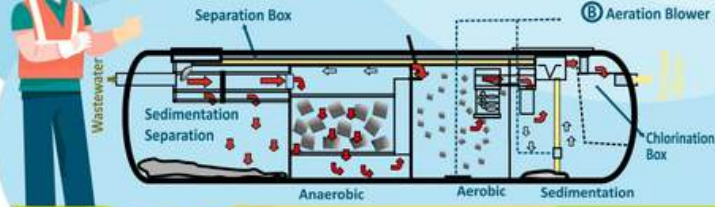
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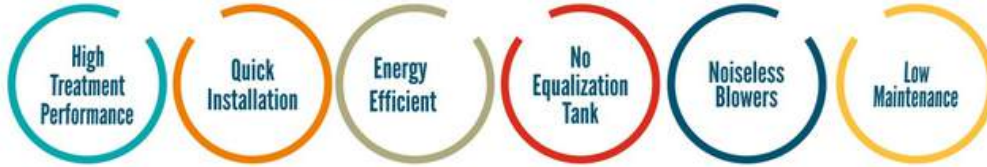
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**DAIKI JOHKASOU
HIGH PERFORMANCE STP**

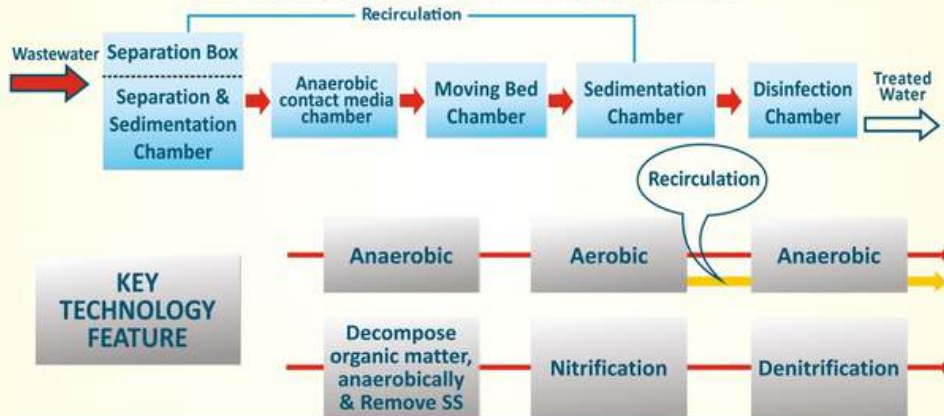
PROCESS DESCRIPTION OF PLANT



KEY ADVANTAGES



TREATMENT PROCESS FLOW CHART



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Role of Biofertilizers in enhancing soil health

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Abstract

Agriculture today faces the challenge of increasing food production while preserving soil health. Excessive use of chemical fertilizers has boosted yields but degraded soil fertility and biological activity. Biofertilizers offer a sustainable alternative by enhancing soil productivity through beneficial microorganisms. Soil microbes support plant growth through nutrient cycling, nitrogen fixation, and the conversion of unavailable nutrients into accessible forms, thereby reducing reliance on synthetic inputs. Fungi improve water and nutrient absorption and strengthen soil structure. Bacteria such as Rhizobium, Pseudomonas, and Azospirillum promote root growth and suppress pathogens. Overall, biofertilizers help maintain soil health, improve crop resilience, and reduce environmental pollution. Secondary data-based research used for this study reveals the following. According to Nasrollahzadeh et al. (2023), plant growth-promoting rhizobacteria (PGPR) and vermicompost with reduced chemical fertilizers increase oil yield and biodiesel in rapeseed and mustard by approximately 4.77%. Experiments conducted by Ikiz et al. (2024) on various categories of mineral fertilizer (MF) and PGPR reported improved plant nutrient uptake, with iron uptake increasing by up to 26%, and increased yield by up to 18.94%. Oyebamiji et al. (2023) demonstrated that aquaculture nutrient integration on maize resulted in an increase in plant height by 35.8% - 44.4%, the leaf length increased by 20.3-39.3%, and the root length increased by 38.8 - 66%, along with an optimum yield and reduction of chemical fertilizers up to 25-75%. Another survey study conducted by Kuang et al. (2024) on farmers' perception to organic and natural fertilizers over chemical ones, claimed that 42.67% farmers agreed the effect was good, and 22.90% believed the effect was general. Overall, biofertilizers strengthen plant growth improves soil structure for sustainable agriculture. Encouraging their use can reduce chemical inputs, restore soil biological balance, and promote long-term productivity. Strengthening the living component of soil is therefore essential for achieving environmentally responsible and economically viable agriculture.

Keywords: Biofertilizers, Mycorrhizae, PGPR, Organic farming, Chemical fertilizers



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Anthropogenic stress on Aquatic Ecosystems: Impending threats of Microplastics, Eutrophication, and Ocean Acidification

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Abstract

The synergistic effect of microplastic pollution, eutrophication, and ocean acidification increases harm to aquatic life. These problems have gotten worse over time, especially since the rise of industry, and they now affect both freshwater and marine environments all over the world. Microplastics, which come from plastic waste and industry, are now found in almost all bodies of water. They are new pollutants that are showing undesirable effects on aquatic ecosystems. It is becoming the cause of DNA and cellular damage, oxidative stress, alterations in gene expression, and decreased cell viability by significantly increasing the production of reactive oxygen species (ROS). These tiny particles are easy for aquatic organisms to eat, which can hurt their insides, expose them to harmful chemicals, and move toxins through the food chain. Eutrophication, which is caused by too many nutrients from farming and urban runoff, increases microplastic content in water bodies. Organic matter, discharge of pollutants such as sulfide and heavy metals, are the emerging causes of algal blooms formation that lower the amount of oxygen in water and make the condition hypoxic, which is the primary factor contributing to the loss of seagrass. This makes dead zones where many aquatic species live. Ocean acidification is another problem worsening as the amount of CO₂ in the air increases. The oceans are taking in more carbon dioxide, which makes the water more acidic. This makes it hard for corals and shellfish to build and keep their shells. OA is slowly developing as the major cause that is influencing various physiological aspects of marine invertebrates by lowering their immunity, energy budget, metabolism, growth, and development, creating interference in the marine ecosystem, which hurts marine life and makes biodiversity worse. These issues are mutually related to each other, which makes the situation even worse. For instance, acidification can make microplastics more toxic, and waters that are full of nutrients can help them build up. These repeated exposures make organisms in the environment stressors together, mess up food webs, make species less able to adapt, and may even hurt human health by making seafood unsafe to eat. These effects together show that there is a big problem with the environment contributing to deterioration and triggering harmful outcomes for aquatic biodiversity. To fix it, we need to manage our trash better, use less plastic, stop nutrient pollution, and use more environmentally friendly methods. Long-term solutions depend on coordinated global efforts to protect aquatic ecosystems and maintain their balance.

Keywords: Synergistic effect, Dead zones, Hypoxic, Reactive oxygen species, Heavy metals.



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Climate-Driven Water Scarcity in Nigeria’s Benue River Basin: An Integrated Hydro-Climatic Modeling Approach

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Abstract

Climate-driven water scarcity in Nigeria’s Benue River Basin remains an urgent challenge amid increasing hydro-climatic variability and anthropogenic pressures. This study advances the regional understanding by integrating high-resolution hydro-climatic datasets (1990–2025) with a hybrid modeling framework that couples nonparametric trend analysis (Mann-Kendall, Sen’s slope) and machine learning diagnostics. Unlike previous studies, which predominantly relied on single-method analyses or generic baselines, our methodology employs nonlinear elasticity metrics and cross-basin statistical comparisons to uncover spatio-temporal patterns in water availability and deficit. Model robustness is validated through ablation studies, effect size estimates, and uncertainty quantification, providing statistically rigorous insights into the complex feedbacks between land use change, precipitation extremes, and river discharge. The findings contribute actionable knowledge for adaptive water management and policy formulation in data-limited regions, emphasizing the limitations and uncertainties inherent in hydro-climatic modeling for semi-arid West Africa

Keywords: Benue Basin, climate variability, integrated hydrological modeling, CMIP6 projections, water scarcity adaptation



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DNA barcoding of Small indigenous fishes (SIFs) from the Gomti River, Uttar Pradesh

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Abstract

In the present study, fish samples were collected from the Gomti River in Uttar Pradesh. Freshwater areas host many fish species, and Small Indigenous Fishes (SIFs) are particularly important for both nature and human food. But it is difficult to characterise these fish solely on morphological grounds, because many species look very similar. To address this challenge, DNA barcoding was employed for accurate species identification. A total of 12 fish samples were collected from various locations during the study period, including species such as *Nandus nandus*, *Labeo gonius*, *Systemus sarana*, and *Chanda nama*. DNA was extracted using the phenol-chloroform method, followed by amplification and verification of the COI gene. The resulting sequences were compared using NCBI tools such as BLAST, and the data were stored in FASTA format. MEGA 11 software was utilised to confirm species identification and analyse phylogenetic relationships. The findings demonstrate that DNA barcoding facilitates accurate identification of fish species and reduces taxonomic ambiguity. This approach can contribute to the conservation of endangered species, including those listed in the Red Data Book, and support effective management of freshwater fish populations.

Keywords: Gomti River, NCBI blast, DNA barcoding, Red Data Book, Mega 11, COI gene



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Risk Assessment of e-Waste Management Failure Factors Using FMEA

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Abstract

The exponential growth in electronic product consumption, coupled with rapid technological obsolescence, has transformed e-waste into one of the fastest-growing and most hazardous waste streams globally. In India, particularly in rapidly urbanizing cities such as Chennai, ineffective management systems, informal sector dominance, and weak regulatory enforcement have intensified environmental and occupational risks. However, systematic and quantitative evaluation of failure factors within the e-waste management chain remains limited. This study presents a comprehensive risk assessment of e-waste management using the Failure Mode and Effects Analysis (FMEA) framework. A multi-method approach integrating process mapping, stakeholder analysis, field observations, structured questionnaires, and expert inputs were employed to identify and evaluate failure modes across the entire lifecycle—from generation to final disposal. Key stakeholders from both formal and informal sectors were included to capture system-wide vulnerabilities. Risk prioritization was performed using Severity (S), Occurrence (O), and Detection (D) scores to compute Risk Priority Numbers (RPN). The findings reveal a pronounced risk concentration in the informal sector, with critical failure modes such as absence of monitoring (RPN 448), unregulated sourcing (RPN 392), open dismantling (RPN 378), acid leaching (RPN 378), and lack of PPE (RPN 378). Collection centers also exhibited high-risk conditions, including improper handling (RPN 288) and hazardous waste mixing (RPN 240). At the source level, behavioral failures such as improper segregation (RPN 252) and disposal with municipal waste (RPN 210) significantly contribute to downstream risk amplification. In contrast, the formal sector demonstrated controlled risk levels, with most RPN values below 72, attributed to structured operations and regulatory compliance. The study establishes a clear risk escalation gradient from generation to informal recycling, identifying informal processing as the most critical intervention point. It underscores the urgent need for regulatory strengthening, infrastructure development, behavioral change, and formal-informal sector integration. The proposed FMEA-based framework offers a robust, data-driven, and replicable model for advancing sustainable e-waste management in urban systems.

Keywords: E-waste management, FMEA, Risk assessment, Informal sector, RPN, Chennai



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Development of a Palatable and Nutrient-Optimised Fish Feed for Accelerated Growth in Aquaculture

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Abstract

Aquaculture efficiency is strongly influenced by the nutritional quality and acceptability of feed. This review paper focuses on studying and designing an advanced fish feed formulation that not only meets the complete nutritional requirements of fish but also enhances feed intake through improved palatability. The primary objective is to achieve accelerated growth, enabling fish to attain the growth equivalent of two months within a shortened period of approximately 1 to 1.5 months. The formulated feed incorporates balanced proportions of high-quality protein sources, including fish meal, plant-based proteins, and biologically enriched ingredients such as earthworm powder, ensuring the availability of essential amino acids for rapid tissue development. Lipids are included as a concentrated energy source to support metabolic activities, while carbohydrates are optimised to maintain energy balance. Furthermore, essential vitamins and minerals are integrated to strengthen the immune response, promote physiological functions, and enhance overall health. A key innovation of this formulation lies in its enhanced palatability. Natural feed attractants and flavour-enhancing compounds are utilised to stimulate feeding behaviour, thereby increasing feed consumption and minimising wastage. Improved digestibility is also considered to ensure efficient nutrient absorption and conversion into biomass. In conclusion, a nutritionally enriched and palatable feed formulation can significantly improve growth performance, feed conversion efficiency, and survival rate in fish. This approach offers a promising strategy for sustainable aquaculture by reducing the culture period while maximising productivity.

Keywords: Aquaculture nutrition, Fish feed formulation, Palatable feed, Nutrient optimisation



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Spatiotemporal Variation of Land Use and Land Cover and their Association with Soil - Carbon at Village and City Scales in The Chennai Megacity

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Abstract

Rapid urbanization and infrastructure expansion have significantly altered land cover patterns, impacting carbon storage and emissions. This study investigates the spatiotemporal dynamics of Land Use and Land Cover (LULC) and their influence on soil carbon across village and city scales within the Chennai Megacity region from 2018 to 2024. The research integrates remote sensing, Geographic Information Systems (GIS), and soil carbon datasets to quantify these changes and assess environmental implications. Sentinel-2 satellite imagery was processed using Google Earth Engine and ArcGIS to generate LULC maps, perform supervised classification, and identify transition patterns. Key spectral indices were applied to evaluate vegetation, water bodies, and built-up areas. Soil carbon parameters, including Soil Organic Carbon (SOC), Organic Carbon Density (OCD), Organic Carbon Stock (OCS), Soil Inorganic Carbon (SIC), and Total Carbon (TC), were derived from SoilGrids data at 30 cm depth and analysed using zonal statistics. Results indicate a significant increase in built-up areas and water bodies, alongside a decline in cropland, reflecting urban expansion trends. Spatial analysis reveals that peripheral and less disturbed regions exhibit higher carbon storage, while core urban areas show reduced carbon levels due to anthropogenic disturbances. Mean SOC, SIC, and TC values were 11.1 g/kg, 3.43 g/kg, and 14.53 g/kg, respectively, indicating moderate carbon availability with spatial variability across the study area. Village-scale regions demonstrated relatively higher carbon retention compared to densely urbanized city zones. The study highlights the role of LULC transitions in shaping soil carbon dynamics and emphasizes the need for integrated urban-rural planning strategies.

Keywords: LULC, Soil Carbon, Remote Sensing, GIS, Chennai Megacity, Spatial Analysis



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Image Processing and Computer Vision Systems for the Quality Assessment of Stored Millet Grains

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Abstract

The quality of Millet grain during storage is a critical factor affecting its market value and consumer acceptance. Conventional grain quality assessment is often labour-intensive, inaccurate, and inadequate for monitoring large-scale bulk storage facilities. In this study, a non-destructive automated quality assessment system that combines image processing and computer vision techniques is proposed to evaluate the quality of stored Millet grains. The proposed application utilises high-resolution images and advanced image processing techniques, including preprocessing, segmentation, and feature extraction. This system identifies quality attributes such as grain size, shape, colour variation, surface texture, foreign matter, and signs of insect infestation or fungal contamination. Further, machine learning algorithms were integrated to accurately and consistently classify grains and pests into distinct quality categories. Additionally, the computer vision system facilitates real-time monitoring and early identification of quality deterioration, reduces post-harvest losses, and ensures quality standards. Moreover, the study highlights that these technologies enhance precision in quality control while minimising human error and operational costs compared to traditional methods. The findings demonstrate that image processing and computer vision systems can significantly increase the precision, effectiveness, and scalability of grain quality evaluation during storage. This approach provides a promising solution for modernising post-harvest management practices and supports the development of smart, technology-driven food quality assurance in the agricultural sectors.

Keywords: Millets grains, Image Processing, Computer Vision Systems and Quality assurance



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Isolation, Characterization, and Molecular Identification of Bacteria from Plastic Waste of Hazaribag

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Abstract

The bacteria present in various plastic wastes have spread because of the bio-hazardous plastic waste specimens used in daily life. The current investigation's goal was to use a phenotypic approach to identify bacterial isolates collected from plastic waste in Hazaribag. On Nutrient Agar (NA) medium, the bacterial isolates were obtained by the direct plate technique. They were purified by examining colony morphology and then streaking after 4-7 days of growth at 37° C. A light microscope was used to evaluate the morphology of the bacterial isolates, and various media were used to record the culture properties. More than sixty different bacterial species were discovered, ranging from numerous genera, such as *Bacillus* and *Arthrobacter*. Most commonly identified bacteria were *Bacillus subtilis*, *Bacillus amyloliquifaciens*, and *Arthrobacter defluvii*, among others. The isolates were also characterized at physico-chemical as well as at biochemical levels. Also, an antibiotic sensitivity test for a few selected test isolates was done, and the zone of inhibition was measured. Later on, their genomic DNA was extracted, and the molecular size was determined on agarose gel electrophoresis. According to these findings, a variety of bacteria found in plastic waste might pose a health danger to people if they have not been rendered inactive before being released into the environment. These studies revealed that there may be a health concern associated with plastic waste, and it was urged that they be managed carefully to limit the spread of infectious germs.

Keywords: Isolates, Streaking, Biochemical, Inhibition, Molecular



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Integrating eDNA, Plastisphere Microbiomes, and AI-Based Freshwater Snail Sentinels for Predicting Microplastic-Driven Disease Emergence

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Abstract

Microplastic pollution has become a widespread environmental problem with increasing impacts on aquatic ecosystems and public health. In addition to their physical effects, microplastics act as surfaces for diverse microbial communities, known as the plastisphere, which may influence how pathogens survive and spread. This study examines the potential of freshwater snails as sentinel organisms for detecting and predicting microplastic-driven disease emergence within a One Health framework. By combining environmental DNA (eDNA) approaches with knowledge of plastisphere-associated microbiomes, a multi-layered strategy is proposed to assess ecological and epidemiological risks in freshwater systems. Freshwater snails, as intermediate hosts for several parasitic diseases, provide a biologically relevant model for connecting environmental contamination with disease dynamics. eDNA-based monitoring allows for non-invasive detection of both parasites and microbial signatures in water bodies, making it a scalable tool for early risk assessment. At the same time, studying plastisphere communities helps identify shifts in microbial composition that may support pathogen survival or increase virulence under pollution stress. To support these approaches, a data-driven modeling framework is introduced to predict disease emergence using environmental variables such as microplastic concentration and water quality parameters. This integrated approach aims to link ecological monitoring with predictive analysis, contributing to early warning systems for pollution-related disease risks. Overall, the study highlights the importance of combining biological indicators, molecular tools, and computational methods to address complex environmental health challenges.

Keywords: Microplastics, Freshwater Snails, eDNA, Plastisphere Microbiome, Disease Emergence.



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RESHAPING HARVESTS - CLIMATE CHANGE AND INDIAN AGRICULTURE

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Abstract

Climate change has emerged as one of the most pressing challenges confronting the Indian agriculture sector, which sustains nearly half of the country’s workforce and contributes significantly to food security and rural livelihoods. Rising temperatures, erratic rainfall patterns, and increasing frequency of extreme weather events are disrupting traditional farming cycles, reducing crop yields, and threatening the stability of agricultural production. This abstract examines the multifaceted impacts of climate change on Indian agriculture, highlighting both ecological and socio-economic dimensions. Shifts in monsoon behaviour, prolonged droughts, and floods have undermined the reliability of water resources, particularly in rain-fed regions that account for a majority of cultivated land. Heat stress affects staple crops such as wheat, rice, and pulses, while changing pest and disease dynamics further compromise productivity. These ecological disruptions translate into socio-economic vulnerabilities, as smallholder farmers—who form the backbone of Indian agriculture—struggle with declining incomes, rising indebtedness, and heightened risks of food insecurity. At the same time, climate change is reshaping agricultural markets and policy priorities. The demand for climate-resilient crops, sustainable irrigation practices, and adaptive technologies is growing. Government initiatives such as crop insurance schemes, promotion of drought-tolerant varieties, and investment in renewable energy for irrigation reflect attempts to mitigate risks. However, challenges remain in ensuring equitable access to resources, bridging knowledge gaps, and integrating traditional farming wisdom with modern innovations. This study argues that addressing climate change in Indian agriculture requires a holistic approach that combines technological adaptation, policy reform, and community participation. Building resilience involves not only safeguarding crop yields but also empowering farmers through education, financial support, and participatory governance. Ultimately, the future of Indian agriculture depends on its ability to adapt to climatic uncertainties while sustaining livelihoods and ensuring national food security.

Keywords: Food security, Farmer livelihoods, Climate-resilient crops, Integrated farming systems, Policy adaptation, Sustainable development



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Future of Sandalwood in India: From Molecular Insights to Agroforestry Perspectives

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Abstract

Santalum album L., known as Indian sandalwood, is an imperative commercial and cultural tree species native to India, also in Asia and Australia. Sandalwood has been considered the best heartwood and essential oil-bearing species. Its importance extends to the pharmaceutical and cosmetic industries. However, natural populations of sandalwood have drastically reduced due to overexploitation, habitat decline, stringent governmental regulations, and biotic pressures. The Union Budget of 2026 has given importance to a high-value agroforestry tree. This effort has been initiated to understand its potential in enhancing farmer income through improved cultivation practices. This policy move will provide impetus to the sandalwood sector. In addition to this policy move, recent progress in the field of genomics has improved our understanding of the biosynthesis of oil, heartwood formation, and adaptation of the species to abiotic stresses. The important genes controlling these processes have been identified. The MYB and WRKY families of transcription factors have been recognized as key players. The terpene synthase family of genes and the SAUR family have also been identified. Use of molecular markers such as SSRs and SNPs helps in the assessment of genetic diversity, thus supporting the development of breeding programs. Similarly, functional genomics assists in the identification of genotype-specific expression profiles for oil yield and environmental resilience. However, some major challenges exist, including the lack of adoption of genomic tools in breeding programs, the lack of functional validation of candidate genes, the use of CRISPR/Cas9 genome editing, and the lack of early molecular biomarkers for selection. However, some challenges include the lack of training for farmers, financial constraints, and reassurance issues. The importance of the amalgamation of genomics tools with silvicultural practices, germplasm conservation, and the development of supportive policies cannot be overemphasized for the improvement of the sustainability, productivity, and resilience of the species.

Keywords: *Santalum album*, Agroforestry policy, Genomics-assisted breeding, Genetic diversity, Essential oil biosynthesis, Climate resilience



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CRISPR/Cas9-Mediated Editing of Key Stress-Regulatory Genes to Develop Climate-Smart, Multi-Stress-Resilient Indian Mustard

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Abstract

Indian mustard (*Brassica juncea*) is one of India's most important oilseed crops, yet its productivity is increasingly constrained by abiotic stresses such as drought, salinity, heat, and cold conditions that are intensifying under climate change. Developing climate-smart mustard varieties with enhanced resilience is therefore essential for sustaining edible oil security. In this study, we employed CRISPR/Cas9-based genome editing to precisely modify key negative regulators of abiotic stress signaling, including ABI1, TTG2, GI, PIF3, and AITR. Highly efficient gRNAs were designed, and both single-gene and multiplex CRISPR/Cas9 constructs were generated to introduce edits mimicking beneficial natural allelic variants. The multiplex editing framework allows simultaneous modification of key stress-regulatory genes, providing a powerful approach to engineer complex, multi-stress resilience that is difficult to achieve through conventional methods. Agrobacterium-mediated transformation of the Indian mustard cultivars RH0725, RH1424, and RH1745 resulted in high regeneration and transformation efficiencies, yielding genome-edited events with strong knockout scores confirmed through Sanger sequencing. The T₁ and T₂ progenies are currently progressing in greenhouse conditions, where they are being screened for transgene-free segregants and evaluated for their anticipated improvements in multi-stress tolerance. These ongoing assessments are expected to deliver robust, climate-resilient mustard lines suitable for sustainable cultivation under changing environmental conditions. This work highlights the transformative potential of agricultural biotechnology in developing climate-resilient mustard varieties. By leveraging genome editing, multiplex targeting strategies, and efficient transformation pipelines, the project accelerates the development of improved Brassica lines capable of withstanding multiple stresses. Aligned with the theme “Agricultural Biotechnology and Sustainable Food Systems,” this research advances innovative, science-driven solutions that directly contribute to resilient agriculture and long-term food security.

Keywords: Abiotic stress tolerance, Climate-resilient, CRISPR/Cas9, Indian mustard, Multiplex genome editing, Sustainable agriculture



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N-TERMINAL MUTAGENESIS OF STAPHYLOKINASE AND ITS IMPACT ON PLASMINOGEN ACTIVATION

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Abstract

The exposure of a positively charged residue, lysine¹¹ (Lys¹¹), at the N-terminus following proteolytic cleavage of the Lys¹⁰-Lys¹¹ peptide bond, is necessary for the plasminogen activation by staphylokinase (SAK) from *Staphylococcus aureus*. However, in many natural variants of SAK, Lys¹¹ is substituted by isoleucine (Ile) or valine (Val). To investigate the molecular mechanism by which Lys¹¹ and its substitutions at the N-terminus of SAK modulate its plasminogen activation potential, we performed substitution and deletion mutagenesis of Lys¹¹. Mutants of SAK were constructed and expressed in *E. coli*. Purified protein samples were characterized and compared to wild-type SAK for their activation patterns. SAK full-length mutants carrying substitutions of Lys¹¹ with Ile or Val exhibited N-terminal processing and plasminogen activation efficiency comparable to wild-type. A truncated mutant with N-terminal Ile also remained functionally active, whereas the Val-exposed truncated form was inactive. Our experimental studies suggested that both Lys and Ile, exposed at the N-terminus, are able to expose the active site of the P_m correctly for the docking of the substrate P_g, and therefore, remain functional. In contrast, Val, due to its smaller side chain, requires additional structural support (e.g., a flexible N-terminal extension) for functional activity. Furthermore, unlike streptokinase, the presence of Ile or Val at the N-terminus of SAK does not enable non-proteolytic activation of plasminogen. Overall, these findings highlight the importance of N-terminal residue identity in governing efficient and controlled plasminogen activation by SAK. Such mechanistic insights may support the development of safer, more targeted thrombolytic agents, contributing to improved therapeutic outcomes and healthcare sustainability.

Keywords: Staphylokinase (SAK), Plasminogen Activation, N-Terminal Mutagenesis, Protein-Protein Interaction, Thrombolytic Therapy.



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Toward Functional Tomatoes: Precision Genome Editing for Enhanced Nutrition and Climate Adaptation

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Abstract

The concept of food as medicine highlights the development of nutritionally enhanced crops that deliver both dietary and therapeutic benefits. In this study, tomato (*Solanum lycopersicum* L.) was employed as a model system to investigate the potential of genome editing for improving health-related traits while preserving agronomic performance. Key genes involved in fruit development, nutritional composition, and shelf life, including SP5G (SELF-PRUNING 5G), pectate lyase (PL), and lycopene β -cyclase (LCYB) were targeted to regulate flowering time, fruit firmness, lycopene accumulation, and post-harvest stability. In addition, metabolic pathways associated with γ -aminobutyric acid (GABA) and *sl7*, linked to provitamin D₃ biosynthesis, were explored to further enhance the nutraceutical value of tomato fruits. Genome editing was implemented across multiple tomato cultivars, including Arka Vikas, Pusa Ruby, and Pusa Early Dwarf, using tissue culture-based transformation and regeneration approaches. Targeted editing of the SP5G gene resulted in early flowering and a compact plant architecture, contributing to improved yield potential and cultivation efficiency. Modification of the pectate lyase (PL) gene significantly enhanced fruit firmness and shelf life by minimizing cracking and post-harvest weight loss, without compromising fruit color or market quality. Furthermore, optimization of carotenoid biosynthesis pathways led to increased lycopene accumulation, thereby enhancing antioxidant capacity and nutritional value. Phenotypic assessment of the edited lines revealed improved fruit quality, extended shelf life, and stable growth characteristics across diverse genetic backgrounds. Overall, this study demonstrates the effectiveness of precision genome editing as a robust approach for developing climate-resilient, nutritionally enriched, and high-yielding tomato varieties. By integrating advanced biotechnology with crop improvement strategies, the findings support the advancement of functional foods and reinforce the concept of food as medicine.

Keywords: Functional foods; Fruit quality; Multi-target genome editing; Nutraceuticals; Precision breeding



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Improving Germination and Rooting Success in *Diospyros lotus* Linn. Under Subtropical Conditions of Jammu

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Abstract

Persimmons (genus *Diospyros*, family Ebenaceae) comprise nearly 190 species distributed across warm temperate and subtropical regions, with *Diospyros lotus* (date plum) recognized for its nutritional, medicinal, and rootstock value. However, its large-scale propagation is constrained by poor seed germination, slow growth, and graft incompatibility. The present study was conducted during 2024–2025 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu to standardize seed and vegetative propagation techniques for *D. lotus* under subtropical conditions. Two experiments were carried out using a factorial Completely Randomized Design with three replications. The first experiment evaluated five growing media and various pre-sowing treatments, including water soaking, GA₃ application, and acid scarification, on seed germination and seedling growth. The second experiment assessed the influence of rooting hormones (IBA and NAA) and seasonal variation on semi-hardwood cuttings. Results revealed that the growing medium comprising garden soil, sand, and farmyard manure (1:1:1) significantly enhanced germination (71.69%), seedling height, and stem diameter, while the cocopeat-based medium improved root length. Among pre-sowing treatments, GA₃ @ 300 ppm for 48 hours proved most effective in improving germination and growth parameters. The combined treatment of optimal medium and GA₃ further enhanced biomass accumulation. In vegetative propagation, NAA @ 100 ppm applied during spring (March–April) significantly improved sprouting, rooting, and overall growth performance of cuttings. The study concludes that integrated use of appropriate growing media, GA₃ treatment, and seasonal hormone application can effectively enhance propagation efficiency of *Diospyros lotus* under subtropical conditions.

Keywords: *Diospyros lotus*, Growing media, GA₃, Seed scarification, Germination



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Deciphering morpho-physiological and biochemical basis of seedling stage waterlogging tolerance in cowpea (*Vigna unguiculata* [L.] Walp.)

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Abstract

Waterlogging stress is one of the critical constraint to cowpea productivity in India, particularly under changing rainfall patterns and poorly drained soils. In this study, 169 diverse cowpea genotypes were subjected to waterlogging stress at seed (for 6 days) and seedling stage (for 10 days). The changes in morpho-physiological parameters under waterlogging and optimal water conditions were analysed to understand cowpea's response to waterlogging. Waterlogging delayed or even prevented germination, decreased seedling establishment, and affected shoot and root development. Based on percent germination and seedling establishment, four genotypes (IGC159, IGC194, IGC233 & IGC263) were identified as highly tolerant. At the seedling stage, the results indicated that plant height, leaf area, root and shoot length, fresh and dry weight of roots, shoots, and complete seedlings, root architectural traits and SPAD value were significantly reduced under waterlogging as compared to the control. However, the number of adventitious roots (AR) and their length were increased under waterlogging. Based on the waterlogging tolerance coefficient (WTC) and multivariate analysis methods, six genotypes (IGC-45, IGC-78, IGC-98, IGC-57, IGC-161 & IGC-109) were classified as highly tolerant, while five genotypes (IGC-47, IGC-85, IGC-55, IGC-82 & IGC-134) were classified as the most sensitive. Subsequently, two highly tolerant (IGC-45 & IGC-78) and two highly susceptible (IGC-47 & IGC-85) genotypes were subjected to incremental stress periods (0 h, 24 h, 48 h, 72 h & 96 h) to elucidate the biochemical basis of tolerance mechanisms. The waterlogging stress reduced the morpho-physiological traits in both tolerant and susceptible genotypes, with a more severe impact in susceptible genotypes. The tolerant genotypes exhibited vigorous ARs and higher WTC compared to susceptible genotypes. Furthermore, tolerant genotypes showed increased proline content and maintained elevated levels of antioxidants and anaerobic metabolism enzymes. Thus, robust antioxidant potential and efficient anaerobic metabolism were the key mechanisms enabling waterlogging tolerance in cowpea. Our findings provide valuable insights for breeding cowpea varieties with enhanced waterlogging tolerance.

Keywords: Cowpea, Waterlogging, Seedling, Physiological, Biochemical



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Functional and Structural Insights into GmXIP1-1 Aquaporin: A Boron Transporter Driving Stress Resilience in Soybean

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Abstract

Aquaporins are integral membrane proteins ubiquitously present across living systems, primarily facilitating water transport. In plants, aquaporins have diversified to transport a wide range of small solutes, including H₂O₂, CO₂, urea, silicon, and boron, thereby playing crucial roles in growth, development, and stress adaptation. Among the plant aquaporin subfamilies, the XIP (Uncharacterised intrinsic protein) remains poorly characterized and is notably absent in several model plant species such as Arabidopsis and rice, limiting functional insights. Evolutionary analysis further reveals that XIP aquaporins are absent in monocots, members of the Brassicaceae family, gymnosperms, and algae, suggesting a lineage-specific distribution that may account for their limited functional characterization. In the present study, the GmXIP1-1 gene was cloned from soybean and functionally characterized to elucidate its solute specificity. Heterologous expression of GmXIP1-1 in yeast revealed a significant transport activity. Gene expression profiling studied across different tissues showed flower-specific high expression of GmXIP1-1, suggesting its involvement in reproductive development, particularly pollen formation, where boron is critical for cell wall integrity and fertility. Importantly, boron transport is tightly linked with plant responses to environmental stresses such as drought, salinity, and temperature fluctuations, where micronutrient homeostasis becomes crucial for maintaining cellular stability. Thus, GmXIP1-1 may contribute to stress resilience by regulating boron distribution under adverse environmental conditions. Our ongoing research involving molecular dynamics simulations and homology-based structural modeling will provide insights into pore morphology and identify key residues governing selective solute transport. Understanding the structural and functional dynamics of GmXIP1-1 will not only advance knowledge of aquaporin-mediated transport but also support the development of climate-resilient crops. Such insights can be leveraged using genome editing tools to engineer aquaporins for improved nutrient use efficiency, stress tolerance, and sustainable agricultural productivity, aligning with global efforts toward environmental sustainability and climate stewardship.

Keywords: Aquaporin, Uncharacterised Intrinsic Protein, Boron, Stress Resilience, Soybean



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Post-discharge enhancement of non-thermal plasma for biodegradation of Reactive Red 120 dye by microbial consortium

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Abstract

The presence of azo dyes in wastewater from the textile industries is a major environmental problem due to their persistence, toxicity and non-biodegradability. Red reactive 120 (RR120) is one of the most widely used dyes due to its complex aromatic structure and stability. This study aimed at an interaction between the gliding arc discharge and a bacterial consortium for the degradation of the dye RR120. Three bacterial species: *Staphylococcus aureus*, *Vibrio Cholerae* and *Escherichia coli* were isolated from the surface waters of Yaounde (Cameroon) and combined into a consortium. After biological treatment alone, the consortium bleached 58.67% of RR120 (50 mgL⁻¹) after 24h of incubation. For the plasma treatment alone for 5 and 10 min, 24% and 27% were obtained, thus reducing the COD/BOD5 ratio from 6.3 to 1.8 and 0.75 respectively for a treatment of 5 and 10 min. Its decolorization rates were seen at high levels under post-discharge conditions (excluding the reactor after discharge) after 24h, the RR120 solutions pre-treated for 5 and 10 min gave us 33% and 33%. As regards the coupling plasma/consortium, the solutions pre-treated with plasma for 5 and 10 min were decolorized at 81% and 89% by the consortium after 24h of incubation. A significant interaction between the plasma and the consortium is indeed observed for the decolorization of the RR120 dye while reducing the energy required for this purpose. critical for cell wall integrity and fertility. Importantly, boron transport is tightly linked with plant responses to environmental stresses such as drought, salinity, and temperature fluctuations, where micronutrient homeostasis becomes crucial for maintaining cellular stability. Thus, GmXIP1-1 may contribute to stress resilience by regulating boron distribution under adverse environmental conditions. Our ongoing research involving molecular dynamics simulations and homology-based structural modeling will provide insights into pore morphology and identify key residues governing selective solute transport. Understanding the structural and functional dynamics of GmXIP1-1 will not only advance knowledge of aquaporin-mediated transport but also support the development of climate-resilient crops. Such insights can be leveraged using genome editing tools to engineer aquaporins for improved nutrient use efficiency, stress tolerance, and sustainable agricultural productivity, aligning with global efforts toward environmental sustainability and climate stewardship.

Keywords: Bacterial consortium, Non-thermal plasma, Reactive red 120, Coupling treatment system, Microbial metabolism



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Morpho-molecular characterization for yield and nutritional quality traits in Barnyard millet diverse germplasm

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Abstract

Barnyard millet (*Echinochloa* spp.) is an annual, short-day C4 crop valued for both feed and fodder. A total of 187 germplasm lines including 3 checks were evaluated in Kharif 2024 at the Seed & Research Farm, Rani Lakshmi Bai Central Agricultural University, Jhansi for 13 quantitative & 5 qualitative traits. The ANOVA revealed significant difference for majority of traits. Highest GCV and PCV was observed for chlorophyll content, stover yield, grain iron content, zinc content and grain yield. The grain yield showed a positive correlation with plant height (0.465***), followed by stover yield (0.416***), panicle length (0.338***), no. of basal tillers (0.284), 1000 seed weight (0.242***), width of flag leaf (0.212**) and chlorophyll content (0.189**). Principal component analysis revealed that four main components (PC1, PC2, PC3, and PC4) produced 63.61% variability among genotypes. Nineteen out of the 25 SSR markers were found polymorphic. The marker amplified a total of 70 alleles which varied from 1 to 5 per, locus with a mean of 2.8 per locus. The maximum PIC value was recorded for primer RM 263 (0.67) followed by BMSSR 2 (0.63). UPGMA cluster analysis, PCoA and the dendrogram divided 187 genotypes into four groups. Accessions IEc No. 383, IEc No. 107 and IEc No. 82 exhibit superior grain yield. Accessions, IEc No. 508, IEc No. 397 and IEc No. 431 were rich for both Fe and Zn content. In structure analysis, the genotypes were divided into two sub populations, both had admixture and no pure line was observed.

Keywords: Germplasm collection and conservation, Genetic diversity, Morpho-molecular characterization, Landrace evaluation



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Plant-Derived Feedstocks for Bioplastics: Pathways Toward Sustainable Packaging Systems

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Abstract

The persistent accumulation of synthetic plastic waste has become a major environmental concern, driving the transition toward sustainable material alternatives in packaging applications. In this context, bioplastics derived from plant-based resources present a viable approach due to their renewable origin, lower greenhouse gas emissions, and potential for biodegradation. The present study provides an evaluation of plant-derived feedstocks utilized in bioplastic production, including starch-based crops (e.g., maize, potato, cassava), sugar-rich sources (e.g., sugarcane, sugar beet), lignocellulosic biomass (e.g., bamboo, eucalyptus), and oilseed plants (e.g., soybean, castor). The analysis focuses on the structural characteristics, conversion efficiency, and material performance of these feedstocks in the development of biopolymers such as polylactic acid (PLA), polyhydroxyalkanoates (PHA), and thermoplastic starch. Their applicability in sustainable packaging systems—particularly in food-grade materials, disposable commodities, and biodegradable films—is examined in relation to functional properties and environmental benefits. Key constraints, including feedstock-food competition, economic feasibility, and inadequate end-of-life management infrastructure, are also addressed. Furthermore, emerging strategies involving second-generation biomass, agricultural residues, and algal resources are discussed as promising alternatives to enhance resource efficiency and sustainability. The findings highlight the significance of integrating plant-based bioplastics within circular economy frameworks to reduce environmental burden and promote responsible material use. This study contributes to advancing the scientific understanding and practical implementation of renewable packaging materials aligned with global sustainability objectives.

Keywords: Bioplastics, Sustainable Packaging, Plant Feedstocks, Polylactic Acid, Lignocellulosic Biomass.



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Assessing endo-genetic axis to combat hypertension for health sustainability

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Abstract

Hypertension remains a global health crisis, contributing to over 10 million annual deaths and straining healthcare sustainability. This study assesses the endo-genetic axis—the bidirectional interplay between endocrine signaling pathways (e.g., renin-angiotensin-aldosterone system [RAAS], sympathetic nervous system, and circadian-regulated hormones like cortisol and melatonin) and genetic variants, as a novel framework to combat hypertension. Disruptions in this axis, particularly circadian misalignment from modern lifestyles, exacerbate endothelial dysfunction, vascular stiffness, and sodium retention, driving sustained blood pressure elevation. Leveraging a cohort of 1,248 participants from diverse ethnic backgrounds, we employed high-throughput SNP genotyping alongside endocrine profiling and 24-hour ambulatory blood pressure monitoring synchronized to chronotype assessments. Polygenic risk scores (PRS) integrated 45 hypertension-associated loci, revealing that individuals with high PRS and evening chronotypes exhibited 28% greater nocturnal hypertension prevalence ($p < 0.001$). Multivariate analyses, including circadian phase-adjusted Cox regression, identified key endo-genetic interactions: the CLOCK rs1801260 G-allele synergized with elevated aldosterone-to-renin ratios to predict 1.8-fold hypertension risk ($HR=1.82$, 95% CI: 1.45-2.29). Interventions targeting the axis, chronotherapy with timed RAAS inhibitors (e.g., evening losartan) and melatonin supplementation, reduced systolic blood pressure by 15 mmHg in high-risk genotypes ($p=0.002$), outperforming standard regimens. Machine learning models (random forest) achieved 87% accuracy in predicting treatment response based on endo-genetic profiles. These findings advocate precision chrono-medicine to restore endo-genetic homeostasis, promoting long-term health sustainability by minimizing polypharmacy, enhancing adherence, and curbing cardiovascular events. Future trials should validate scalable genotyping for population-level deployment, bridging molecular insights to public health equity.

Keywords: Endo-genetic axis, Circadian clock genes, Hypertension precision medicine, SNP genotyping chronotherapy, RAAS polygenic risk score



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Prioritizing Tree Outside Forest Land Use Management for Optimizing Carbon Sink in the Indian Sub-Himalayan Region

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Abstract

Land use, land-use change (LULUC), contributes to a significant amount of carbon emissions, and as a result, global warming occurs. Nature-based solutions (NbS) through agriculture and forestry management practices are crucial to mitigate the impact of global climate change. The present study, conducted at the main campus of Uttar Banga Krishi Vishwavidyalaya, Pundibari, quantified the vegetative carbon stock of 14 different tree-based land use systems, compared with uncultivated fallow and paddy monoculture. Standing tree biomass and biomass carbon stock (BCS) varied significantly among the systems, and they were considerably higher than the paddy monocropping and uncultivated fallow land. Above-ground biomass (AGB), below-ground biomass (BGB), total biomass (TB), and BCS quantified were 9.79-179.91, 2.45-44.98, 12.24-224.89, and 5.75-105.70 Mg ha⁻¹. *Terminalia arjuna* plantation was quantified with the highest biomass carbon stock (105.7 Mg ha⁻¹) followed by *Anthocephalus cadamba* plantation (76.71 Mg ha⁻¹) and *Lagerstroemia parviflora* plantation (69.26 Mg ha⁻¹). On an average, the BCS in descending order is mixed plantations (67.92 Mg ha⁻¹) > pure forest tree species plantations (61.58 Mg ha⁻¹) > commercial plantation crops (40.35 Mg ha⁻¹) > orchards (16.18 Mg ha⁻¹) > paddy monoculture (3.96 Mg ha⁻¹) and uncropped fallow land (0.54 Mg ha⁻¹). Prioritizing land management of non-forested landscapes is recommended to increase tree cover through social forestry and agroforestry programmes with tree species having higher potential to store carbon, sustain agricultural productivity, and mitigate climate change as well.

Keywords: Land uses land use change, Climate change, Nature-based solution, Tree biomass carbon.



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Enzyme-Mediated Bioremediation of Distillery Industry Wastewater by MnP-Producing Strain DIMnP07

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Abstract

The rapid expansion of alcohol production, driven by its extensive industrial applications and increasing use as a renewable fuel, has led to the generation of large volumes of highly polluted distillery industry wastewater (DIW), posing serious environmental concerns. Therefore, the present study focuses on the bioremediation of DIW using a manganese peroxidase (MnP)-producing bacterial strain, DIMnP07. The isolate demonstrated significant detoxification potential within 144 hours of treatment. A substantial reduction in key physicochemical parameters was observed, including chemical oxygen demand (79.00%), biological oxygen demand (81.77%), total dissolved solids (69.71%), phosphate (64.21%), sulphate (61.81%), nitrate (65.03%), and phenol (70.04%). Additionally, effective removal of heavy metals such as Zn (81.43%), Cu (74.61%), Mn (71.09%), Fe (60.00%), and Pb (57.31%) was recorded. The strain exhibited enhanced MnP production, reaching a peak activity of 6.34 IU/mL/min at 96 hours under optimized conditions (pH 8, 35 °C, 0.5% glucose and peptone, 10 mL inoculum, and 120 rpm). This high enzymatic activity indicates a strong oxidative potential for the degradation of recalcitrant coloring compounds and complex organic pollutants. Further confirmation through FT-IR and GC-MS analyses revealed the transformation of these contaminants into simpler and less toxic metabolites, demonstrating effective biodegradation rather than mere decolorization. Phytotoxicity studies supported the environmental safety of the treated effluent, with 80% seed germination of *Phaseolus aureus* L., indicating a significant reduction in residual toxicity. Overall, the findings highlight the potential of strain DIMnP07 as an efficient, eco-friendly, and sustainable solution for the treatment of distillery wastewater.

Keywords: Microbial enzymes; Industrial Wastewater; Detoxification; Bioremediation; Phytotoxicity; Distillery



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Role of Mass Media in Promoting Millets for Climate Resilience and Nutritional Security: A Study of Bihar

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Abstract

Millets are climate-resilient and nutrient-dense crops that have historically played a significant role in Indian agriculture, especially in rain-fed and marginal areas. Due to the dominance of rice-wheat cropping systems, shifting food tastes, a lack of market support, and low awareness among farmers and consumers, millet farming in Bihar has decreased over time despite its high nutritional content and capacity to adapt to unfavorable climatic conditions. Policies at the federal and state levels have recently shown renewed interest in millets due to growing worries about climate change, malnutrition, and sustainable agriculture. This study looks at how the media in Bihar promotes millets as climate-resilient crops. It focuses on how government-sponsored initiatives to promote millets and their nutritional, economic, and environmental advantages are disseminated through print, radio, television, digital, and social media. Secondary data from government reports, policy documents, media content, and published literature served as the study foundation. According to the study, public discourse and awareness of millets are greatly influenced by the mass media. However, its efficacy in Bihar is hindered by the lack of region-specific content, poor integration with interpersonal communication and extension programs, and insufficient coverage of local success stories. In order to achieve nutritional security and climate resilience, strengthening media-based communication techniques can improve consumer acceptance, farmer participation, and the resurgence of millet production.

Keywords: Millets, Mass Media, Bihar, Climate Change, Sustainable Agriculture, Nutritional Security



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Shade-mediated morphometric adaptations in bamboo *Pseudoxytenanthera stocksii* under native tree canopies: A nature-based pathway for climate-smart agroforestry and ecological resilience

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Abstract

Bamboo, often regarded as a cornerstone species for ecological restoration and climate resilience, offers immense potential within the framework of sustainable agroforestry and circular bioeconomy. In the context of the conference theme “Planet vs. Plastics” and broader imperatives of environmental sustainability, the present study examines how microclimatic modulation through native tree canopies influences the morphometric architecture of *Pseudoxytenanthera stocksii*, an endemic sympodial bamboo of the Western Ghats. Field investigations were conducted across ten representative sites encompassing three canopy regimes- dense shade (70-80%), moderated shade (30-50%), and open exposure. A total of 120 clumps were systematically sampled, generating 9,120 observations from 240 culms to evaluate internodal length, culm diameter, wall thickness, and diameter-to-wall thickness (d/w) ratio. Culms developing under shaded conditions exhibited pronounced elongation of internodes, enhanced culm girth, and optimized wall thickness, reflecting adaptive strategies that balance resource allocation, mechanical stability, and vertical growth under moderated thermal and moisture regimes. Conversely, open-grown culms displayed reduced internodal extension, compact structural organization, and increased tapering- traits indicative of resilience to higher irradiance and thermal variability. The d/w ratio consistently revealed greater hollowness in shaded culms, suggesting improved material efficiency- an attribute of particular relevance for sustainable biomass utilization and eco-friendly material substitution. These findings underscore the ecological intelligence of bamboo in responding to canopy-mediated microenvironments and highlight its strategic role in climate change mitigation, biodiversity conservation, and sustainable material transitions. Integrating bamboo within native tree-based agroforestry systems emerges as a scientifically robust, nature-based solution- capable of enhancing carbon sequestration, reducing dependency on synthetic and plastic-based materials, and advancing regenerative landscape management aligned with global sustainability goals.

Keywords: Bamboo cultivation, Mixed farming, Plant interactions, Traditional agroforestry, Western Ghats



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Isolation and Screening of Heavy Metal Resistant Bacteria and Water Quality Assessment of River Yamuna at Prayagraj

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Abstract

The Yamuna River, the most important tributary of the Ganga, plays a crucial role in sustaining human civilization. However, it is currently experiencing severe pollution due to increasing anthropogenic activities. In Prayagraj, untreated domestic sewage and industrial effluents are directly discharged into the river, introducing a wide range of contaminants. Among these, heavy metals pose significant environmental and health risks. The present study focuses on evaluating the physicochemical and microbiological characteristics of Yamuna River water to assess its quality. Key physicochemical parameters, including pH, temperature, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), biochemical oxygen demand (BOD), and chemical oxygen demand (COD), were analyzed at different sampling locations. Microbial contamination was assessed using the Most Probable Number (MPN) method to detect coliform bacteria. The results revealed a high level of pollution in the river, with significant contamination by *Escherichia coli*. In addition, heavy metal-resistant bacterial isolates were screened from water samples by the plate diffusion method. The study successfully identified isolates resistant to cadmium (Cd) and lead (Pb), among which strains SRAS1 and SRAS5 exhibited strong resistance. These findings suggest that such bacterial isolates have potential applications in microbial bioremediation for the removal of heavy metals from contaminated river water, offering an eco-friendly and cost-effective solution for pollution management.

Keywords: Coliform contamination, Environmental pollution, Heavy metal-resistant bacteria, Microbial bioremediation, Physicochemical analysis, Yamuna River.



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Grass-Mediated Stabilization of Soil Organic Carbon in Semi-Arid Restored Lands: Evidence from ¹³C Natural Abundance,

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Abstract

Land restoration with grasses is an effective approach to enhance soil organic carbon (SOC) and biomass productivity in semi-arid regions. To develop improved restoration policies for preserving or increasing SOC stocks and ecosystem functions, it is essential to understand how different grasses affect SOC dynamics in restored lands. In this study, long-term SOC sequestration was evaluated by analyzing aggregate-associated carbon (C) and ¹³C natural abundance following restoration with *Cenchrus ciliaris*, *Panicum maximum*, *Chrysopogon fulvus*, *Heteropogon contortus*, *Setaria nervosum*, and *Vetiveria zizanioides* in semi-arid India. Among these species, *C. ciliaris*, *H. contortus*, and *S. nervosum* notably increased the proportion of large macroaggregates from 5 to 21% at the surface and from 1.7 to 12.3% in the subsurface, accompanied by a significant (P 0.05) decline in microaggregates. The higher $\delta^{13}C$ values in small macroaggregates indicated stronger carbon stabilization within microaggregates under all grasses. These small macroaggregates protected approximately 22–33% and 8–15% of total SOC at the surface and subsurface, respectively, in soils restored with *C. ciliaris*, *H. contortus*, and *S. nervosum*. The roots of these grasses contributed about 12.66–13.75% and 2.22–11.24% of SOC in the surface and subsurface layers, respectively. Carbon transfer occurred from macroaggregates to microaggregates in soils under *C. ciliaris*, *H. contortus*, and *S. nervosum*, explaining their greater SOC stabilization potential. This enhanced aggregate-protected carbon was linked to higher root biomass, density, and decay rates of these grasses. Conversely, *P. maximum*, *C. fulvus*, and *V. zizanioides* exhibited carbon transfer from microaggregates to macroaggregates, leading to lower SOC stabilization. Therefore, *C. ciliaris*, *H. contortus*, and *S. nervosum* emerge as promising species for effective SOC sequestration in semi-arid ecosystems.

Keywords: Grasses; Soil aggregates; ¹³C natural abundance; Carbon stabilization pathways; Semi-arid degraded land



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Isolation of Chlorpyrifos-Resistant Bacteria and Water Quality Assessment of Samaspur Wetland, Uttar Pradesh

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Abstract

Wetlands are important ecosystems that help maintain environmental balance and support a wide range of living organisms, along with human activities such as agriculture and fishing. In recent years, these ecosystems have been affected by increasing agricultural practices around them. Runoff from nearby fields often carries pesticides and herbicides into wetland areas, which can lead to contamination of water and soil. One such commonly used pesticide is chlorpyrifos, which is known for its persistence in the environment for a long time, and many researchers have worked on methods to degrade it from the environment. In this study, water and soil samples were collected from the Samaspur Wetland. Water quality was assessed by analyzing parameters such as pH, temperature, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), chemical oxygen demand (COD), and biochemical oxygen demand (BOD). The results showed that the physicochemical condition of the water was within acceptable limits. However, microbiological analysis using the MPN method indicated the presence of coliform bacteria, including *Escherichia coli*. Soil samples from the same site were used to isolate chlorpyrifos-degrading bacteria through serial dilution and spray plate methods. Two bacterial isolates, JKAS1 and JKAS2, were obtained and showed the ability to grow at pH 7, 30°C, and in the presence of 100 ppm chlorpyrifos. These findings suggest that the selected isolates have the potential to degrade chlorpyrifos and may be useful in the bioremediation of contaminated environments.

Keywords: Bioremediation, Bacterial isolates, Chlorpyrifos, MPN, Physicochemical parameters, Samaspur Wetland.



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Isolation and identification of Fungi from Agricultural soil, followed by the synthesis of bio-nanoparticles using fungal extract

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Abstract

The green synthesis of bio-nanoparticles using biological methods has emerged as an eco-friendly and cost-effective alternative to conventional chemical and physical approaches. Bio-nanoparticles are produced using plant extracts, microorganisms such as bacteria and fungi, or biomolecules that act as reducing and stabilising agents. This study shows the survey of the agricultural field, Mahewa Prayagraj district, Uttar Pradesh, and the soil samples were collected from the rhizosphere of the plant. Isolation of microbes from agricultural soil by serial dilution and plate count method, and growth was observed on a PDA plate. After the screening and identification of fungi, *Fusarium* spp. was found; after that, a slant was prepared for pure culture. Furthermore, the mass extract of *Fusarium* spp. was prepared for the synthesis of bio-nanoparticles. Some species of *Fusarium* enhance the soil quality and plant performance; hence, the *Fusarium* fungal extract and AgNO₃ (silver nitrate) are used as a metallic material for the synthesis of bio-nanoparticles. AgNO₃ is used because of its high solubility, easy reduction, purity, stability, antimicrobial property, and cost-effectiveness. Bio-nanoparticles exhibit unique physicochemical properties, enhanced reactivity, and biocompatibility, enabling and enhancing efficient interaction with plant systems. These environmentally friendly nanoparticles are applied to plants through soil and foliar methods. In agriculture, it plays a significant role in improving seed germination, root and shoot growth, nutrient uptake, stress tolerance, promoting plant growth by enhancing photosynthetic efficiency, antimicrobial property, plant metabolism, and regulating hormonal activity. Overall, the application of bio-nanoparticles contributes to increased plant yield and supports sustainable agricultural practices.

Keywords: AgNO₃, Antimicrobial property, Bio-nanoparticles, *Fusarium* spp., Green synthesis, Microorganisms.



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Environmental Perturbations and Climate Change: Linking Genotypic Alterations to Phenotypic Plasticity in Fishes

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Abstract

Environmental perturbations driven by contemporary climate change profoundly impact aquatic ecosystems, particularly on fish populations, by altering temperature, oxygen availability, hydrological regimes, and the chemical composition of water bodies. These changes impose strong selective pressures that influence both genotypic configurations and phenotypic expressions. This review synthesizes current understanding of how climate-induced environmental variability mediates the dynamic relationship between genetic adaptation and phenotypic plasticity in fishes. Empirical evidence indicates that climate change significantly modifies key life-history traits, including growth rates, reproductive timing, migration patterns, survival, and fecundity, with temperature emerging as a primary driver of these responses. While such phenotypic shifts are often rapid, they are predominantly attributed to plastic responses rather than to confirmed evolutionary changes, highlighting the complexity of disentangling genetic adaptation from environmentally induced variability. Phenotypic plasticity provides an immediate mechanism by which fishes can cope with environmental fluctuations through acclimation and flexible reaction norms. In contrast, long-term persistence depends on adaptive genetic variation and evolutionary potential. However, evidence for microevolutionary responses remains limited, primarily due to methodological challenges in distinguishing genetic changes from plastic effects and in attributing causality specifically to climate-related factors. Additionally, interactions among ecological, evolutionary, and demographic processes shape population resilience, with life-history traits, dispersal ability, and genetic diversity influencing adaptive capacity. This study highlights the necessity of integrative approaches that combine genomics, long-term ecological data, and experimental frameworks to elucidate the mechanisms linking genotypic alterations to phenotypic plasticity. Understanding these linkages is critical for predicting fish responses to ongoing climate change and for developing sustainable conservation and fisheries management strategies in rapidly changing aquatic environments.

Keywords: Climate change, Phenotype variation, Genotype variation, Evolution, Plasticity



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Assessment of Length-Weight Relationships and Condition Factor in Indoor-Reared Nile Tilapia (*Oreochromis niloticus*)

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Abstract

Morphometric indices are commonly used to assess proximate body composition and the feeding and living conditions of fish. The length-weight relationship (LWR) is essential for estimating the biomass of various fish populations and is valuable for evaluating fish condition and growth patterns. The condition factor (CF) provides insight into the development and adaptability of fish and can be used to assess a species' feeding activity, reflecting its effective utilization of available food resources. This study investigates the length-weight relationships (LWR) and condition factor of indoor-reared Nile tilapia (*Oreochromis niloticus*). A total of 250 Nile tilapia were randomly allocated to six water tanks and fed floating fish feed. At 30-day intervals, measurements were taken to determine the length-weight relationship and condition factor. The length-weight relationship was analysed using the equation, where W represents body weight, L is total length, and a and b are regression constants. The constants a and b were estimated using the least-squares method applied to log-transformed data as $\log W = \log a + b \log L$ (Ricker 1973). Fulton's condition factor (K) was estimated using the relationship $K = 100W/L^3$ to assess fish condition in an indoor-reared tank. Final lengths and weights differed significantly each month across all reared groups. Regression analysis indicated a significant positive correlation ($r = 0.97, 0.95, 0.93, 0.98, \text{ and } 0.99$) between length and weight of *Oreochromis niloticus* from November to March. The regression exponent “ b ” values exceeded 3, indicating a positive allometric growth pattern in *Oreochromis niloticus*, whereas the initial month of indoor rearing ($b = 2.99$) exhibited negative allometry. These findings demonstrate that the indoor-reared population of *Oreochromis niloticus* exhibited favorable conditions and growth performance under laboratory-developed physico-chemical conditions. The results are valuable for informing sustainable management and conservation strategies for this species in the Gomti River and adjacent ecosystems.

Keywords: *Oreochromis niloticus*, LWR, Condition factor, Allometric growth, Conservation



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Soil Carbon Dynamics and Sequestration Potential under Diversified Cropping Systems in the Terai Region of Uttarakhand, India

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Abstract

The rice-wheat-fallow system in the Indo-Gangetic Plains has led to gradual SOC decline due to monoculture, intensive tillage and limited organic matter return. A field experiment was conducted for two years (2023-24&2024-25) at GBPUAT, Pantnagar with eight cropping systems under RBD with three replications. Soil samples (0-15 and 15-30 cm) were analysed for SOC, organic matter, carbon fractions (very labile, labile, less labile and non-labile carbon), bulk density, SOC stock and carbon sequestration rate; June 2023 soil served as baseline. Results revealed that soybean-wheat-cowpea (T5) recorded the highest VLC (5.46 g kg⁻¹) at 0-15 cm in 2023-24, while black gram-gram-sesbania (T8) recorded the highest VLC (7.67 g kg⁻¹) in 2024-25. Labile carbon was highest under T8 in 2023-24 and sorghum-berseem-pearl millet in 2024-25 at 0-15 cm, while T7 recorded the highest VLC (7.41 g kg⁻¹) at 15-30 cm in 2024-25, indicating greater labile carbon enrichment under organic matter-contributing systems. Non-labile carbon was highest under T5 (14.82 g kg⁻¹) at 0-15 cm in 2024-25, reflecting stable carbon accumulation. T8 recorded the highest total SOC stock in both the depth in both 2023-24 and 2024-25, followed by T7 and lowest under conventional rice-wheat-fallow (T1) in both years. Carbon management index was highest under T6 and T5 in both years. Carbon sequestration was highest under T8 at both depths in both years, followed by T7 and T2, while T1 recorded negative sequestration at 15-30 cm (-0.435 and -0.31 Mg C ha⁻¹ in 2023-24 and 2024-25, respectively) confirming the carbon-depleting nature of continuous rice-wheat cultivation. Legume and vegetable-based diversification enhanced labile carbon fractions, CMI and carbon sequestration, thus emerges as an effective strategy for carbon sequestration and sustainable soil health management.

Keywords: Soil organic carbon; Carbon fractions; SOC stock; Carbon sequestration; Legume-based cropping system, Indo-Gangetic Plains



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Extension Strategies for Enhancing Role of Farmers, Youth and Women in Environmental Stewardship

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Abstract

Extension has the greater responsibility in order to facilitate community awareness and participation for management and judicious use of natural resources, to rehabilitate degraded lands, and to strengthen social capital in rural systems through institution and capacity building programmes. The most important challenge for the future extension managers would be the management of knowledge. The success of a farmer in the years to come is going to be primarily dependent upon his level of knowledge. The permanent solution for land problems (degraded and waste lands) lies in sustainable land management i.e., Agroforestry (Lakdi, Chara, Phal aur Ann-Krishivaniki hai Jeevan: Wood, Fodder, Fruit and Grain-Agroforestry is Life Again). Effective extension strategies are crucial for enhancing the role of farmers, youth, and women in environmental stewardship. This paper outlines approaches to empower these groups in promoting sustainable environmental practices. Farmers need capacity-building programs focusing on sustainable agriculture, climate-resilient practices, and resource conservation. Demonstrating success stories and providing incentives can motivate adoption. For youth, digital extension tools like mobile apps and social media can spread awareness and build communities around environmental issues. Integrating environmental education in schools and colleges fosters a culture of sustainability. Women's involvement as Krishivaniki Rajdoot (Agroforestry Ambassador) in environmental stewardship can be strengthened through self-help groups focusing on eco-friendly livelihoods and conservation practices. Access to resources and decision-making platforms is key. Extension strategies include: (1) Capacity building: Training on sustainable practices and technologies, (2) Digital outreach: Using ICT tools to reach wider audiences, (3) Community engagement: Mobilizing groups for collective action, and (4) Incentives: Recognition and rewards for sustainable practices. Effective extension approaches can enhance awareness, build skills, and motivate farmers, youth, and women to contribute to environmental conservation. Policy support and partnerships with NGOs, State line departments, and community groups can amplify these efforts. By targeting these groups with tailored strategies, environmental stewardship can be strengthened at the grassroots level.

Keywords: Community awareness, Natural resources, Capacity building, Digital outreach



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Azolla pinnata as a Climate Change Mitigation Tool: An Aquatic, Protein-Rich and Resource-Efficient Non-Conventional Fodder Source

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Abstract

Fodder crops remain the most economical feed source for livestock; however, in India, land allocation for green fodder cultivation rarely exceeds 5% of the gross cropped area, leading to significant feed deficits. This challenge is further intensified under climate change due to resource scarcity, increased competition for land, and rising greenhouse gas (GHG) emissions from conventional livestock systems. In this context, non-conventional and resource-efficient fodder production systems are crucial for sustainable livestock management and climate change mitigation. *Azolla pinnata*, an aquatic fern with a symbiotic association with the nitrogen-fixing cyanobacterium *Anabaena azollae*, offers a promising low-carbon alternative fodder source. Its cultivation requires minimal land, low water input, and no synthetic nitrogen fertilizers, thereby significantly reducing nitrous oxide (N₂O) emissions. Additionally, azolla-based feeding has been reported to improve feed conversion efficiency and reduce enteric methane (CH₄) emissions in ruminants. *Azolla* is rich in protein (25–35%), 10–15% minerals, 7–10% a mixture of amino acids, vitamins (A, B12, and beta-carotene), and bioactive compounds, making it a highly nutritious feed supplement. It can be easily cultivated in small pits or containers using locally available inputs such as soil and dung slurry, yielding 1.5–2.0 kg fresh biomass per m² within a 10-day cycle. Its rapid growth and high productivity contribute to enhanced carbon sequestration potential and reduced dependency on conventional fodder crops. Thus, integration of *Azolla pinnata* into livestock feeding systems not only addresses fodder scarcity but also serves as an effective climate-resilient and GHG mitigation strategy, supporting sustainable and low-emission agricultural systems.

Keywords: Azolla, Fodder, Protein, Livestock, Resource-efficiency, GHG emission.



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Integrative multi-omics for enhancing combined-stress resilience in agroforestry tree species

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Abstract

Trees often encounter simultaneous and cumulative biotic (diseases, insect pests) and abiotic stressors like drought, salinity, heat, and waterlogging. Multi-omics approaches are becoming increasingly pivotal for elucidating mechanisms of combined stress resilience in woody perennials of agroforestry importance. Despite notable advancements, critical research gaps persist in case of perennial trees. Recent progress includes the development of reference genomes and pangenomes for key species such as poplar, eucalyptus, neem, malabar neem, karanj, and teak, alongside comprehensive transcriptomic and metabolomic profiling under abiotic stresses. These datasets have facilitated the identification of stress-responsive genes, regulatory networks, and metabolic pathways governing root system architecture, hydraulic efficiency, lignin biosynthesis, and reactive oxygen species (ROS) scavenging, thereby contributing to genomic and marker-assisted selection strategies. A significant milestone is the emergence of species-specific databases, such as WP-MOD, which integrate multi-omics and taxonomic data across numerous woody species, offering a centralized resource for data exploration and analysis. Concurrently, advances in high-throughput sequencing, epigenomics, and single-cell omics initially developed for annual crops are being adapted to tree systems, uncovering novel regulatory loci and epigenetic mechanisms underlying stress-responsive phenotypes. However, major challenges remain. There is limited integration of multi-omics datasets with long-term field phenomics and climate projection models, resulting in a gap between laboratory-derived resilience signatures and their validation under real-world agroforestry conditions. Functional validation of candidate genes is also constrained by long generation cycles, recalcitrance to genetic transformation, and the lack of well-characterized mutant resources in woody perennials. Additionally, insufficient standardization of omics protocols and metadata across species hampers comparative genomics and large-scale meta-analyses. Emerging research trends emphasize predictive breeding, genome-environment (G×E) association studies, and artificial intelligence-driven integration of genomic, environmental, and phenotypic datasets to enable climate-smart deployment of tree genotypes. Futuristic research focuses on the integration of multi-omics with CRISPR-based genome editing, microbiome engineering, and the establishment of collaborative frameworks to effectively translate multi-omics-driven insights into resilient and sustainable agroforestry systems.

Keywords: Multi-omics, Woody perennials, Combined stress resilience, Agroforestry systems, Genome editing, Climate-adaptive breeding



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Development of a Novel Bacterial–Algal Consortium for Efficient Treatment and Detoxification of Distillery Effluent

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Abstract

This study presents the first application of a novel bioremediation technology utilizing a bacterial-microalgal consortium (BAC), BV3NVNT1, composed of a laccase-producing *Bacillus velezensis* HIM03 (bacterial partner) and *Scenedesmus* sp. NVNT1 (microalgal partner), for the effective treatment of highly hazardous and recalcitrant distillery effluent (DE). The results revealed that the BAC-BV3NVNT1 significantly reduced the pH of the treated DE from 8.44 ± 0.25 to 7.10 ± 0.01 and achieved substantial removal efficiencies for color (94.12%), BOD (95.08%), COD (92.68%), TDS (86.42%), phosphate (77.43%), sulfate (75.48%), nitrate (80.61%), and phenol (89.04%). These results were achieved under optimal conditions using a self-fabricated vertical photobioreactor (vPBR) with a 2 L working volume (inner dimensions: L: 12 × W: 12 × H: 25 cm). The reactor was operated in batch mode with cool white-blue fluorescent LED lights at an intensity of 4000-5000 lux, a maintained temperature of $30 \pm 1^\circ\text{C}$, an inoculum volume of 40%, and a 12-hour dark/light cycle. These conditions were maintained to support the growth of the novel bacterial-microalgal consortium and its cultivation, along with DE treatment, over 12 days. The Fourier transform-infrared (FT-IR) spectroscopy and gas chromatography-mass spectrometry (GC-MS) analysis revealed that most of the organic pollutants characterized in the untreated (UT) DE were completely mineralized or transformed into new metabolic products in DE treated with the novel BAC-BV3NVNT1 under optimized conditions. Additionally, the phytotoxicity of DE treated with the novel BAC-BV3NVNT1 was evaluated with *Phaseolus aureus* L. (a terrestrial toxicity model organism) to ensure environmental safety. The results revealed a substantial reduction in the DE-phytotoxicity post-treatment with the newly developed BAC-BV3NVNT1, leading to 88% seed germination compared to seedlings watered with UT-DE (25%, v/v). This finding highlights the potential of the treated DE as a liquid fertilizer for crop irrigation. Overall, the novel bioremediation technology (BAC-BV3NVNT1) demonstrated remarkable potential for effectively treating and detoxifying DE, ensuring environmental protection, and safeguarding public health.

Keywords: Distillery effluent; Decolorization, Bioremediation; COD removal; Photobioreactor; Phytotoxicity; Environmental safety



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Bioremediation of Chromium Using Chromium-Resistant Bacteria for Environmental Safety

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Abstract

Chromium contamination, particularly in its hexavalent form [Cr(VI)], poses a serious threat to environmental and public health due to its high toxicity, mobility, and carcinogenic nature. Industrial activities such as electroplating, leather tanning, textile processing, and mining have significantly contributed to chromium accumulation in soil and water systems. The present study explores the potential of chromium-resistant bacteria as an eco-friendly and sustainable approach for the bioremediation of chromium-contaminated environments. Chromium-resistant bacterial strains were isolated from contaminated sites and screened for their tolerance to varying concentrations of Cr(VI). Selected isolates were further evaluated for their chromium removal efficiency under optimized physicochemical conditions, including pH, temperature, and initial metal concentration. The mechanisms involved in chromium removal were investigated, focusing on microbial reduction of toxic Cr(VI) to the less toxic trivalent form [Cr(III)], along with biosorption and bioaccumulation processes. Results demonstrated that the selected bacterial strains exhibited significant chromium resistance and removal efficiency, achieving substantial reduction of Cr(VI) within a defined incubation period. The study also highlights the role of enzymatic activity and cell surface interactions in enhancing chromium detoxification. Furthermore, the treated samples showed a marked decrease in toxicity, indicating improved environmental safety. This study underscores the effectiveness of chromium-resistant bacteria as a promising tool for bioremediation. The application of such microbial systems offers a cost-effective, environmentally benign, and scalable solution for mitigating chromium pollution. Future research should focus on field-scale applications and the development of microbial consortia to enhance remediation efficiency under diverse environmental conditions.

Keywords: Bioremediation, Biodetoxification, Chromium, Chromium Resistant Bacteria, Toxicity, Environmental Safety



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Prevalence and Antibiotic Sensitivity Pattern of UTI Pathogens in Local Patients

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Abstract

Urinary tract infections (UTIs) are among the most common bacterial infections affecting individuals across all age groups, with a higher prevalence in females. The increasing emergence of antibiotic-resistant uropathogens has become a significant public health concern, complicating treatment strategies and leading to recurrent infections. The present study aimed to investigate the prevalence of UTI-causing pathogens and analyze their antibiotic sensitivity patterns among local patients. Midstream urine samples were collected from clinically suspected UTI patients and processed using standard microbiological techniques. Isolates were identified based on colony morphology, staining characteristics, and biochemical tests. Antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method in accordance with standard guidelines. The results revealed that most of the pathogens were the predominant uropathogens with a higher incidence of UTIs. Antibiotic sensitivity profiling indicated that most isolates showed high sensitivity to several pathogens against commonly used antibiotics. The study highlights an alarming trend of multidrug resistance among uropathogens, emphasizing the need for regular surveillance of antibiotic susceptibility patterns. Such data are crucial for guiding empirical therapy and minimizing the misuse of antibiotics. Implementation of antibiotic stewardship programs and increased awareness regarding rational drug use are essential to control the spread of resistant strains. In conclusion, continuous monitoring of UTI pathogens and their resistance profiles is vital for effective clinical management and ensuring better patient outcomes.

Keywords: Pathogens, Urine, Antibiotic Resistance, Patients, Disease, Infection.



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Bacterial Distribution and Sensitive Profile in Clinical Specimens Collected from Local Patients

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Abstract

Bacterial infections remain a major cause of morbidity and mortality, particularly in developing regions where empirical antibiotic use is common. Understanding the distribution of bacterial pathogens and their antibiotic sensitivity patterns is essential for effective clinical management and infection control. The present study aimed to investigate the bacterial profile and antibiotic susceptibility patterns in various clinical specimens collected from local patients. A total of clinical samples, including urine, blood, pus, sputum, and wound swabs, were collected from patients presenting with suspected bacterial infections. Samples were processed using standard microbiological procedures for isolation and identification based on colony morphology, Gram staining, and biochemical characterization. Antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method following standard guidelines. The results revealed a diverse distribution of bacterial pathogens isolated from the collected samples. Gram-negative bacteria predominated in most specimen types, particularly in urine and sputum samples, while Gram-positive bacteria were more commonly associated with wound and pus samples. Antibiotic sensitivity testing indicated that isolates showed higher susceptibility to advanced antibiotics, whereas significant resistance was observed against commonly prescribed antibiotics. The findings highlight the growing concern of multidrug-resistant bacterial strains in clinical settings. Continuous monitoring of pathogen distribution and their resistance patterns is crucial for guiding appropriate antibiotic therapy and reducing the burden of antimicrobial resistance. The study underscores the need for rational antibiotic use and implementation of effective infection control strategies to improve patient outcomes.

Keywords: Clinical samples, Bacterial pathogens, Antibiotic, Antibiotic Resistance, Susceptibility, Resistance



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Genetic dissection of peduncle length and its weight in wheat (*Triticum aestivum* L.) using 35K SNP chip under combined heat and drought stress

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Abstract

Wheat is an important staple food crop in India and is being threatened by various abiotic stresses like drought, heat, and combined heat and drought stress. The wheat peduncle is an important part of the culm, which can maintain the supply of photosynthates to grains under harsh climatic conditions. Abiotic stress significantly impacts wheat yield by shortening the peduncle, which reduces overall plant height and impairs grain filling due to less photosynthate transport to grains. At this juncture, a field experiment had been conducted at the Division of Plant Physiology, Indian Agricultural Research Institute, New Delhi, India, to map the genomic regions controlling the peduncle length (PDL) and peduncle weight (PDW) in wheat by using 220 recombinant inbred lines (RILs), developed by crossing two contrasting parents, HD3086/HI1500. Genotyping of 21-day-old wheat seedlings has been done with the 35K Axiom Wheat Breeder's Array, followed by quantitative trait loci (QTLs) mapping with Inclusive Composite Interval Mapping (ICIM) software. Candidate gene prediction within the flanking markers of identified QTLs (mapped within 1cM), has been done by using the BioMart tool available in the Ensembl Plants database. From this study, several quantitative trait loci (QTLs) have been mapped for PDL & PDW, most of which have been mapped in wheat genome B and D. QTLs, QPDL/PDW.iari.4B and QPDL/PDW.iari.4D, harbored two important genes, reduced height-1 (Rht-D1) and teosinte branched-1 like (TB-1 like), which were found to be involved in controlling PDL & PDW in wheat. Furthermore, gene interaction analysis using the STRING database inferred that Rht-1 and TB-1 interact with other putative genes, indicating strong gene networks control these traits in wheat. After successful validation of the identified QTLs in multilocation trials, these QTLs can be transferred to the elite wheat germplasms using efficient breeding tools to enhance yield in this global climate change scenario.

Keywords: Combined stress, Peduncle Length, Peduncle weight, Quantitative trait loci, Wheat



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Carbon dioxide mitigation potential of Pongamia pinnata trees for cleaner atmosphere in the context of changing climate

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Abstract

Pongamia pinnata (L.) Pierre, popularly known as ‘karanj’, is one of the important multipurpose tree species acquired focus around the globe being a tree-borne oil seed species. In the context of climate change scenario and to meet the sustainable development goals, tree-borne oil seed species (TBOS) has to play many significant roles in this direction. Despite, having immense importance of this tree in particular, the strategic researches are scanty on this species and there are many basic challenges to understand the intricacies involved to harness its potential for climate change mitigation. The importance of understanding the basic strategies being adopted by the tree species for carbon gain and thereby mitigating the carbon dioxide in particular remain big research gap. On this background, the experiments were conducted in the contrasting tree populations of Pongamia pinnata in the semi-arid climate of central India at the research farm of the Institute. The contrasting types, namely, clonal and seedling trees were included in the studies for evaluating comparative responses with reference to their efficiency in CO₂ mitigation potential and associated physiological mechanisms. Differential efficiencies were evaluated for net CO₂ assimilation and associated gas exchange functions of the trees in two contrasting seasons (dry hot summer and post-monsoon) where the weather of dry hot summer remains very harsh (maximum temperature hovers around 48°C) and the moist post-monsoon remains conducive. Evaluations showed that the clonal trees had relatively higher A_{max} (PPFD saturated net CO₂ assimilation) during hot summer than the seedling trees which not only enhances atmospheric carbon capture but also indicated its endurance towards harsh dry climate demonstrating significant potential for climate change mitigation. Eventually CO₂ sequestration leads to greater biomass production and helps to mitigate the greenhouse effect as it is envisaged similarly for this tree as well. Moreover, instantaneous water use efficiency (WUE_i) of CO₂ assimilation was also deciphered along with ecophysiological traits namely, leaf area index (LAI), dynamics of spectra based Chlorophyll content index (CCI) in the contrasting tree populations for unravelling their association with carbon gain. Allometric equation was used for estimation of tree biomass and subsequently standard IPCC protocol was followed for estimation of the sequestration of CO₂ equivalent from the biomass data in the contrasting tree population. Although, clonal population has revealed relatively more potential in CO₂ mitigation than the seedling population, the Pongamia pinnata trees, in general have remarkable scope to mitigate CO₂ from the atmosphere based on their judicious utilisation depending on the climatic situations.

Keywords: Carbon dioxide mitigation; Climate change; Ecophysiology; Photosynthesis; Trees



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Agroforestry: A Sustainable Approach to Climate Adaptation in Agriculture

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Abstract

Agroforestry, which involves the integration of trees with crops and livestock, offers a sustainable and multifunctional approach to addressing climate-related challenges. It improves soil health through enhanced nutrient cycling and organic matter addition, leading to better soil structure and productivity. Furthermore, agroforestry systems contribute to efficient water management by increasing infiltration, reducing surface runoff, and minimizing soil erosion, which is particularly beneficial in drought-prone and degraded regions. In addition to supporting climate adaptation, agroforestry plays a vital role in climate change mitigation. Trees in these systems act as carbon sinks, sequestering atmospheric carbon dioxide and thereby reducing greenhouse gas concentrations. Agroforestry also enhances biodiversity by providing diverse habitats, which improves ecosystem stability and resilience. Another key advantage is the diversification of farm income through the production of timber, fruits, fodder, and other non-timber forest products, reducing farmers' economic risks. Despite these benefits, the widespread adoption of agroforestry remains limited due to several constraints. These include inadequate policy support, unclear land tenure systems, limited access to extension services, and insufficient technical knowledge among farmers. Additionally, challenges such as delayed economic returns and lack of quality planting materials hinder its uptake. To unlock the full potential of agroforestry, coordinated efforts from governments, NGOs, and the private sector are essential. Strengthening institutional support, improving awareness, and promoting knowledge sharing can significantly enhance adoption and contribute to sustainable, climate-resilient agriculture.

Keywords: Agroforestry; Climate change; Adaptation; Mitigation; Climate-resilient agriculture



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Agroforestry for Environmental Stewardship in Food Production Systems

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Abstract

Fossil fuels such as coal, oil, and gas are the prime contributors to global climate change, accounting for over 75% of global greenhouse gas emissions. Given that, rising temperatures are altering weather patterns and upsetting the natural equilibrium. Amidst this climate change, India is experiencing rising temperatures, altered rainfall patterns, and increased frequency of extreme weather events like droughts, floods, and heatwaves, leading to food insecurity. Outlined by the Intergovernmental Panel on Climate Change (IPCC), adoption of the agroforestry system plays a promising role in climate change mitigation through carbon sequestration in plant biomass and soil for a longer period of time and thereby can address the need for global food security by preventing the loss of crop yield through microclimate moderation. Besides this, it also delivers ecosystem services, sustainable production, biodiversity conservation, soil and water conservation, and livelihood security for countless farmers. In addition, agroforestry is crucial to reaching land degradation neutrality by preventing soil erosion and enhancing nutrient recycling. This review covers agroforestry concepts and technology that have increased the productivity and profitability of land use systems in different climates, highlighting environmental oversight in sustainable food production.

Keywords: Agroforestry, Climate change, Carbon sequestration, Land degradation neutrality, Environment security, Nature positive food production



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Fruit Forests: A Nature-Based Solution for Nutrition Security, Biodiversity Conservation and Ecosystem Restoration

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Abstract

Globally, land degradation and biodiversity loss have intensified due to monoculture agriculture and unsustainable land use practices. According to the Food and Agriculture Organization, agroforestry covers more than 43% of all agricultural land in the world, where 30% of the rural population inhabits. This supports nearly 900 million people and demonstrating significant potential for restoring degraded landscapes. One billion hectares of degraded agricultural land can be improved through the planned development of trees through agroforestry. Studies indicate that agroforestry-based systems can maintain 50–80% of the biodiversity found in natural forests, highlighting their ecological importance in agricultural landscapes. According to the World Health Organization, inadequate consumption of fruits and vegetables is a major dietary risk factor contributing to non-communicable diseases worldwide. Integrating diverse fruit species within agroforestry landscapes can enhance year-round availability of nutrient-rich foods containing vitamins, minerals, antioxidants, and dietary fiber. Therefore, fruit forest can be viable option to overcome the above mentioned problem. Fruit forests, a diversified form of agroforestry integrating fruit trees with shrubs, crops, and natural vegetation, are increasingly recognized as a sustainable strategy for biodiversity conservation and ecosystem restoration. Fruit forest systems enhance structural complexity and plant diversity, thereby creating habitats for pollinators, birds, and beneficial insects while improving soil health, nutrient cycling, and microclimate regulation. Meta-analysis studies across multiple regions have reported that diversified agroforestry systems can provide up to 45% higher biodiversity and 65% greater ecosystem service benefits compared to conventional monocropping systems. Furthermore, fruit forests contribute to climate resilience through carbon sequestration, soil conservation, and reduced land degradation. These multifunctional systems simultaneously support biodiversity conservation, ecosystem restoration, sustainable food production, and improved human nutrition. Therefore, promoting fruit forest-based agroforestry models in degraded and semi-arid regions offers a nature-based solution for ecological restoration while strengthening nutritional security, health security, and sustainable rural livelihoods.

Keywords: Agroforestry, Biodiversity Conservation, Ecosystem Restoration, Fruit Forests, Nutritional Security, Nature-Based Solution, Health Security.



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Assessment of ornamental fish biodiversity in the Gomti River, Uttar Pradesh, through DNA barcoding

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Abstract

Freshwater ornamental fish are part of biodiversity and play essential roles in ecosystems as mosquito predators, such as guppies, thereby reducing mosquito-borne diseases. Small invertebrates serve as cleaners by consuming algae or detritus, like the Siamese species. Besides their ecological functions, these fish hold high aesthetic value and provide significant economic opportunities in rural areas. They contribute to pest control, habitat maintenance, nutrient cycling, and biodiversity. Over 1,500 ornamental fish species, representing 60% of all ornamental fish species, play significant roles in specific niches in the tropical waters of Asia and South America. This study aims to accurately identify unknown species from the Gomti River using integrative taxonomy. A total of 13 voucher fish species belonging to 5 orders, 8 families, and 13 genera were collected from the river. Thirteen samples of ornamental fish were analysed for morphological data on site (Fish Base, Catalogue of the Fishes of Bangladesh), and genomic data were identified using DNA barcoding. Genomic DNA was extracted using the phenol-chloroform method, and the mitochondrial gene cytochrome c oxidase subunit I (COI) was amplified. Sequences were analysed using NCBI tools and nucleotide BLAST, with the correct species name percentage indicated to assess accuracy. Sequences were created in FASTA format. Phylogenetic analysis, nucleotide composition, and genetic distances were analysed using MEGA11 software. Based on all criteria, the results showed that 100% of voucher species were identified as Least Concern according to IUCN status. In the future, these species may become threatened. Therefore, managing overexploitation, agrochemicals, pesticides (including DDT), and industrial bioaccumulation of harmful metals such as cadmium, mercury, and lead is essential to protect aquatic life. Conservation approaches such as cryopreservation, live gene banks, tissue banking, cell line development, and exotic species control are necessary to maintain IUCN status.

Keywords: DNA barcoding, Ornamental fish, Mitochondrial gene, Phenol-chloroform method, Gomti River, COI gene, IUCN status, NCBI, BLAST, FASTA, MEGA11



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Bioremediation: A Sustainable Approach for Environmental Pollution Management

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Abstract

Environmental pollution has emerged as one of the most critical global challenges due to rapid industrialization, urbanization, and improper waste disposal practices. Conventional methods of pollution control, such as chemical and physical treatments, are often costly and may generate secondary pollutants. In this context, bioremediation has gained significant attention as an eco-friendly, cost-effective, and sustainable alternative. Bioremediation utilizes microorganisms, plants, or their enzymes to degrade, detoxify, or remove contaminants from soil, water, and air. This paper explores various bioremediation techniques, including microbial remediation, phytoremediation, and mycoremediation, highlighting their mechanisms and applications in treating pollutants such as heavy metals, hydrocarbons, pesticides, and industrial effluents. The study also discusses recent advancements in genetic engineering and molecular biotechnology that enhance the efficiency of bioremediation processes. Furthermore, the role of environmental factors influencing the success of these biological methods is examined. Despite its advantages, bioremediation faces certain limitations, including slow degradation rates and sensitivity to environmental conditions. Therefore, integrating biotechnological innovations with traditional remediation approaches is essential for achieving optimal results. This paper concludes that bioremediation represents a promising and sustainable strategy for pollution management, contributing to environmental restoration and long-term ecological balance.

Keywords: Bioremediation, Biodegradation, Phycoremediation, Mycoremediation, Pollution Mitigation



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PHYTOREMEDIATION AND CONSTRUCTED WETLANDS FOR POLLUTANT REMOVAL

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Abstract

Contamination of heavy metals, specifically in soil, is one of the critical environmental issues that has a great impact on human health and the ecosystem. Once introduced to the soil, these toxic heavy metals persist for a long period, affecting the environment and, thereafter, communities living near the contaminated areas. The most common environmental heavy metals are Copper (Cu), Nickel (Ni), Chromium (Cr), Lead (Pb), Cadmium (Cd), Mercury (Hg), Iron(Fe) and Arsenic(As). Remediation techniques have been developed to rectify the heavy metal contaminated sites, including surface capping, encapsulation, filling, soil flushing, soil washing, stabilization, vitrification, phytoremediation, and bioremediation. Constructed wetlands (CWs) are affordable and reliable green technologies for the treatment of various types of wastewater. Constructed wetlands (CWLs) are engineered systems built for sewage treatment utilizing natural processes of soil, substrate, plant, and microorganism with a synergistic combination of physical, chemical, and biological functions. Constructed wetlands (CWs) are mainly classified into free water surface (FWS) and subsurface flow (SSF) wetlands. FWS wetlands resemble natural wetlands, where wastewater flows slowly over the soil or substrate surface in shallow water. In contrast, SSF wetlands allow wastewater to move beneath the surface through gravel, sand, or other porous media, reducing odour and mosquito problems. Plants play a major role in CW performance by absorbing nutrients and pollutants and by supporting microbial activity. Commonly used macrophytes include emergent, submerged, floating-leaved, and free-floating plants. Frequently used emergent species include *Phragmites* spp., *Typha* spp., *Scirpus* spp., *Iris* spp., and *Eleocharis* spp., which are preferred for their strong root systems and high tolerance to pollution. Common submerged plants include *Hydrilla verticillata*, *Ceratophyllum demersum*, *Vallisneria natans*, and *Myriophyllum verticillatum*, all of which help remove nutrients and contaminants from wastewater. Among free-floating plants, *Lemna minor* is widely used because of its rapid growth and effective nutrient removal capacity. Phytoremediation using constructed wetlands (CWs) has become a logical solution to improve the quality of contaminated waters by acting as a sink for various contaminants.

Keywords: Bioremediation, Biodegradation, Phycoremediation, Mycoremediation, Pollution Mitigation



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LEADERSHIP AND PARTICIPATION OF YOUTH AND WOMEN IN ENVIRONMENTAL STEWARDSHIP: CHALLENGES AND OPPORTUNITIES

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Abstract

Environmental stewardship is a vital approach to addressing global challenges such as climate change, biodiversity loss, and resource depletion. In this context, youth and women play a significant role in promoting sustainable practices and ensuring environmental conservation. Youth contribute through innovation, awareness campaigns, and active participation in climate movements, while women bring valuable indigenous knowledge, resource management skills, and community leadership. Despite their contributions, both groups face challenges such as limited access to resources, lack of representation in decision-making, and socio-cultural barriers. This study highlights the importance of empowering youth and women through education, capacity building, and inclusive policies. A socio-ecological perspective is used to understand their role in strengthening environmental governance and promoting sustainability. The study emphasizes that integrating youth and women into environmental stewardship leads to more effective and equitable outcomes. Their active involvement enhances community resilience, supports sustainable development goals, and fosters long-term ecological balance.

Keywords: Environmental Stewardship, Sustainability, Climate Change, Empowerment, Gender Equality, Participation



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NEXT-GENERATION APPROACHES IN PLANT PATHOLOGY: ROLE OF NANOTECHNOLOGY AND MOLECULAR TOOLS IN DISEASE DETECTION AND MANAGEMENT

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Abstract

Plant pathogens significantly limit crop productivity and pose a serious threat to global food security. Although chemical control methods are widely used, their continuous application often results in the development of resistant pathogen strains and causes environmental concerns, including the disruption of beneficial soil microorganisms. Therefore, there is an urgent need for sustainable, rapid, and reliable approaches for both the detection and management of plant diseases. Recent advancements in nanotechnology provide innovative solutions for overcoming these limitations. Tools such as microneedle patches, nanopore sequencing, Nano barcoding, Nano biosensors, and quantum dots enable highly sensitive, rapid, and real-time detection of plant pathogens. Beyond detection, molecular and nanotechnology-based strategies are increasingly being utilized for effective disease control. Techniques like RNA interference (RNAi) and CRISPR-mediated genome editing allow precise targeting of pathogens, while nanoparticles such as silver, silica, and chitosan exhibit strong antimicrobial activity and can enhance plant immunity. Additionally, nanocarriers facilitate the efficient delivery of agrochemicals, reducing dosage and environmental impact.

Keywords: Plant pathogens, Nanotechnology, Molecular diagnostics, Nano biosensors, RNA interference, Disease Management



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SOIL REMEDIATION POTENTIAL OF BIOCHAR AND ORGANIC AMENDMENTS IN CONTAMINATED AGRO-ECOSYSTEMS

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Abstract

Soil contamination caused by excessive use of agrochemicals, industrial emissions, toxic substances such as heavy metals, pesticides, and other organic pollutants accumulates in soils, which adversely affect soil fertility, microbial activity, and crop productivity. Therefore, the development of sustainable, environmentally friendly approaches for soil detoxification and remediation is essential. Biochar, a carbon-rich material produced through the pyrolysis of biomass under limited oxygen conditions, possesses a highly porous structure, large surface area, and numerous functional groups. These properties enable biochar to adsorb, immobilize, and stabilize various contaminants, thereby reducing their mobility and bioavailability in soil. In addition, biochar enhances soil physical and chemical properties such as soil structure, water holding capacity, and nutrient retention. Organic amendments such as compost, farmyard manure, green manure, and vermicompost further contribute to soil detoxification by increasing soil organic matter, enhancing microbial activity, and promoting the degradation or stabilization of toxic compounds. The integrated use of biochar and organic amendments provides synergistic effects, improving soil health, enhancing nutrient cycling, and supporting sustainable management of contaminated agro-ecosystems.

Keywords: Biochar, Organic amendments, Soil detoxification, Soil remediation, Heavy metal Immobilization, Sustainable agriculture.



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Ensiling Bajra Napier hybrid grass using lactic acid bacterial inoculants as additives

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Abstract

Silage is being increasingly used as it serves as a constant supply of fodder throughout the year. The basis of the ensiling process is the naturally occurring anaerobic fermentation of fodder crops and grasses in the presence of lactic acid-producing bacteria, which convert readily fermentable carbohydrates into organic acids, primarily lactic acid. This experiment was aimed at isolating and characterizing lactic acid bacteria to improve ensiling various types of grasses by increasing lactic acid production and rapidly lowering the silage pH. About 69 lactic acid bacterial cultures (LAB) were isolated from the phyllosphere region as well as endophytes of different grasses at available in IGFRI Jhansi such as Guinea grass, Dinanath grass, dhawalu grass, anjan grass, dhaman grass, lampa grass, sen grass, and from silages of various grasses (including temperate grasses silage and apple silages) in different batches by using MRS agar media. Isolates were examined for colony morphology, and catalase-negative and gram-positive bacterial isolates were screened for in vitro lactic acid production. About nine LAB isolates were chosen based on their lactic acid production, and they were used as inoculant additives (@ -1×10^8 CFU/ml) for ensiling Bajra Napier (BN) hybrid grass. Clean, surface-sterilized plastic containers were utilized for making silage by maintaining airtight sealing to ensure anaerobic conditions. Following an incubation period of 45 days at room temperature, the containers were examined for fermentation and organoleptic properties. The average LAB count in the inoculated containers ranged from 42.5×10^3 to 75×10^3 CFU/g, compared to the control (40.8×10^3 CFU/g). The boxes inoculated with the culture gave an average of 245.5 to 599.0 mg of lactic acid, while the uninoculated control recorded 223.9 mg. The average pH drop in silage inoculated with LAB ranged from 4.82 to 4.21, compared to the control (4.94 to 4.85). Percent DM reduction in silage ranged from 1.65 - 2.76%. Volatile fatty acid profile showed that acetic, propionic, isobutyric, butyric, isovaleric, and valeric acids were found at lower concentrations than the control, while lactic acid was higher (0.264-0.697%) in inoculated treatments than in the control (0.26%). Another batch of selected 9 LAB from temperate grasses silage were also used to prepare BN hybrid (LA: 116.8-246.3 mg and pH: 4.87-4.58 vs. 69.5 and 5.07 in control) and Cenchrus ciliaris silage (LA: 221.3-240.1 mg; pH: 4.79-3.86; %DM loss: 1.43-0.96 vs. Control 214.4, 5.23 and 1.55, respectively). About 4 efficient LAB isolates were identified which enhanced the ensiling process and resulted in higher-quality silage.

Keywords: Silage, Lactic acid bacteria, BN hybrid, grass.



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Carbon Sequestration and Soil Organic Carbon Dynamics of Forest in Mitigating Climate Change

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Abstract

Climate change has emerged as a major global concern in the present century due to the continuous rise in atmospheric carbon dioxide (CO₂) and other greenhouse gases driven by anthropogenic activities such as deforestation, land-use change, and fossil fuel combustion. Forest ecosystems act as natural reservoirs that mitigate climate change by serving as dynamic carbon sinks, absorbing CO₂ through photosynthesis and storing it in plant tissues, which is later transferred to the soil via litterfall, root turnover, rhizodeposition, and root exudation, contributing to soil organic carbon (SOC). The balance of soil carbon is regulated by complex SOC dynamics such as decomposition, humification, and mineralization, along with physical, chemical, and biological protection mechanisms that control carbon turnover and long-term stabilization. Globally, soil and living biomass together store nearly 90% of total carbon, with tropical forests sequestering more carbon in living biomass, while boreal forests contain the largest share of soil carbon, followed by temperate and tropical forests. Notably, soils store approximately four times more carbon than vegetation and two to four times more than the atmosphere. Initiatives such as the “4 per mille” highlight the importance of enhancing soil carbon stocks as a sustainable climate solution. Therefore, integrating vegetation-based carbon sequestration with soil organic carbon stabilization can reduce atmospheric CO₂ levels, improve ecosystem resilience, and strengthen climate change mitigation strategies.

Keywords: Climate change, Carbon sequestration, Soil organic carbon



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Morpho-Elemental Analysis of Rodent and Bird Droppings: Insights from SEM and EDX Techniques

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Abstract

Rodents, classified within the order Rodentia, are gnawing mammals distinguished by a single pair of continuously growing incisors and a diastema separating these from the molars. Their droppings are typically small, dark-brown pellets resembling grains of rice. Birds, belonging to the class Aves, are endothermic vertebrates characterised by feathers, toothless beaks, and hard-shelled eggs. Bird droppings contribute to plant nutrition due to their high nitrogen, phosphorus, and potassium (NPK) content. Both rodents and birds play significant roles in zoology and palaeontology, offering insights into animal behaviour, reproduction, and ecological functions such as seed dispersal and disease transmission. Their rapid population growth and wide geographic distribution render their fossils valuable for reconstructing past ecosystems and environmental changes. Fossilised droppings (coprolites) provide information on historical ecological relationships and trophic interactions, while contemporary droppings reveal diet, habitat preferences, and species distribution. Understanding environmental dynamics in current research requires recognising rodents, birds, and their droppings. Rodent and bird droppings were identified based on their shape and morphology. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX) analyses conducted in palaeontology laboratories indicated that rodent samples primarily contained carbon, calcium, silica, and oxygen. In contrast, bird droppings contained carbon, calcium, phosphorus, magnesium, and oxygen. These morphological and elemental differences reflect species-specific diets, metabolic processes, and ecological roles. Integrating multiple identification methods provides a robust approach for distinguishing species and evaluating environmental conditions. Such analyses yield insights into diet, habitat, and ecology, underscoring faecal analysis as a non-invasive method for investigating biodiversity and ecosystem dynamics.

Keywords: Rodentia, Rodent dropping, Bird dropping, SEM, EDX, Coprolite



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Reconstructing an Eocene Angiosperm Forest: Evidence from Micro-Biota in Kutch Amber

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Abstract

Over the past two decades, Eocene amber from the Kutch lignites of Gujarat has provided significant insights into ancient biodiversity and palaeoecology, offering a unique perspective on early Cenozoic terrestrial ecosystems. This research reconstructs a Dipterocarpaceae-dominated, broad-leaved tropical angiosperm forest using exceptionally preserved amber micro-biota from the Umarsar Lignite Mine in the Kutch Basin. More than fifty inclusions have been identified, representing arboreal, terrestrial, sub-soil, and freshwater aquatic components, which reflect a highly diverse and structured ecosystem. The arboreal assemblage is dominated by Diptera (true flies), indicating proximity to water bodies and complex ecological interactions, including parasitic relationships potentially associated with early mammalian hosts. Associated floral remains, such as pollen grains and plant debris, together with bees and wasps, demonstrate the presence of active and well-established pollination networks. Bark-dwelling communities, represented by social insects such as ants and termites, indicate organised colony structures within the forest ecosystem. Arachnid inclusions, particularly spiders, provide evidence of phoretic associations and advanced ecological adaptations. The preservation of egg sacs alongside spider specimens suggests parental care, highlighting behavioural complexity in these early arthropod communities. The litter and sub-soil biota include phytophagous beetles and sarcoptid mites, which indicate humid, organic-rich conditions at the forest floor. Freshwater ostracods with preserved soft tissues further confirm the presence of perennial water bodies within or near the forested landscape. The occurrence of euhedral crystals within amber nodules suggests an aerosol origin, possibly linked to volcanic activity following the Deccan Traps eruptions. Collectively, this diverse micro-biota assemblage indicates faunal exchange among India, Europe, Asia, and Gondwana during the early Eocene, when India was an equatorial island during a period of global climatic warming and intensified biotic radiation.

Keywords: Eocene, Forest, Kutch, Angiosperm, Euhedral Crystals



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Early Eocene Biotic Assemblage and Palaeoenvironmental Reconstruction from the Valia Lignite Mine, Cambay Basin, Gujarat, India

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Abstract

The Early Eocene layers at the Valia Lignite Mine in Gujarat’s Cambay Basin offer important information about ancient biodiversity and environmental conditions in low-latitude areas. This research brings together evidence from pollen, fossils, geochemistry, amber inclusions, dinoflagellate cysts, vertebrate remains, and carbon isotope data to piece together the environment and climate from about 56 to 53 million years ago. The sequence of lignite and shale shows a shift from marshy land to shallow sea, likely due to global warming events. Dinoflagellate cysts, especially Apectodinium species, help date these layers to the late Thanetian to early Ypresian. A clear drop in carbon isotope values in the shale matches the Early Eocene Thermal Maximum (ETM-2), showing changes in the global carbon cycle and higher CO₂ levels. Pollen analysis shows angiosperms, mangroves, and fungi were common, pointing to a warm, wet, coastal rainforest with heavy rainfall. Amber with ants and midges, plus vertebrate fossils, reveals a rich ecosystem with land, freshwater, and marine life. All this evidence suggests the area was a near-shore environment with occasional seawater flooding and strong land influence. This study shows how warming events shaped Early Eocene ecosystems and helps us understand how life responded to climate change in the tropics.

Keywords: Amber, Cambay Basin, Dinocysts, Early Eocene, Valia, Palaeoenvironment



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Uncovering Ancient Life: The Exceptional Fossil and Amber Record of the Tadkeshwar Lignite Mine

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Abstract

Approximately 50 to 55 million years ago, the Tadkeshwar lignite mine yielded exceptionally well-preserved fossils, including the oldest known amber containing insects such as termites, mosquitoes, and flies, as well as flora and fauna samples with ancient DNA and preserved body structures. The Tadkeshwar fossils provide valuable ecological information about the Indian region, highlighting insect diversity and evidence of fungal interactions. Analysis of these fossils reveals interspecies relationships, the presence of parasites, and fungal traces preserved in amber. These natural archives may also contain previously unidentified species, offering important insights into the biodiversity that existed millions of years ago. The significance of the Tadkeshwar fossils lies in their potential to advance evolutionary studies of insect, microorganism, and plant lifecycles, structures, and DNA recombination, thanks to their exceptionally preserved microscopic details.

Keywords: Flora, Fauna, DNA, Tadkeshwar, Fossils



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Inhibitory Effects of Arsenic Trioxide on Adipogenesis via PPAR γ Pathway Modulation

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Abstract

PPAR γ (Peroxisome Proliferator-Activated Receptor gamma) and its co-regulator C/EBP (alpha) are the main regulators of adipogenesis, which refers to the process of converting preadipocytes into mature adipocytes. Arsenic trioxide (As₂O₃), a therapeutic agent used clinically, has been found to disrupt adipogenic differentiation at sub-apoptotic concentrations. To identify the impact of arsenic trioxide on PPAR γ -mediated transcriptional regulation in 3T3-L1 preadipocytes, in particular, by inhibiting PPAR γ and C/EBP4 protein expression. Continuous exposure of 3T3-L1 preadipocytes to sub-apoptotic concentrations of arsenic trioxide that were clinically achievable was conducted. Western blotting was used to detect protein expression levels of PPAR γ and C/EBP 3. Western blotting detects impairment of the heterodimeric transcriptional complex that activates adipogenic genes. Western blot analysis indicated that sustained arsenic trioxide treatment significantly repressed PPAR γ protein expression in 3T3-L1 preadipocytes in a fashion that was similar to that of the adipogenic programme inhibition. Western blot also revealed that the interaction between PPAR γ was significantly disturbed by the presence of arsenic trioxide, which suggests that the arsenic trioxide disrupts the assembly of the transcriptional complex necessary in the activation of the downstream adipogenic target genes. Arsenic trioxide inhibits adipogenesis in preadipocytes, 3T3-L1, by specific inhibition of the PPAR transcriptional pathway, including the down-regulation of the expression of PPAR γ and C/EBP α proteins. These results define the PPAR γ inhibition as the main mechanistic foundation of the anti-adipogenic effect of arsenic trioxide.

Keywords: PPAR γ , Arsenic trioxide, Western blotting, 3T3-L1 Preadipocyte, C/EBP α , sub-apoptotic.



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Microplastic induced Lung Fibrosis via Activation of inflammatory pathway

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Abstract

Microplastics (MPs) are synthetic polymer particles between 1 μm and 1 mm in size, generated through the degradation of larger plastic debris or direct release. MPs have become significant environmental contaminants with potential consequences for human health. Their small size and high surface reactivity enable MPs to cross biological barriers and accumulate in organs such as the lungs, where they may induce pulmonary toxicity. This study examines the mechanistic role of MPs in the progression of lung fibrosis, focusing on the underlying signaling pathways. Exposure to MPs stimulates the production of reactive oxygen species (ROS), resulting in oxidative stress, organ damage—particularly in the lungs—and the initiation of pro-inflammatory cascades within lung tissues. These responses promote activation of fibrotic signaling pathways, which, in turn, upregulate profibrotic markers. This molecular shift drives epithelial–mesenchymal transition (EMT) and myofibroblast activation, leading to excessive extracellular matrix (ECM) deposition and structural remodeling of lung tissue. The findings underscore the interconnected roles of oxidative stress, inflammatory signaling, and profibrotic pathways in MPs-induced pulmonary toxicity. In summary, the study clarifies how MPs' exposure activates lung fibrosis pathways and suggests that targeting these mechanisms may provide therapeutic strategies to address environmentally induced pulmonary diseases.

Keywords: Microplastic, Ros, ECM, EMT, Lung



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Comparative study of physicochemical parameters of surface water influenced by anthropogenic activities of the Freshwater River

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Abstract

Surface water bodies are increasingly exposed to anthropogenic disturbances that substantially alter their physicochemical characteristics and threaten the health of aquatic ecosystems. This study examines the effects of human activities on surface water quality and evaluates their implications for aquatic biodiversity by conducting a comparative assessment of water samples from the Gomati River in Lucknow and the Triveni Sangam in Prayagraj. A comprehensive analysis of key physicochemical parameters, including pH, dissolved oxygen (DO), turbidity, electrical conductivity (EC), hardness, alkalinity, chloride, chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS), and nutrients such as nitrates and phosphates, was conducted to assess water quality variations resulting from anthropogenic pressures. The results indicated distinct spatial variations between the two sites. The Gomati River displayed moderate pH, low electrical conductivity, and elevated concentrations of chemical oxygen demand, total suspended solids, total dissolved solids, hardness, alkalinity, and chloride, suggesting a higher pollution load. In contrast, the Sangam site exhibited moderate pH, low electrical conductivity, low chemical oxygen demand, high total suspended solids, relatively lower total dissolved solids and hardness, but increased alkalinity and chloride concentrations. These findings demonstrate that anthropogenic activities substantially degrade surface water quality, thereby posing risks to aquatic biodiversity, human health, and ecological sustainability. The study highlights the urgent need for integrated water resource management strategies, such as improved waste disposal systems, advanced wastewater treatment technologies, and stringent environmental regulations, to mitigate pollution and safeguard freshwater ecosystems.

Keywords: Anthropogenic activities, Water quality, Physicochemical parameters, Biodiversity, Environmental pollution



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Evaluating Surface Water Quality through Heavy Metals Assessment: Impacts on Human Health and Sustainable Development

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Abstract

This study investigates the impact of heavy metal contamination on living organisms by comprehensively assessing surface water quality in the Gomati River, particularly in Lucknow. A quantitative analysis of water samples collected from peri-urban, urban, and industrial stretches was conducted to determine spatial variations in toxic heavy metal concentrations and associated physicochemical parameters. The primary objective was to develop an integrated evaluation of surface water quality by examining the prevalence, distribution, and combined effects of heavy metal contamination across different sites (Ghaila pull site, Gau Ghat site, Kudiya Ghat site, and Baikunt Dham site). The results demonstrated significant site-specific variations in water quality. Site 1 exhibited high pH and COD, with the lowest TSS and TDS, and moderate levels of Cu and Fe, while Zn, Cd, and Cr were negligible. Site 2 showed the highest pH, the lowest EC, the highest TSS, and moderate COD, with negligible Cd, very low Cr, low Cu, moderate Fe, and slightly elevated Zn. Site 3 recorded medium pH, high EC, TSS, and TDS, with the lowest COD, and trace levels of Cd and Zn, along with moderate Fe. In contrast, Site 4 displayed the lowest pH but the highest EC, TSS, TDS, and COD, along with the highest Fe concentration, indicating substantial toxicity, with Cd at high levels and Zn, Cr, and Cu at moderate concentrations. The findings highlight considerable spatial heterogeneity in heavy metal distribution, reflecting the influence of anthropogenic inputs. Elevated metal concentrations in surface waters pose persistent risks to aquatic ecosystems and human health, primarily originating from industrial and domestic sources, including sugar processing units, paint and chemical industries, fertilisers, pesticides, cement, and construction activities.

Keywords: Heavy metals, Physicochemical parameters, Surface water quality, Gomati River, Water pollution, Toxicity



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BIOPLASTIC PRODUCTION USING MICROBIAL STRAINS

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Abstract

Growing demand for environmentally friendly alternatives to petroleum-based plastics has led to significant global interest in bioplastics. These biodegradable polymers, produced from renewable biological sources, provide a responsible substitute for conventional plastics. Microbial synthesis stands out among production methods for its efficiency, sustainability, and scalability. Bacteria, fungi, and algae can produce biodegradable polymers such as polyhydroxyalkanoates (PHAs), polyhydroxybutyrate (PHB), and polylactic acid (PLA). These microbial biopolymers have physicochemical properties similar to conventional plastics and are biodegradable. This review identifies current bioplastic production methods, including the types of microorganisms involved, the major bacterial species, the metabolic processes involved in polymer synthesis, and factors that affect product yield, to provide additional information on microbial biopolymer bioplastics. Additionally, current developments in genetic engineering and fermentation techniques are presented, along with industrial uses of microbial bioplastics. The difficulties and potential of using microbial strains to produce green bioplastics on a wide scale are examined.

Keywords: Bioplastic, Polyhydroxyalkanoates, Polyhydroxybutyrate, Polylactic acid, Environment, Sustainability



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Nano-Antibiotics: Assessment of Antimicrobial Activity in Vitro

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Abstract

Antimicrobial resistance (AMR) is a major worldwide health concern that is spreading rapidly, reducing the effectiveness of common medications and increasing the risk of treatment failure in infectious diseases. The rise of drug-resistant microorganisms, including *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa* has highlighted the need for new antimicrobials. With the creation of nano-antibiotics, which use nanoscale materials as either antibacterial agents or antibiotic delivery vehicles, nanotechnology has emerged as a possible alternative in recent years. Nano-antibiotics can target microbial cells and improve the therapeutic efficacy of antimicrobial medicines due to their small size, large surface area, and favourable physicochemical properties. These nano-antibiotic systems—metal and metal oxide nanoparticles, polymer-based nanoparticles, and lipid-based nanocarriers—are presented in this study. Their capacity to damage bacterial membranes, generate reactive oxygen species (ROS), and interact with cellular biomolecules, while preventing bacterial biofilm formation, is the primary explanation for their antimicrobial activity. Additionally, it explains standard in vitro techniques for assessing antimicrobial activity, such as time-kill experiments, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and agar diffusion assays. The benefits of nano-antibiotics—such as enhanced antibacterial activity, drug stability, controlled drug release, and efficacy against bacteria resistant to multiple drugs—as well as their current disadvantages and challenges regarding toxicity, cost, and regulatory approval are also emphasised. To combat the growing problem of antibiotic resistance, research on nano-antibiotics is generally considered a promising avenue for developing next-generation antimicrobial drugs.

Keywords: Bioplastic, Polyhydroxyalkanoates, Polyhydroxybutyrate, Polylactic acid, Environment, Sustainability



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Decoding the Roots of Agony: Unravelling the Mechanisms of Cancer-Related Neuropathic Pain

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Abstract

The phrase “neuropathic pain” refers to discomfort brought on by a malfunctioning nervous system. It can develop due to several reasons, such as poisoning, surgery, radiation, trauma, or certain congenital conditions. In simple terms, it is pain that results from a problem in the somatosensory nervous system. In cancer patients, neuropathic pain is quite common and can be very challenging to deal with. It may occur either due to the cancer itself, especially when tumours affect the nerves, or as a result of treatments like surgery, radiotherapy, and chemotherapy. In many cases, cancer-related pain is not of a single type but a combination of different pains, where neuropathic pain is one of the main components. Cancer treatments such as surgery, radiotherapy, and chemotherapy can sometimes lead to unwanted complications, including pain. Among these, chemotherapy and tumours that directly damage the nervous system are the major causes of neuropathic pain in cancer patients. One of the most commonly seen conditions is chemotherapy-induced neuropathy, where patients may experience pain, changes in sensation like tingling or numbness, and sometimes even difficulty in movement. This type of pain usually lasts for a long time. It may remain constant in some patients, while in others it may come and go. Because of this, it becomes important to identify neuropathic pain separately from other types of cancer-related pain, as it can be harder to manage and often requires a different treatment approach. This paper focuses on how common neuropathic pain is in cancer patients, what causes it, how the nervous system and sensory pathways are involved, and what factors increase the risk. This paper explores prevalence, underlying mechanisms, impact of nervous and sensory pathways, identification of risk factors, and current approaches to the management of cancer-related neuropathic pain.

Keywords: Neuropathic Pain, Cancer, Chemotherapy-induced neuropathy, Radiotherapy, Sensory pathway, Risk factor



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Molecular Docking of Cardiovascular Drugs and Their Energy Comparison

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Abstract

Cytochrome P450 3A4 (CYP3A4) is the main liver enzyme involved in phase-I oxidative metabolism for about half of all prescribed drugs, including many used for heart conditions. When patients take several drugs at once, especially combinations for heart failure and high blood pressure, these drugs can compete for the same CYP3A4 binding site. This competition can change how quickly drugs are cleared from the body, affect their levels in the blood, and increase the risk of drug-drug interactions (DDIs). While CYP3A4’s role in processing cardiovascular drugs is well known, there is still limited computational data on how different types of heart medications bind within its active site. This study set out to measure and compare the interactions of two commonly prescribed heart drugs, Ivabradine (an HCN channel blocker) and Losartan (an AT1 receptor blocker), with CYP3A4. Both drugs were analysed using a combination of Density Functional Theory (DFT) and molecular docking. The structures of the drugs were built from validated data and optimised using quantum chemical methods at the B3LYP/6-311G level with Gaussian 09. Vibrational frequency analysis confirmed that each structure was stable and at a true energy minimum. These optimised structures were then used for molecular docking with AutoDock 4.2, using a Lamarckian genetic algorithm (150 runs and 2,500,000 energy evaluations per run), with the grid box centred on the haem iron of CYP3A4. Docked results were grouped at an RMSD of 2.0 Å or less. The lowest-energy pose from the largest group was chosen for each drug. Inhibition constants (Ki) were calculated from the AutoDock binding free energy using the equation $\Delta G = RT \ln Ki$, with $R = 1.987 \text{ cal}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$ and $T = 298.15 \text{ K}$. The findings showed that Losartan binds more strongly to CYP3A4 than Ivabradine, with a higher binding energy (-3.28 vs -1.57 kcal/mol) and an 18-fold lower Ki, indicating greater affinity. Both drugs showed stable, consistent docking results ($\text{RMSD} \leq 2.0 \text{ \AA}$) and were confirmed to be at true energy minima by DFT (B3LYP/6-311G), with no imaginary frequencies. Losartan had a binding free energy of -3.28 kcal/mol and a calculated inhibition constant (Ki) of 3.96 mM. Ivabradine had a binding free energy of -1.57 kcal/mol and a Ki of 71.25 mM under the same conditions. These Ki values, in the millimolar range, reflect the semi-empirical nature of the AutoDock scoring method and are similar to published estimates from early cytochrome P450 interaction screens. They are not absolute measures of drug potency but are useful for comparing drugs within the same scoring system. The main findings are the 1.71 kcal/mol difference in binding free energy and the 18-fold difference in Ki between the two drugs. Losartan fits better with the CYP3A4 active site than Ivabradine, as shown by its more negative binding free energy and lower Ki in the AutoDock scoring system. Clinically, this suggests Losartan may compete more strongly with CYP3A4 during liver metabolism. This could affect the risk of drug-drug interactions in patients taking both drugs. Overall, these results provide an initial computational view of how different heart drugs interact with CYP3A4 and demonstrate the value of combining DFT and docking methods to study drug metabolism and improve therapy.

Keywords: Molecular Docking; CYP3A4 Enzyme; Ivabradine; Losartan; Density Functional Theory; B3LYP/6-311G; Thermodynamic Binding Affinity



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Molecular Docking of Lung Cancer Drugs and Their Comparative Analysis

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Abstract

Lung cancer is one of the most serious diseases and a major cause of death worldwide. Developing effective and targeted treatments for lung cancer is, therefore, very important. In this project, computational methods were used to study how different anti-cancer drugs interact with specific proteins involved in lung cancer. Three drugs, Ceritinib, Entrectinib, and Repotrectinib, were selected and tested against three important protein targets: ALK, ROS1, and TRKA. The structures of these proteins and drugs were prepared using computational tools, and molecular docking was carried out using AutoDock software to understand how strongly these drugs bind to the proteins. The results showed that Entrectinib has the strongest binding with the ALK protein, indicating better effectiveness. Repotrectinib showed good and consistent binding with all three proteins, suggesting it may act as a multi-target drug. Ceritinib showed comparatively weaker binding interactions. These results help in understanding which drug may work better for targeting lung cancer at the molecular level. Overall, this study demonstrates that molecular docking is a useful and cost-effective method for studying drug-protein interactions and can help in the development of better treatments for lung cancer in the future.

Keywords: Lung Cancer, ALK, ROS1, TRKA, Drug-Protein interaction



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Microplastics-Induced Activation of Liver Fibrosis Pathways: Mitigative Roles of Dietary Supplements

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Abstract

Microplastics have become a serious environmental pollutant that enters various ecosystems and eventually the human body through direct environmental exposure. This infiltration poses a major health risk, especially to the liver, a primary metabolic organ highly sensitive to the harmful effects of microplastics. Oxidative stress, inflammation, and disorders in cellular signalling have been linked to MPs' exposure, which triggers liver fibrosis. The study investigates microplastics' (MPs) liver fibrosis activation mechanisms and dietary supplements' protective effects. Microplastics result in excessive production of reactive oxygen species (ROS), causing oxidative damage to liver cells (hepatocytes). These include the transforming growth factor-beta (TGF- β) and Wnt/ β -catenin signalling. These pathways increase the activation of hepatic cells, which play a key role in building the extracellular matrix (ECM) and advanced fibrosis. Dietary supplements have been considered as potential protective agents against liver damage caused by microplastics. Vitamin C, vitamin E, curcumin, and omega-3 fatty acids are dietary antioxidants that are potent free-radical scavengers and help alleviate inflammation. Their actions can also inhibit fibrosis-related pathways. Studies using animal models demonstrate that microplastics accumulate in liver tissue, causing structural and functional changes. Histopathological investigations show liver cell degeneration, inflammatory cell infiltration, and increased collagen deposition, which are indicators of liver fibrosis. Biochemical analyses show elevated levels of liver enzymes, such as alanine aminotransferase (ALT) and aspartate aminotransferase (AST), which indicate liver cell damage. Additionally, levels of oxidative stress markers, such as malondialdehyde (MDA), are markedly elevated. In contrast, the catalytic activities of antioxidant enzymes such as superoxide dismutase (SOD) and catalase (CAT) are decreased. Oxidative stress is thus confirmed as a major contributing factor to liver damage from microplastics. The use of dietary supplements has proven to protect against such changes. Together, these findings show that microplastics pose a serious health risk, as they can lead to liver fibrosis, primarily through oxidative stress, inflammation, and activation of fibrosis-promoting pathways. Dietary supplements are readily available as a protective measure against the aforementioned negative effects. The study highlights the need to focus on reducing microplastic pollution and minimising human exposure. Overall, dietary strategies and controlling environmental pollution can prevent human liver fibrosis caused by microplastics, yielding greater public health benefits.

Keywords: Microplastic, Oxidative stress, Cellular signalling, Liver fibrosis, Dietary supplements



SAVE THE ENVIRONMENT (STE)

(A SOCIETY FOR RESEARCH, AWARENESS, AND SOCIAL DEVELOPMENT)

KOLKATA, WEST BENGAL, INDIA

CITATION: Saxena, G. (Ed.). (2026). Proceedings of National Conference on Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026): Commemorating Earth Day – “Our Power, Our Planet”. Save the Environment (STE), Kolkata, West Bengal, India. ISBN 123456789654123.



PROCEEDINGS OF National Conference on

ISBN: 978-81-685789-7-5

**FRONTIERS IN ENVIRONMENTAL SUSTAINABILITY, CLIMATE STEWARDSHIP, AND BIOTECHNOLOGY
(FESCBT-2026): COMMEMORATING EARTH DAY – “Our Power, Our Planet” April 22-23, 2026, hybrid mode**

ORGANIZED BY

ICAR-Central Agroforestry Research Institute (CAFRI) Jhansi, Uttar Pradesh, INDIA
Save The Environment (STE) Kolkata, West Bengal, INDIA

ABSTRACT Type: P015
Page No. 68

IN ASSOCIATION WITH

Indian Society of Agroforestry (ISAF) Jhansi, Uttar Pradesh, INDIA
The Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi, INDIA

Integrating Biocontrol and Nanobiotechnology: The Role of *Chaetomium globosum* in Sustainable Agriculture

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Abstract

The increasing global demand for sustainable food production necessitates innovative, eco-friendly solutions that reduce dependency on chemical inputs while enhancing crop productivity and resilience. In this context, fungal biotechnology has emerged as a promising approach, with *Chaetomium globosum* gaining significant attention due to its multifaceted role in agricultural systems. This study explores the biotechnological potential of *Chaetomium globosum* in promoting sustainable agriculture through its applications as a biocontrol agent, plant growth promoter, and nanobiotechnology resource. *Chaetomium globosum* exhibits strong antagonistic activity against a wide range of phytopathogens, particularly *Fusarium* species, through mechanisms such as mycoparasitism, production of antifungal metabolites, and induction of systemic resistance in plants. Additionally, its ability to enhance nutrient uptake and stimulate plant growth contributes to improved crop yield and soil health. Recent advancements highlight its role in green synthesis of metal nanoparticles, including silver and iron nanoparticles, which demonstrate enhanced antimicrobial and plant-protective properties, offering a novel avenue for sustainable disease management. Furthermore, the integration of *Chaetomium globosum*-based technologies into agricultural practices supports reduced chemical pesticide usage, improved environmental safety, and long-term soil fertility. This aligns with global sustainable development goals and the transition toward resilient food systems. The present study underscores the potential of *Chaetomium globosum* as a key bioresource in agricultural biotechnology, paving the way for its large-scale application in sustainable food production systems.

Keywords: *Chaetomium globosum*; Biocontrol; Sustainable agriculture; Green synthesis; Nanoparticles



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IN ASSOCIATION WITH

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The Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi, INDIA

Deciphering Primordial Life: Advanced Analytical Techniques in Precambrian Paleobiology

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Abstract

Primordial life encompasses approximately 80% of Earth's history, representing the era during which the planet transitioned from an anaerobic to an oxygenated environment and became dominated by Wilson Plate tectonics. Research on primordial life provides significant insights into the origin and early evolution of chemical and biological systems on Earth. However, understanding of this concept is limited by the scarcity of early fossil records and the historical lack of advanced analytical techniques. This paper highlights advanced multi-scalar techniques available to contemporary Proterozoic palaeobiologists. These include non-intrusive and non-destructive optical, laser, and X-ray methods, as well as electron beam techniques. Advanced imaging tools such as Scanning Electron Microscopy (SEM) facilitate elemental analysis, while Raman Spectroscopy determines the chemical composition of fossils. Collectively, these methods yield morphological, mineralogical, and biochemical data. An overview of each technique is provided using examples from well-preserved biota. Together, these techniques provide comprehensive results for microfossil analysis and generate highly valuable data for ongoing research. In conclusion, the application of advanced analytical techniques enables scientists to study and analyze the condition of primordial fossils more effectively. These advances contribute to a deeper understanding of primordial biosignatures and refine the criteria for detecting early life on Earth and other terrestrial environments.

Keywords: Premordial life, Early Earth Conditions, Scanning Electron Microscopy (SEM), Raman Spectroscopy, Microfossils.



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IN ASSOCIATION WITH

Indian Society of Agroforestry (ISAF) Jhansi, Uttar Pradesh, INDIA
The Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi, INDIA

Exploring the Origin and Evolution of Life During the Precambrian Era: Evidence from Microfossils and Using Maceration techniques, Microscopic Analysis

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Abstract

The Precambrian era is one of the oldest and longest eras as it is estimated to cover nearly 80% of the history of Earth. In this era, life existed in the form of simple organisms, prokaryotes, mostly microorganisms, like bacteria and archaea. They were thriving despite very difficult environmental conditions. Early Earth had scarce oxygen content and consisted of various gases like methane, ammonia, carbon dioxide, and water vapor. A gradual increase in photosynthesis performed by cyanobacteria and other such organisms led to the Great Oxygenation Event, which modified the atmosphere and led to evolution. In this paper, some of the fossils from the Precambrian era have been investigated using several advanced techniques, including microscopy and other analytical methods. Some of these methods include the maceration technique used to extract organic components from sedimentary rock. Various imaging tools, such as Confocal Laser Scanning Microscopy (CLSM), Field Emission Scanning Electron Microscopy (FESEM), and Energy Dispersive X-ray analysis (EDAX), are used to give more information about these microfossils. In our study, we found that there were microfossils present in stromatolites. By using the combined method of maceration and imaging, we could provide better evidence of life in those times and get knowledge regarding the paleo-environmental conditions and evolutionary processes that occurred during the Precambrian era. A combination of maceration and imaging techniques is useful for gaining information about Earth’s history, evolution, and effects of climatic change. It will also help us understand the modifications in the Earth’s atmosphere and biogeochemical cycles and the adaptations made by simple organisms in that era. Moreover, this type of investigation will aid astrobiologists in studying models for possible existence of life in outer planets.

Keywords: Premordial life, Early Earth Conditions, Scanning Electron Microscopy (SEM), Raman Spectroscopy, Microfossils.



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The Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi, INDIA

Green Synthesis of Arsenic Nanoparticles Using Plant Extracts and Their Biological Applications

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Abstract

Nanotechnology is a rapidly growing field with broad applications in various sectors such as medicine, environmental science, and biotechnology. Different physical and chemical methods are being used to synthesise nanoparticles, but these methods generally involve toxic chemicals, high energy, and end up producing hazardous byproducts, which limit their applications in some areas. Green synthesis of nanoparticles utilising different biological systems has emerged as a cost-effective and eco-friendly alternative to conventional chemical and physical methods. This study reports the use of phytochemicals present in different plant extracts, acting as reducing and stabilising agents for the synthesis of arsenic nanoparticles. The phytochemically synthesised nanoparticles were characterised by different techniques, including X-ray diffraction analysis and scanning electron microscopy, which confirmed the formation, dispersion, and stability of the nanoparticles. The synthesised nanoparticles were found to be polydisperse and crystalline in nature, and the size of the nanoparticles ranged from 10 to 50 nm. The biologically synthesised arsenic nanoparticles were also evaluated for their biological applications. It was observed that the synthesised nanoparticles are highly toxic against various pathogens and also possess good antioxidant activity. The high antimicrobial activity of nanoparticles may be attributed to the smaller particle size, which provides greater surface area for interaction with microbial cell membranes, resulting in greater toxicity. The antioxidant activity may be due to the presence of bioactive phytochemicals adsorbed on the nanoparticle surface, which contribute to the enzyme inhibition and free radical scavenging. The present study is important and may find applicability in the development of quantum dots, gene delivery, novel drug delivery, and other therapeutic products.

Keywords: Nanoparticles, Green synthesis, Toxicity, and Drug delivery



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UNITED NATIONS DECADE ON
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**FRONTIERS IN ENVIRONMENTAL SUSTAINABILITY,
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Commemorating Earth Day – "Our Power, Our Planet,"

22-23 April, 2026

📍 ICAR-CAFRI, JHANSI, U.P.



Organised by



SAVE THE ENVIRONMENT
Gurugram / Kolkata

Technical Partners



Indian Society of Agroforestry
Jhansi, Uttar Pradesh



The Society for Science of Climate Change and
Sustainable Environment (SSCE), New Delhi

Registration Link

<https://docs.google.com/forms/d/e/1FAIpQLSdbSLLWOTHBdUJYCcs2U0DUOcVq8rBNDLLZhQKWLNIrrNiLw/viewform?usp=header>

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ABOUT THE CONFERENCE

The National Conference on Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026), commemorating Earth Day 2026 under the global theme “*Our Power, Our Planet*”, is envisioned as a dynamic platform for scientists, academicians, policymakers, researchers, industry professionals, and environmental advocates to deliberate on sustainable solutions for a cleaner and greener planet. The conference emphasizes the integration of environmental sustainability, climate stewardship, and biotechnological innovations to address pressing global challenges such as climate change, pollution, biodiversity loss, waste treatment and plastic waste management. It aims to foster collaboration and knowledge exchange among experts working at the intersection of environmental science and biotechnology to promote long-term ecological balance and resource conservation.

This scientific gathering will feature keynote lectures, invited talks, oral and poster presentations, and panel discussions focusing on frontier research areas including environmental biotechnology, climate change mitigation, biodiversity conservation, sustainable agriculture, waste management, and plastic biodegradation. Special emphasis will be placed on promoting circular bioeconomy models, regenerative technologies, and the application of biotechnology in environmental restoration. The conference will provide a unique opportunity for participants to explore the latest innovations in green technologies, bioremediation, renewable resources, and ecosystem restoration that contribute to achieving the United Nations Sustainable Development Goals (SDGs).

Commemorating Earth Day, FESCBT-2026 seeks to inspire collective responsibility and awareness for reducing plastic dependency, safeguarding biodiversity, and promoting climate stewardship through science-based initiatives and sustainable practices. It seeks to create a collaborative research environment that strengthens academic-industry partnerships and generates policy recommendations for sustainable development. Through its multidisciplinary approach, the conference aspires to advance India's and the global community's commitment to environmental protection and responsible innovation, envisioning a future where biotechnology becomes a key driver of sustainability and climate resilience. Ultimately, FESCBT-2026: “*Our Power, Our Planet*” aspires to serve as a catalyst for scientific exchange, policy dialogue, and actionable outcomes that contribute to the reduction of plastic dependency, enhancement of environmental quality, and realization of a sustainable future for all.

THEMES OF THE CONFERENCE

ICAR-CAFRI, Jhansi; Save The Environment (STE) Gurugram / Kolkata; the Indian Society of Agroforestry and the Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi invites abstracts/papers that must be directly relevant to the following sub-themes:

Theme 1: Agricultural Biotechnology and Sustainable Food Systems

Subthemes:

- ❖ Climate-resilient crops and smart agricultural technologies
- ❖ Genetic engineering and genome editing (CRISPR/Cas, TALENs) for crop enhancement
- ❖ Development of high-yielding, pest-resistant, and climate-resilient varieties
- ❖ Application of plant tissue culture and micropropagation in crop improvement
- ❖ Beneficial soil microbes (biofertilizers, mycorrhizae, PGPR)
- ❖ Microbial inoculants for nitrogen fixation, phosphorus solubilizers
- ❖ Development of biopesticides, biofungicides, and biocontrol agents
- ❖ RNA interference (RNAi) and transgenic strategies for pest resistance
- ❖ Detection and control of emerging plant pathogens through molecular diagnostics
- ❖ Biotechnological approaches to enhance tolerance against drought, salinity, and temperature stress
- ❖ Climate-smart crops for sustainable agriculture under changing environments
- ❖ Biofortification of crops with essential micronutrients
- ❖ Functional foods, probiotics, and nutraceutical development through biotechnology.
- ❖ Biotechnological tools for post-harvest loss reduction and storage improvement





- ❖ Biosensors for detecting foodborne pathogens and contaminants
- ❖ Edible coatings and biodegradable packaging innovations
- ❖ Artificial intelligence in sustainable agriculture
- ❖ Digital Farming for a Climate-Resilient Future

Theme 2: Biodiversity Conservation and Ecosystem Restoration

Subthemes:

- ❖ Monitoring and mapping of terrestrial, aquatic, and marine biodiversity
- ❖ Impact of land-use change, pollution, and invasive species on native biodiversity
- ❖ Use of DNA barcoding, genomics, and metagenomics in species identification
- ❖ Genetic diversity assessment and population structure analysis for endangered species
- ❖ Application of biotechnology in ex situ and in situ conservation
- ❖ Cryopreservation, tissue culture, and cloning for rare and threatened species preservation
- ❖ Nature-based solutions (NbS) and ecological engineering for habitat restoration
- ❖ Ecotourism and livelihood-linked conservation models
- ❖ Impacts of microplastic pollution, eutrophication, and ocean acidification on aquatic life
- ❖ Impacts of global warming on ecosystems and species distribution
- ❖ Adaptation and mitigation strategies for biodiversity under climate stress
- ❖ Biotechnological tools for detection and management of invasives
- ❖ Implementation of international conventions (CBD, CITES, Ramsar, Paris Agreement)
- ❖ National biodiversity strategies, action plans, and legal frameworks
- ❖ Role of biodiversity assessments in Environmental Impact Assessments (EIA)
- ❖ Sustainable financing mechanisms and biodiversity offsets
- ❖ Emerging tools: drones, AI, and GIS for biodiversity monitoring
- ❖ Role of biotechnology and synthetic biology in ecosystem recovery

Theme 3: Education, Awareness, and Policy for Sustainable Future

Subthemes:

- ❖ Environmental education and citizen science initiatives
- ❖ Science communication and behavioural change for sustainability
- ❖ Role of youth and women in environmental stewardship
- ❖ Policy interventions, governance, and sustainable urban development
- ❖ Academia–industry–government collaborations for green innovation

Theme 4: Emerging Biotechnologies for Environmental and Health Sustainability

Subthemes:

- ❖ Environmental DNA (eDNA) and metagenomics for ecosystem surveillance
- ❖ Microbiome analysis for soil, water, and air quality assessment
- ❖ Functional genomics in pollutant degradation and bioremediation
- ❖ Bioinformatics tools and data analytics for ecological risk assessment
- ❖ Design and engineering of microbial chassis for pollution control and bioenergy
- ❖ Synthetic biosystems for CO₂ fixation, waste valorization, and nutrient recycling
- ❖ Development of cell-free biosensors and bio-circuits for environmental detection
- ❖ Green synthesis of nanoparticles using biological systems
- ❖ Nanobiomaterials for water purification, pollutant removal, and antimicrobial activity
- ❖ Targeted drug delivery and diagnostic applications of nanobiotechnology
- ❖ Toxicological assessment and safe use of nanomaterials in the environment
- ❖ CRISPR-based solutions for enhancing stress tolerance and disease resistance in crops
- ❖ Gene editing for bioremediation and waste degradation applications
- ❖ Therapeutic gene editing in combating emerging infectious diseases
- ❖ Microbial and enzymatic biosensors for detecting environmental contaminants
- ❖ Lab-on-a-chip and portable diagnostic devices for field applications





- ❖ Point-of-care technologies for pathogen detection and water testing
- ❖ Integration of AI and IoT in biosensing and environmental diagnostics
- ❖ Production of vaccines, therapeutic proteins, and antibodies through biotechnological routes
- ❖ Algal and plant-based expression systems for pharmaceuticals (“molecular farming”)
- ❖ Role of bioengineering in carbon capture and climate mitigation
- ❖ Microbial and enzymatic processes for greenhouse gas reduction
- ❖ Ecosystem restoration using genetically enhanced microorganisms and plants
- ❖ AI-driven modeling of biological systems for sustainability applications

Theme 5: Environmental Biotechnology and Pollution Management

Subthemes:

- ❖ Biotechnological solutions for pollution control and wastewater treatment
- ❖ Microbial degradation and bioconversion of plastics and pollutants
- ❖ Advances in bioremediation and bioaugmentation technologies
- ❖ Bioengineering approaches for restoring contaminated ecosystems
- ❖ Sustainable industrial biotechnology and bio-based materials
- ❖ Wastewater Treatment and Resource Recovery
- ❖ Solid Waste Management and Bioconversion Technologies
- ❖ Environmental Genomics, Metagenomics, and Bioinformatics
- ❖ Biosensors and Bioindicators for Environmental Monitoring
- ❖ Bioenergy, Biodiesel, Biofuel, and Sustainable Environmental Technologies

Theme 6: Environmental Sustainability and Climate Change Mitigation

Subthemes:

- ❖ Carbon capture, utilization, and storage (CCUS)
- ❖ Environmental policy, planning, and sustainable development
- ❖ Impact of climate change on biodiversity, agriculture, and ecosystems
- ❖ Renewable and clean energy technologies for sustainable development
- ❖ Greenhouse gas reduction, carbon sequestration, and energy-efficient systems
- ❖ Artificial intelligence and IoT for environmental monitoring
- ❖ Sustainable cities, green buildings, and transport systems
- ❖ Nature-based solutions for climate resilience

Theme 7: Plastic Pollution, Bioplastics, and Circular Bio-economy

Subthemes:

- ❖ Environmental and health impacts of plastic contamination in soil, air, and water
- ❖ Monitoring, assessment and mapping of plastic

Theme 8: Water, Soil, and Waste Management

Subthemes:

- ❖ Physicochemical and biological treatment of industrial and municipal wastewater
- ❖ Bioreactors, membrane technologies, and advanced oxidation processes (AOPs)
- ❖ Phytoremediation and constructed wetlands for pollutant removal
- ❖ Water reuse for agriculture and industrial applications
- ❖ Circular economy approaches in water and waste management
- ❖ Safe management of sludge and biosolids
- ❖ Role of biochar and organic amendments in soil detoxification
- ❖ Monitoring soil contamination using molecular and remote-sensing tools
- ❖ Soil microbial diversity and its role in nutrient cycling
- ❖ Integrated nutrient management and organic farming practices
- ❖ Waste-to-energy technologies (biogas, pyrolysis, gasification)
- ❖ Biodegradation and recycling of plastic waste (“Planet vs. Plastics”)





- ❖ Management of e-waste, biomedical, and chemical waste
- ❖ Biotechnological valorization of agri-waste into high-value compounds

Special Session: “Our Power, Our Planet” (Earth Day 2026 Theme)

- Renewable Energy for a Sustainable Future.
- Climate Action and Carbon Neutrality.
- Biodiversity Conservation and Ecosystem Restoration.
- Circular Economy and Sustainable Resource Management
- Community Empowerment and Environmental Stewardship

About Organizers

ICAR-CENTRAL AGROFORESTRY RESEARCH INSTITUTE

ICAR-Central Agroforestry Research Institute (ICAR-CAFRI), formerly the National Research Centre for Agroforestry, is a multidisciplinary premier research institute of the Indian Council of Agricultural Research (ICAR) with a major focus on integrating trees, crops and livestock on the same farmland. With vision to improve quality of life of rural people through integration of perennials on agriculture landscape for economic, environmental and social benefits. This is the only dedicated research institute of the country working on key research areas of agroforestry. CAFRI has developed robust agroforestry models and package of practices for different agroclimatic conditions covering small and marginal farmers and provides technical backstopping to the States and stakeholders.

For details, please visit: <https://cafri.res.in>

SAVE THE ENVIRONMENT (STE)

Save the Environment (STE) is a prominent non-governmental organization (NGO) headquartered in Kolkata, with an active presence in Gurugram and other parts of India. Save The Environment (STE) was founded and registered on 19th November 1990 [Reg no. S/66/489 of 1990-91]. Since then, STE has been privileged to collaborate with organizations and departments of repute, like WWF (India), AIIHPH, Indo-Canada environment facility, DST and DRDO to counter the long-standing issue of arsenic poisoning of water, especially in rural areas of West Bengal, India. Established with the mission of promoting environmental awareness, conservation, and sustainable development, STE works tirelessly to protect natural ecosystems and advocate for responsible environmental stewardship. STE engages in a wide range of activities, including environmental education, research, policy advocacy, and community outreach. Its initiatives cover critical areas such as waste management, water and air pollution control, renewable energy promotion, biodiversity conservation, and plastic reduction campaigns. The organization also conducts seminars, workshops, conferences, and awareness programs to sensitize students, researchers, and the public about pressing environmental challenges and possible solutions. . The NGO also recognizes and supports individuals and organizations contributing to environmental protection through awards and fellowships.

For details, please visit: <https://www.stenvironment.org/>

INDIAN SOCIETY OF AGROFORESTRY (ISAF)

The Indian Society of Agroforestry (ISAF) is a non-for-profit society that dwells on information generation, dissemination and promotion of agroforestry and allied sectors for the cause of enhancing the socio-economic and environmental benefits to the farmers and stakeholders. The Society was founded during the Golden Jubilee Year celebrations of India's Independence in July 1998 with the following objectives:

- To encourage basic, applied and strategic research in the field of agroforestry.
- To disseminate knowledge and technology related to agroforestry.
- To organize & provide facilities for seminars and conferences for agroforestry, scientists, environmentalists, research and development workers and farmers.
- To encourage close cooperation among organizations having interest in the field of agroforestry.

For details please visit: <https://indiansocietyofagroforestry.wordpress.com>





THE SOCIETY FOR SCIENCE OF CLIMATE CHANGE AND SUSTAINABLE ENVIRONMENT (SSCE)

The Society for Science of Climate Change and Sustainable Environment (SSCE) has been formed to lead the awareness drive on various impacts of climate change. Society is planning to initiate awareness drive by writing various articles related to climate change, initiating a review journal, organizing seminars and conferences and highlighting the options of various stakeholders such as farmers, scientists, policymakers, teachers, students and government officers. This awareness drive will help in understanding the causes and consequences of global climate change and their impact on agriculture crop productivity and food security.

For details, please visit: <https://ssceonline.wordpress.com>



STE AWARDS - 2026

LAST DATE 25th March 2026

Save The Environment Awards–2026 are a tangible symbol of the eminence and excellence of contributions made by individuals and institutions. These awards inspire and encourage contributors who have demonstrated outstanding dedication in diverse fields of science and social service, through their expertise, commitment, and purposeful approach toward achieving meaningful societal goals. Recognizing such extraordinary efforts is essential to boost confidence, foster continued excellence, and honour remarkable service rendered to science and society. Save The Environment (STE) confers the following categories of awards and honours upon such eminent personalities:

- 1. STE Dr. APJ Abdul Kalam Award**
This award is conferred every year to the senior scientist of DRDO/ ISRO (working or retired) who has significantly contributed towards science and technology in India. Nominations will be from STE.
- 2. STE Dr. Praloy O. Basu Lifetime Achievement Award**
This award is conferred every year to any citizen of India, who has made a difference to the society by his/her contributions in terms of education/ policies/ S & T/ Social Service and others. Nominations will be from STE.
- 3. STE Green Excellence Award**
This award is constituted to honor those professionals who have excelled in safeguarding and protecting the environment.
- 4. STE Fellowship Awards**
STE Fellowship award is conferred to the Indian senior scientists /Academics for their outstanding achievements in various fields of Science & Technology and Education.





5. **STE Women Excellence Award**
This award is constituted to recognize the Indian women scientists/ Academicians for their contributions in the field of science and environment.
6. **STE Water Awards**
The awards are conferred to the Indian nationals who have made a difference in the area of water by their efforts.
7. **STE Best Innovation for Environment Award**
8. **STE Best School Principal Award**
9. **STE Best Teacher Award**
10. **STE International Achiever Awards**
11. **STE Meritorious Award for Excellence in Academics and Research**
12. **STE Young Researcher Awards (Age limit: Faculty/ researchers between 25 to 40 years can apply.)**
13. **STE Humanitarian Award for NGO**
14. **STE Green Campus Award**
15. **STE Student Award**

A. School Level

B. College Level

Eligibility Criterion: Only individuals who hold active membership with Save The Environment (STE) are eligible to apply for the award and applicants must be registered members of Save The Environment (STE) prior to submitting an application for the award.

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CALL FOR ABSTRACT

Abstracts and original papers are invited on the conference themes and subthemes for poster and oral presentations. The soft copy of the abstract in MS Word format (Times New Roman, font size 12, spacing 1.5) must include a suitable title, a list of authors, affiliations, the name of the presenting author that should be underlined, and contact details of the presenting author, including email. The abstract should not exceed 300 words including 5-6 keywords with a major emphasis on the background of the problem, methodology, results, and discussion, and should be submitted to the organizer.....by **31st March, 2026**. The abstracts will be published in the 'Souvenir and Abstract Book' and released in the inaugural session of the conference. The participants may present their papers at the Conference by oral/poster whereas UG and PG students of basic sciences are encouraged to demonstrate their innovative ideas through flow charts or models.

ORAL AND POSTER PRESENTATION

Papers are invited for oral and poster presentations. Each oral presentation will be given ten minutes, with a maximum of fifteen slides that must contain the following elements: an introduction, materials and methods, results, and conclusion. It is recommended that the oral presentation be converted to PDF format before the presentation/submission. The poster should be related to the topic and sub-themes of the Conference. The poster should be 3x4 feet in portrait style and must contain the following elements: a title, name, theme, and affiliation at the top, and the introduction, materials and methods, results, and conclusion as the major portion. The poster should be clearly visible from a distance of 1 meter.

CONFERENCE AWARD

The Organizing Committee of FESCBT-2026 will confer the following awards during the conference:

1. FESB-2026 Best Oral Presentation Award
2. FESB-2026 Best Poster Presentation Award
3. FESB-2026 Related to Topic (Sustainable Environment)
4. FESB-2026 Best Innovation Award (UG/PG students only for Innovative Ideas or Models)

IMPORTANT DATES

Conference Dates	22-23 April, 2026
Registration and Abstract Submission Starts	15.02.2026
Last Date of Registration without late payment	31.03.2026





Last Date of Registration with late fees

12.04.2026

Abstract submission Deadline

31.03.2026

The above dates are mandatory and strictly followed by Organizing and Publication Committee.

REGISTRATION

Particulars

Particulars	Fee	Late Fee
Faculties/ Delegates/Scientists/Academicians Scientists	Rs. 3000.00	Rs. 3500.00
Research Scholars/ Junior Resident/ Senior Resident	Rs. 2000.00	Rs. 2500.00
Students (Graduate/PG)	Rs. 1500.00	Rs. 2000.00
Online Participants	Rs. 1000.00	Rs. 1500.00
Corporate / Industry Delegates	Rs. 5000.00	Rs. 5500.00

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ACCOMMODATION

The accommodation will be arranged on payment basis if requested by the delegates / participants to the organisers.

About Jhansi

Jhansi, a historic city in Indian state of Uttar Pradesh lies in the Bundelkhand region and is known as the karmbhumi of Rani Laxmi Bai. The city is well connected to Delhi, Mumbai, Chennai, Hyderabad, Lucknow, Bangalore and other major cities of India by rail and road network. The nearest Airports are at Khajuraho, New Delhi, Agra, Gwalior, Lucknow and Bhopal. Jhansi Fort, Orchha temple and Fort, Orchha Wildlife Sanctuary, Sukma Dukma Dam, Gwalior Fort, Khajuraho, Panna National Park and other attractions can be approached by road in short time. Jhansi is also a hub of education and learning, housing prestigious universities and research institutions that draw students from across India. Jhansi City has good number of budget hotels that could be booked online. Guest houses at ICAR-CAFRI, ICAR-IGFRI, RLBCAU and Bundelkhand University may also be availed by the delegates on first come first serve basis.





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Conference Report

The National Conference on Frontiers in Environmental Sustainability, Climate Stewardship, and Biotechnology (FESCBT-2026) was successfully organized on 22nd-23rd April 2026 at ICAR-Central Agroforestry Research Institute (CAFRI), Jhansi, Uttar Pradesh, to commemorate Earth Day 2026 under the global theme “Our Power Our Planet.” The conference was jointly organized by ICAR-CAFRI, Save The Environment (STE), Indian Society of Agroforestry (ISAF), and the Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi. The event was conducted under the leadership of



Dr. A. Arunachalam, Patron of the conference. Dr. K. Rajarajan, Senior Scientist, ICAR-CAFRI, Jhansi, and Dr. Gaurav Sharma, Assistant Professor (Mandsaur University, MP) as Organizing Secretary, and Dr. Sukumar Taria, Scientist, ICAR-CAFRI, Jhansi, as Co-Organizing Secretary, with active support from Dr. Kshipra Misra, The President, STE and



Mr. Gian Chand Kashyap (STE), along with The Society for Science of Climate Change and Sustainable Environment (SSCE), New Delhi and other collaborating institutions. The conference witnessed the active participation of more than 70 delegates from across the country, including scientists, academicians, faculty members, researchers, and students, who

actively engaged in discussions and shared their valuable insights throughout the sessions.

The conference commenced on 22nd April 2026 with a traditional and eco-conscious inaugural session, beginning with the symbolic plantation of a sapling in a pot, reflecting a collective commitment towards environmental conservation. This was followed by the warm welcome of dignitaries with bouquets and ceremonial gestures, and the lighting of the



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ceremonial lamp, marking the formal inauguration of the conference. The Organizing Secretary, Dr. K. Rajarajan, delivered the welcome address and presented an overview of the conference, highlighting its objectives, interdisciplinary themes, and relevance to global environmental challenges. Dr. A. Arunachalam, Director, ICAR-CAFRI, Jhansi, in his inaugural remarks emphasized the role of agroforestry and science-driven approaches in addressing climate change, biodiversity loss, and sustainable development. He highlighted the importance of interdisciplinary collaboration



and practical solutions for building climate-resilient and sustainable ecosystems. A brief introduction to Save The Environment (STE) was delivered by Dr. S. K. Singh, emphasizing the importance of environmental awareness and community engagement. The Abstract Book



of the conference was formally released by the dignitaries. The inaugural session was graced by eminent personalities, including Dr. Neloy Khare, Advisor, Ministry of Earth Sciences, Government of India, and Dr. A. K. Singh, Vice Chancellor, RLBCAU, Jhansi, who served as the Chief Guest. During this session, a Life-Time

Achievement Award was conferred upon Dr. A. K. Singh in recognition of his significant contributions to agricultural education and research. The session also included the STE Award Ceremony (Prerna Samman 2026), recognizing contributions in environmental sustainability. At the end of the inaugural session on 22nd April 2026, an Earth Day pledge was administered

to all participants, reaffirming their commitment to environmental protection and sustainable living. The pledge emphasized responsible resource use, reduction of plastic pollution, and collective action towards safeguarding the planet. This moment reinforced the conference theme “Our Power Our Planet” and encouraged



participants to translate knowledge into meaningful environmental Following the inaugural session on 22nd April 2026, the conference progressed into keynote and technical sessions. The keynote address by Dr. Neloy Khare provided valuable insights



into global environmental challenges and emerging opportunities, including the concept of the Blue Economy and climate-responsive strategies. The first technical session featured invited talks by eminent experts covering diverse topics such as Blue Economy, biodigester technology for the waste management, acoustic emission techniques for geohazard monitoring, sustainable urban development, and innovative water treatment systems. These discussions emphasized interdisciplinary approaches and practical solutions aligned with sustainability



goals. The second technical session, held on the afternoon of 22nd April 2026, was chaired by Dr. A. K. Handa and coordinated by Dr. Sukumar Taria and focused on advanced research areas such as microplastics and AI-based environmental monitoring, CRISPR-Cas9 mediated



crop improvement, waterlogging tolerance in cowpea, and functional genomics in soybean. The session was highly interactive, with participants actively engaging in discussions, asking questions, and sharing their perspectives.

A poster session was also organized on the same day, providing a platform for young researchers and students to present their innovative research and interact with experts.

On 23rd April 2026, the second day of the conference, the technical sessions continued with equal enthusiasm and engagement. The third technical session, chaired by Dr. Ajay Kumar Gupta, included presentations on crop improvement, climate change impacts on



fisheries, soil carbon stabilization, silage technology, and integrated farming systems. The fourth technical session, chaired by Dr. R. P. Dwivedi, covered advanced topics such as carbon sequestration, multi-omics approaches in agroforestry species, stress genetics in crops, climate mitigation potential of tree species, agroforestry systems, and nature-based solutions such as fruit forests. These sessions highlighted cutting-edge research and practical



approaches for addressing climate change and environmental sustainability. Throughout the conference, participants actively contributed to discussions, exchanged ideas, and explored practical solutions, making the sessions highly engaging and impactful.

The conference also recognized excellence through various awards, including STE Awards (Prerna Samman 2026), Best Oral Presentation Awards, and Best Poster Presentation Awards, encouraging young researchers and acknowledging outstanding scientific contributions.



The valedictory session held on 23rd April 2026 marked the successful conclusion of the conference and began with a symbolic tree planting ceremony, reinforcing the commitment towards environmental sustainability. The conference report was presented by the Organizing



Secretary, summarizing the key highlights and outcomes. Dr. A. Arunachalam, Director, ICAR-CAFRI, delivered his remarks, appreciating the quality of scientific discussions and the efforts of the organizing team. The session included the STE Awards and conference recognitions. The Guest of Honour, Dr. Rana Pratap Singh, President, SSCE, delivered an inspiring address emphasizing the need to translate scientific knowledge

into actionable strategies. The Chief Guest, Prof. Mukesh Pandey, Vice Chancellor, Bundelkhand University, Jhansi, delivered the valedictory address and was honoured with a Lifetime Achievement Award by the STE Society in recognition of his contributions to higher education and research. The session concluded with the felicitation of dignitaries and a formal Vote of Thanks, marking the successful completion of the conference.



Overall, FESCBT-2026, held on 22nd–23rd April 2026, successfully achieved its objectives by bringing together experts from diverse disciplines to address critical environmental challenges. The conference served as a dynamic platform for knowledge exchange, collaboration, and innovation, and contributed significantly to promoting sustainable, science-driven solutions.



The insights generated and collaborations initiated during the conference are expected to play a vital role in building a sustainable and resilient future.



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(FESCBT-2026): COMMEMORATING EARTH DAY –
“Our Power, Our Planet”

April 22-23, 2026, hybrid mode

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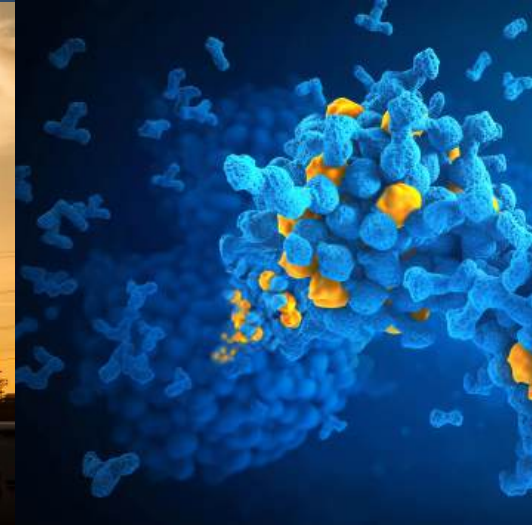
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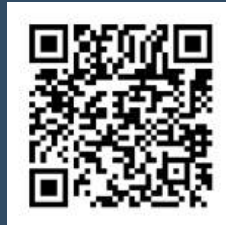
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