Two-Day National Seminar on

"Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change"

Organized by:
Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302

Sponsored by:
Department of Science & Technology and Biotechnology (DSTBT), Govt. of West Bengal

Venue: Sarat Centenary College, Dhaniakhali

Date: **22-23rd April, 2022**

Book of Abstracts

WBDSTBT Sponsored Two-Day National Seminar

Organised by Sarat Centenary College

On

Biodiversity Conservation & Sustainable Development-

with a sense of urgency to combat desertification and climate change

22 & 23 April, 2022

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Chairman: Dr. Sandip Kumar Basak, Principal

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on 22 April 2022

Foreword

Dear My Friends,

The Sixth Assessment Report of the **Intergovernmental Panel on Climate Change (IPCC, 2022)** recognizes the interdependence of climate, ecosystems and biodiversity, and human societies and integrates knowledge more strongly across the natural, ecological, social and economic sciences, rather than earlier IPCC assessments. The assessment of climate change impacts and risks as well as adaptation is centred on non-climatic global trends like biodiversity loss, overall unsustainable consumption of natural resources, land and ecosystem degradation, rapid urbanisation, human demographic shifts, social and economic inequalities and a pandemic. Human society causes climate change. Climate change, through hazards, exposure and vulnerability generates impacts and risks that can surpass limits to adaptation and result in losses and damages. Human society can adapt to, maladapt and mitigate climate change, while ecosystems can adapt and mitigate within limits. Ecosystems and their biodiversity provision livelihoods and ecosystem services. Negative impacts of climate change are observed worldwide on all ecosystems, terrestrial, fresh-water and oceanic, causing shifts in species range and their phenology. Human society impacts ecosystems and also have the potential to restore and conserve them. Climate resilient approaches like biodiversity conservation thereby can support human, ecosystem and planetary health, as well as human well-being. Protecting and restoring ecosystems, and managing land sustainably, has the potential to reduce annual net greenhouse gas emissions by more than 7 giga tonnes by 2030. It will also support adaptation, reduce climate vulnerability, promote biodiversity, and enhance livelihoods. To achieve all this, at recently held **COP26 meeting in Glasgow (in 2021)**, there was a marked commitment to protect precious natural habitats, with 91% of the world's forests covered by a pledge from 137 countries to end deforestation by 2030 while 28 countries launched a roadmap to protect forests through a global shift to sustainable development and trade of agricultural commodities.

Biological diversity – or biodiversity – is the term given to the variety of life on Earth and the natural patterns it forms. The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. This diversity is often understood in terms of the wide variety of plants, animals and microorganisms. So far, about 1.75 million species have been identified; Scientists estimate that there are actually about 13 million species, though estimates range from 3 to 100 million.

Genetic differences within each species –Chromosomes, genes, and DNA – the building blocks of life – determine the uniqueness of each individual and each species, thus creating genetic diversity. The variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes are integral components of ecosystem diversity.

Since the industrial revolution, human activities have increasingly destroyed and degraded forests, grasslands, wetlands and other important ecosystems, threatening human well-being. Seventy-five per cent of the Earth's ice-free land surface has already been significantly altered, most of the oceans are polluted, and more than 85% of the area of wetlands has been lost. This destruction of ecosystems has led to 1 million species (500,000 animals and plants and 500,000 insects) being threatened with extinction over the coming decades to centuries, although many of these extinctions are preventable if we conserve and restore nature. **The major five threats to biodiversity are: 1) Changes in land and sea use, including habitat loss and degradation, 2) Species overexploitation due to extreme hunting and fishing pressure 3) Invasive species and disease 4) pollution and 5) climate change** associated with global warming according to WWF (2020) *Living Planet Report 2020 - Bending the curve of biodiversity loss*.

Signed by 150 government leaders at the 1992 Rio Earth Summit, the **Convention on Biological Diversity (CBD)** is dedicated to promoting sustainable development. The Convention realized that biological diversity is about more than plants, animals and

microorganisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. The Convention establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources.

The Convention's ultimate authority is the **Conference of the Parties (COP),** consisting of all governments (and regional economic integration organizations) that have ratified the treaty. Most of the world's biodiversity is found in developing countries, which consider it a resource for fueling their economic and social development. The Convention also recognizes the close and traditional dependence of indigenous and local communities on biological resources and the need to ensure that these communities share in the benefits arising from the use of their traditional knowledge and practices relating to the conservation and sustainable use of biodiversity. Member governments have undertaken "to respect, preserve and maintain" such knowledge and practices, to promote their wider application with the approval and involvement of the communities concerned, and to encourage the equitable sharing of the benefits derived from their utilization.

We have recently completed the **United Nations Decade on Biodiversity (2011-2020).** Twenty **Aichi Biodiversity Targets** were aimed during this past decade as a strategic framework to save and conserve worldwide biodiversity crisis. Now, Working Group of **CBD** is working on the **Post-2020 Global Biodiversity Framework** preparation at its **Conference of the Parties' fifteenth meeting (COP15, held during 2021-2022)** to consider the draft post-2020 global biodiversity framework with a view to its finalization and adoption. They have short listed the following goals at present:

1. The integrity of all ecosystems is enhanced, with an increase of at least 15 per cent in the area, connectivity and integrity of natural ecosystems, supporting healthy and resilient populations of all species, the rate of extinctions has been reduced at least tenfold, and the risk of species extinctions across all taxonomic and functional groups, is halved, and genetic diversity of wild and domesticated species is safeguarded, with at least 90 per cent of genetic diversity within all species maintained.
2. Nature's contributions to people are valued, maintained or enhanced through conservation and sustainable use supporting the global development agenda for the benefit of all.
3. The benefits from the utilization of genetic resources are shared fairly and equitably, with a substantial increase in both monetary and non-monetary benefits shared, including for the conservation and sustainable use of biodiversity.
4. The gap between available financial and other means of implementation, and those necessary to achieve the 2050 Vision, is closed.

Under this global backdrop, I expect that this Two-Day National Seminar on "Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change" with its broad sub-themes like Biodiversity, Conservation Biology, Sustainable Development Goals, Geomorphology, Changes in land use, Topography, River systems, Environmental Sciences, Environmental ecology, Environmental Impact Assessment, Climate Change, Landscape degradation, Environmental Pollution, Bioremediation, Environmental Microbiology, Wetland Biology, Environmental Biotechnology, Ecological Restoration and any allied field would obviously enrich all of us participating in this event.

My hearty welcome to all of you. Please join our hands to save our planet.

Dr. Sandip Kumar Basak
Principal, Sarat Centenary College & Convenor, Seminar Organizing Committee

(Based on extracts from IPCC (2022) assessment report, COP 26 (2021) reports, CBD website and COP 15, 2021-22 draft reports)

Two Day National Seminar on Biodiversity Conservation and Sustainable Development---with a sense of urgency to combat desertification and climate change

Organised by

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Department of Science & Technology and Biotechnology (DSTBT), Govt. of West Bengal

Venue – Sarat Centenary College, Dhaniakhali, Hooghly

Date – 22nd April & 23rd April,2022

PROGRAMME SCHEDULE

22nd April (Day-1)

Registration Desk Opens at 10.00 am and closes at 12.00 noon
INAUGURAL SESSION (10.30 A.M. to 11 A.M.)
Inaugural Song
Greeting the Guests
Watering the Plant
Welcome Address by the Principal
Chief Guest's Speech
Inaugural Address by Amiya Kumar Kalidaha, WBDSTBT
TECHNICAL SESSION (12NOON to 2 P.M.)
Keynote Address by Punyasloke Bhadury IISER(KOLKATA)
Invited lecture by Milan Kanti Mandal, Directorate of Forests, Govt. of WB
LUNCH BREAK (2 P.M. to 2.30 P.M.)
PRESENTATION SESSION-1 & 2 (2.30 P.M. to 4.30 P.M.)
Oral Presentation by participants

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22-23rd April, 2022

Date: 22.04.2022 **Presentation Session: 1** Time: 02.30 pm

Venue: A P J Kalam Auditorium

Chairman/ Chairperson: Dr Punyasloke Bhadury

Session Coordinator: Dr Bidyut Santra

Sl. No.	Paper Presenter	Tittle of the Paper
1.	Chayan Kumar Giri, Krishna Ray and Sandip Kumar Basak	Study of rare and near threatened species in Indian Sundarbans and their restoration
2.	SubhajitSaha, Ipsita Das, Anindita Banerjee, Krishna Ray and Sandip Kumar Basak	A comparative account of Reproductive biology of mangroves in different habitat conditions indicating cross-pollination as preferred mode of reproductive success in Indian Sundarbans
3.	Hemendra Nath Kotal, Sandip Kumar Basak and Krishna Ray	Study of photosynthesis and photosynthates as osmotic stress warriors in mangroves of Indian Sundarbans
4.	Biswajit Biswas, Sumana Mondal, Chayan Kumar Giri, Mahasweta Mitra Ghosh, Sandip Kumar Basak and Krishna Ray	Diversity of root endophytic bacteria of mangroves, plant growth promotion at lab and at rice fields of Indian Sundarbans
5.	Sumana Mondal, Chayan Kumar Giri, Sandip Kumar Basak and Krishna Ray	Bacterial diversity in native halophytic grass rhizospheres in Indian Sundarbans-Culture independent and Culture dependent scenario
6.	Anup Mandal, Sandip Kumar Basakand Krishna Ray	Ecological aspects of Planctomycetes and Actinobacteria in mangrove forest ecosystem in Indian Sundarbans.
7.	Ipsita Das, Subhajit Sahaand Krishna Ray	'Phenylpropanoid' pathway as a biomarker for screening Sigatoka Leaf Spot disease-resistant *Musa*germplasms
8.	Rudranil Sengupta, Sandip Kumar Basak and Krishna Ray	Revisiting the molecular cross-talk between denitrification and phosphate uptake by PAO bacteria for efficient phosphate bioremediation

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22-23rd April, 2022

Date: 22.04.2022 **Presentation Session: 2** Time: 02.30 pm

Venue: Smart Classroom

Chairman/ Chairperson: Dr Krishna Ray

Session Coordinator: Dr Sanjay Mondal

Sl. No.	Paper Presenter	Tittle of the Paper
1.	Sinjini Mondal and Saurav Moktan	Characterization and Taxonomic implication of spores in Fern and fern-allies from West Bengal
2.	Poulomi Biswas and Sweta Chakraborty	Plant's biodiversity, miraculous co-operation network and impact on ecosystem-A Review
3.	Dr. Moumita Basu	Pollination biology in the perspective of Biodiversity Conservation
4.	Debasruti Boral and Saurav Moktan	Modeling a high-value medicinal plant *Aconitum lethale*Griff. (Ranunculaceae) in Darjeeling Himalaya
5.	Sonai Mishra and Payel Basu	Pollination, plant diversity and role of salinity in pollinationsuccess: A Review
6.	Bhanumati Sarkar	Ethno-botanical study of COPD medicinal plants used by the people of Indian Sundarban with special references to phytochemical and pharmacological understanding
7.	Preshina Rai	Diversity and Species composition of Vascular epiphytes in Temperate zone of Darjeeling Himalaya, India
8.	Dr. Chandan Kumar Jana	*Casuarina equisetifolia L.* : A soil binder plants at Digha coastal region in West Bengal.

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PROGRAMME SCHEDULE

23rdApril (Day-2)

PRESENTATION SESSION-3 (10.00 A.M. to 11.00A.M.)
TECHNICAL SESSION (11.00 A.M. to 2 P.M.)
Invited lecture by Abhaya Prasad Das, Rajiv Gandhi University
Invited lecture by Anirban Roy, West Bengal Biodiversity Board
Invited lecture by Biplab Biswas, Dept. of Geography, The university of Burdwan
LUNCH BREAK (1.30 P.M. to 2 P.M.)
PRESENTATION SESSION-4 & 5 (2 P.M. to 4 P.M.)
Oral Presentation by participants
VALIDICTORY SESSION (4 P.M. to 4.30 P.M.)
Vote of Thanks & Certificate Distribution

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22-23rd April, 2022

Date: 23.04.2022 **Presentation Session: 3** Time: 10.00 am

Venue: Smart Classroom

Chairman/ Chairperson: Dr Ujjal Kumar Mukherjee

Session Coordinator: Dr Sanjay Mondal

Sl. No.	Paper Presenter	Tittle of the Paper
1.	Dr Rajkumar Kundu	Nature and Problems of Farmar Suicides in India Since Liberalization
2.	Dr Khandakar Mahammad Hasib	Environment, Its Protection And — We the People
3.	Pankaj Sen	Preservation of Eco-system: A Justified Government Policy
4.	Dr Ramanuj Konar	Ecological Awareness in the Poems of Temsula Ao
5.	Sankardeb Mondal	Biodiversity as Depicted in Select Works of Tagore: An Inquest
6.	Pallabi Acharyya	Greenhouse Effect, impact on Marine Life
7.	Arabindu Sardar	Degradation of Biodiversity and Force Migration in the Indian Sundarbans- A Study
8.	Dr Satyabrata Bhattachrayya	Solar Geoengineering- jeopardising the Global Biodiversity
9.	Dr Bidyut Santra	Mathematical Modelling of Biodiversity Evolution: A Review

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22-23rd April, 2022

Date: 23.04.2022 **Presentation Session: 4** Time: 2.30 pm

Venue: A P J Kalam Auditorium

Chairman/ Chairperson: Dr Subhojit Bandopadhyay (N D College)

Session Coordinator: Dr Bidyut Santra

Sl. No.	Paper Presenter	Tittle of the Paper
1.	Payel Basu and Sonai Mishra	Microbe Degrading Oil into Methane-A Review
2.	Samriddha Saha and Biplab Biswas	Use of Geospatial Techniques to Estimate Availability of Surface Water Resources in Burdwan Municipality
3.	Sweta Chakraborty and Poulomi Biswas	By Virtue of what Plants Memorized Environmental Stress Through Epigenetic Regulation??-A Review
4.	Rakhe Tepin and Singh R. K.	New records of Hymenochaetaceae (Basidiomycota) from Arunachal Pradesh
5.	Raju Biswas, Saswati Chattopadhyay and Rajib Bandopadhyay	Conservation of potent microbial isolates from high altitude lakes of Sikkim and its biological activities
6.	Dr Khandakar Mahammad Hasib	Genetic diversity in scented rice

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22-23rd April, 2022

Date: 23.04.2022 **Technical Session: 5** Time: 2.30 pm

Venue: Smart Classroom

Chairman/ Chairperson: Dr Biplab Biswas

Session Coordinator: Dr Sanjay Mondal

Sl. No.	Paper Presenter	Tittle of the Paper
1.	Dr.Pintu Shee	Distribution and Change of Agricultural Landuse: A Case Study on Tarakeswar Town in Hooghly District, West Bengal
2.	Dr. Bikash Kumar Panda	Heavy Metal Toxicity and its Impact on Human Health
3.	Dr. Naba Kumar Ghosh	Plastic Pollution and its Impact on Wildlife and their Habitats as well as for Human Populations
4.	Dr. Veera Renuka Lobo	An analysis of Protective Legislation on biodiversity in India
5.	Dr. Tanmoy Dhibor and Dr. Golam Mostafa	Spatial Assessment of Ambient Air Quality of Guwahati City during COVID-19 Pandemic: A Geographical Study
6.	Jishu Sheel	Flood Hazard in Amta-II Block of Haora District, West Bengal: Causes, Consequences and Management
7.	Taraknath Mukherjee	Environmental Protection and Sustainable Development

Inaugural address

Basic Concepts on Intellectual Property and its Rights

Amiya Kumar Kalidaha

Senior Scientific Officer, DSTBT, GoWB, Salt Lake, Kolkata

"Intellectual Property is the oil of the 21st Century. Look at the richest men a hundred years ago; they all made their money extracting natural resources or moving extracting natural resources or moving them around. All today's richest men have made their money out of Intellectual Property"

- Mark Harris Getty, Co-founder and chairman of Getty Images

The process of integrating the Indian economy with the global economy has already gained momentum. Today in the world of changing business opportunities and technology based competition Intellectual Property Rights (IPR) has emerged as an important strategic tool. With the inclusion of IPR in the WTO-TRIPS agreement, Intellectual Property (IP) has acquired a new meaning in recent years. Thus, in 21st Century, IP is one of the main driving forces in "knowledge based modern economy". Intellectual wealth of any country is the determinant of its inherent strength and it is of utmost importance that rights over such intellectual property got to be claimed and protected in accordance with internationally accepted norms of IPR regime governed by WIPO, the World Intellectual Property Organization. As per WIPO Global Innovation Index (GII) 2020, India's Innovation Index rank is 48, while China is at 14. "Who owns your knowledge" is the most important and crucial line while discussing the Intellectual Property Rights (IPR). IPR helps to protect creations of the mind that include inventions orinnovations, literary or artistic work, images, symbols, etc. If a person creates a product, publish abook, or find a new drug, Intellectual Property Rights ensure that only that person gets benefit fromhis/ her work. These rights protect one's creation or work from unfair use by others. It is observed that most of the researchers do not have proper awareness about the different types of IPR which are helpful for doing a good academia-industry research. But the researchers must have a basic knowledge of IPR so that others cannot exploit their hard working research. While referring to a book chapter or a research paper, the researcher must make sure to provide appropriate credit and avoid plagiarism by using effective paraphrasing, summarizing, or quoting the required content. Please remember plagiarism is a serious misconduct in doing a good research! Generally, a patent will not be granted that has already been published (prior art). Researchers, therefore, are advised to file a patent application before publishing a paper on their invention. IP portfolio is the need of the hour and these are not ornamental pieces but strategic tools for earning and fostering R&D. There are two main types of Intellectual Property Rights (IPR):

1. Copyrights and related rights

2. Industrial property, like, Patents, Trademarks, Geographical Indications, Industrial Designs etc.
The benefits of acquiring the intellectual property rights:
1. The increased market value of the business – IP can generate income for the business through licensing, selling or commercializing protected products or services. This, in turn, can improvethe stock market and/ or increase the profit. In case of a sale, merger or acquisition, registered and protected IP assets can increase the value of the business.
2. Convert ideas into profitable assets – IP can help to convert creative ideas into commercially successful products and services. For example, licensing the patent or copyright can result in a steady stream of royalties and additional income that can result in profitable assets.
3. Market the products and services of the business – IP is necessary to create an image for the business like trademark, logo, or design of the product. So, it will help in differentiating the product by advertisement and brand promotion it to the customers.
4. Increase export opportunities for the business – IP can increase the opportunities in export markets. One can use their trademark brands and design for franchising agreements with foreign companies or to export the patented products.

Keynote address

Sundarbans in the era of Anthropocene

Punyasloke Bhadury

Department of Biological Sciences (DBS)

IISER(KOLKATA)

Abstract:

Sundarbans, formed at the delta of Ganga-Brahmaputra-Meghna represents the world's largest contiguous mangrove ecosystem spanning across India and Bangladesh. This unique ecosystem is rich in biodiversity, home to the charismatic swamp tiger and beyond as well as is an abode of Sundari tree. Sundarbans is strongly influenced by freshwater flow and diurnal tides on a daily basis. Therefore, the rich biodiversity is uniquely adapted in this ecosystem. It is home to a number of innumerable islands, some of which are inhabited by local communities and they depend on the natural resources that this mangrove ecosystem offers on a daily basis. Anthropogenic climate forcing is rapidly changing the landscape and waterscape of Sundarbans. Sea level rise, loss of vegetation and other natural resources, rise in surface water temperature, decreased freshwater flow along with inundation of salt water, cyclones among others poses a new set of challenges including linked socio-economics. Many of the islands in Sundarbans are increasingly becoming vulnerable to anthropogenic climate forcing and resulting in rapid loss of land along with natural resources. In this talk the challenges of the long-term existence of Sundarbans in the era of Anthropocene will be narrated along with possible consequences on biodiversity and linked socio-economics.

Invited Lecture

Conservation, Cultivation, and Sustainable Utilization of Medicinal Plants for Livelihood Improvement – lessons from Traditional Knowledge

Abhaya Prasad Das

Department of Botany, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh, India
Formerly: Taxonomy & Environmental Biology Laboratory, Department of Botany, North Bengal University, Darjiling 734013, West Bengal, India
Email: apdas.nbu@gmail.com

Abstract:

Eastern Himalaya and Northeastern part of India forms a very important biodiversity zone of the world. The richness of the biological diversity of the East Himalayan region, located within the territory of IUCN demarcated Himalaya Hotspot for Biodiversity Conservation, is beyond any question. Eastern part of Nepal, whole of Sikkim, major part of the Darjiling district of West Bengal, Tibet, Bhutan and Arunachal Pradesh are located within Eastern Himalaya. This zone is contiguous with two other similar Hotspots, - the Indo-Burma Hotspot and Mountains of SE China Hotspot. Biodiversity of this entire region, particularly of plants, has attracted botanists, plant lovers and plant hunters equally from round the world to visit, explore and to exploit at least during the last three centuries. While, many of the East Himalayan species are no more available in their native habitat, some of those are available in European gardens even today.

Terai and Duars regions in the northern part of West Bengal are also with equally rich vegetation cover having contiguity with the East Himalayan forests.

Even with the highly incomplete knowledge on the flora of Northeastern states we know it represent one of top-rated region in the world for the floristic richness. Innumerable sects of people living there, almost in isolation, without the benefit of advanced civilization but with their traditionally developed knowledge only. Such natural way of learning also include the recognition of the usefulness of the medicinally beneficial pants.

However, the importance of East Himalayan vegetation from the utilitarian point is immense. There are numerous publications related to different types of useful plants native to the region. These include numerous species of medicinal plants. Even today, so many species are regularly but mostly illegally exploited from this entire region and are even exported to remote places. In addition to the scientifically known medicinal plants, there are many more plants those are used in traditional medicines by different groups of people at different places. Recent publications recorded numerous such plants. Journals like *Indian Journal of Traditional Knowledge, Ethnobotany* and *Pleione* are regularly documenting the area's Traditional Knowledge on medicinal plants.

There are large numbers of *in situ* and *ex situ* protected areas established in the region, -in all the states. Some *ex situ* conservatories like Saramsa Garden of Medicinal Plants, Garden of Medicinal Plants of NBU, small gardens in some colleges and schools, some Forest Department Gardens, etc. are conserving medicinal plants. National and State Medicinal Plants Boards are equally helpful in developing such gardens even at the school level. However, medicinal plants cannot be saved in their habitat unless we stop their collection from the wild. Mass scale cultivation along with the

development of region-wise propagation and cultural methodology need immediate implementation. And, at the same time, National and State governments should be 'really serious' to look after that farmers are getting proper return. Our experience from Terai, Duars and Darjeeling Hills, North Bengal, is measurable. Now the armers are no more interested to cultivated Medicinal Plants.

There are numerous *in situ* Protected Areas (PAs) in this region. Sikkim is a very small state but there are seven Sanctuaries, one National Park and one Biosphere Reserve within its territory. On the other hand, 'Terai, Duars and Darjeeling Hills', quite a small area, together have five National Parks, five Sanctuaries and one Tiger Reserve. In addition, there are numerous other reserve forests. Similarly, in different other states of Northeast India numerous such PAs has been recognized. - - Now, we need to remember, most of these PAs are also heavily marketed in the name of ecotourism. Once one environmentally sensible person visiting the Lataguri area, adjacent to Gorumara National Park, he will realize that how in the name of ecotourism openly rampant 'hotel business' is going to destroy the beautiful National Park and the nearby reserve forests. No species can be saved within a boundary wall!! Recent horror of tree felling along the National Highway passing through Lataguri-Surshuti area created a scintillating public agitation in the area. We must remember, that I am shouting for last 20 years or more that, '*conservation and commercial exploitation can't go hand-in-hand*'!

Our assessment of the occurrence of medicinal plants in the MPCAs located in Terai and Duars has exposed the existence of rich green wealth that need to be conserved very carefully. But, these are regularly exploited through the rampant illegal collection.

Population explosion, urbanization, extension of Tea Gardens and other plantations with one or few (with some exotics) species are destroying the habitat. Forest department restarted planting *Cryptomeria japonica* (Dhupi). This has been aggravated through the implementation of different mega-projects within the Hotspot area, including large number of Hydroelectric Power Stations on different hill rivers is degrading different habitat conditions very fast.

Following the suggestion of Dr. Stephen Hawkins, we can settle in other planets, but there we have to survive like a 'Robot' and not as 'Man'!! We should remember, if we survive, we shall survive along with the neighboring biological diversity and not with only our exploitive attitude.

Invited Lecture

Local Biodiversity Management

Anirban Roy
West Bengal Biodiversity Board
(Department of Environment, Govt. Of West Bengal)
Prani Sampad Bhawan (5th Floor)
LB2, Sector lll, Salt Lake City,
Kolkata- 700106
Email: dr.anirbanroy@yahoo.co.in

Abstract:

Biodiversity, the mosaic life forms in the earth, is an outcome of long evolutionary process. Human beings are to depend on different biodiversity components for their own sustenance. Biodiversity not only provides food and health security, but also plays a key role in extending ecological services like hydrological balance, nutrient cycle, flood control, pollution mitigation, pollination etc. Besides, different components of biodiversity have immense aesthetic value that keep good mental health of human beings.

With the varied topography, soil and climate, India sustains wide array of biodiversity within 10 biogeographic zones and has the position in one of the 17 megadiverse countries of the world. Due to high endemicity India also has covered 4 biodiversity hotspots out of 35 such designated areas of the globe. India is one of the 10 Vavilov's centres of origin of crop plants of the world. The magnificent biodiversity of the country nourishes the people since time immemorial and thus India is a treasure of traditional biodiversity knowledge.

But since few decades, biodiversity has been gradually eroded due to climatic catastrophe, anthropogenic pressure like deforestation, alteration of habitats, change in land and land use pattern, rapid urbanization, pollution, unsustainable agricultural practices etc.

Being a signatory of the Convention on Biological Diversity (CBD)India enacted the Biological Diversity Act,2002 and the Biological Diversity Rules, 2004 towards safeguarding the biodiversity heritage of the country.To implement the Act, a three-tier system has been introduced

a) The National Biodiversity Authority(NBA) at national level
b) The State Biodiversity Board (SBB)at state level and
c) Biodiversity Management Committee (BMC) at local level.

The initiatives have been taken all over the country for documentation of biodiversity and related traditional knowledge in the form of People's Biodiversity Register (PBR) at the local level with the community participation, which would be an important driver towards local biodiversity management.

In many places of West Bengal several small conservation initiatives have been taken by the local people like restoration of traditional crop varieties through sustainable agriculture, conservation of indigenous fishes , development of biodiversity park, butterfly garden, herbal garden, plantation of local indigenous trees and fruit plants etc. Such activities are not only conserve the local bio resources but also provide livelihoods to the community.

Invited Lecture

Geospatial Tools for (Biodiversity) Characterization in Wetlands

Biplab Biswas

Department of Geography, The University of Burdwan, Burdwan,

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Abstract:

Geospatial tools and technologies have become essential for almost all spatial research & studies; implementation of developmental planning by the government and other agencies; and identification and mapping of Earth's resources. Wetlands are one of the most important resources with immense environmental and ecological importance. Each of the wetlands carries rich biodiversity. Wetland provides livelihood, supplies food, cleanses the polluted water, moderate weather and climate, protects life below water, supports life on land and many more. Most of these issues are part of the various Sustainable Development Goals (SDGs). Identification of the nature and extent of the wetlands and mapping their rich biodiversity is most effectively done with the help of geospatial technologies. The East Kolkata Wetland (EKW) is one of the Ramsar Sites in India (19/08/2002). East Calcutta Wetlands covers 12,500 ha. It is a World-renowned model of multiple use of wetland. The system is described as "one of the rare examples of environmental protection and development management where a complex ecological process has been adopted by the local farmers for mastering the resource recovery activities" (RIS). The wetland provides about 637 species of Floral diversity; 1288 Species of Faunal diversity; 87 Species of Birds; 150 tons of fresh vegetables daily; 10,500 tons of table fish per year; and provides direct livelihoods for about 50,000 people. Not only the EKW is important in the wetland ecosystem, but all the other wetlands are having equal importance in biodiversity richness and achieving several SDGs. There are various geospatial techniques to identify and map the wetlands. The most common techniques to segregate the forested land, built up land and water bodies from other earth's features are Normalized Difference Vegetation Index (NDVI), Normalized Difference Built-up Index (NDBI); and Modified Normalized Difference Water Index (MNDWI). By using these techniques we could identify wetlands in our neighborhood. For example, using geospatial technology we could identify 375 water bodies in the Burdwan Municipality. Whereas the municipality covers only about 26 Sq Km. Geographers and other Geospatial Scientists and researchers should give special emphasis in the identification and mapping of wetlands, their biodiversity and other societal benefits for achieving SDGs.

Keywords: Geospatial Technology, Wetlands, NDVI, NDBI, MNDWI, EKW, Geography, Burdwan Municipality

Study of rare and near threatened species in Indian Sundarbans and their restoration

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Abstract:

Sundarbans is the world's largest mangrove wetland ecosystem contiguous between India and Bangladesh. In these recent decades, the climate change effect has been drastically evident at the coastal Sundarbans. The successional pattern of mangrove species colonization is no more following the text-book theory. The climax species, *Heritiera fomes*, once dominating the Sundarban mangroves, has become critically endangered for Indian Sundarbans, while being endangeredglobally.Common causes of vanishing of *Heritiera fomes*from the wild are cited as rise of salinity, top-dying disease etc. but till date supported by meagre concrete scientific evidences. Other near threatened taxa like *Phoenix paludosa*, *Intsiabijuga*, *Brownlowiatersa*, *Nypafruiticans*(locally rare) are also becoming restricted in few protected sites in Indian Sundarbans and soon disappearing from settlement area shoreline fringes. We keep saying that these species are losing out because of rise in salinity in sediments but surprisingly in some of the protected riverbanks we find them being preferentially colonized miles after miles. The settlement area shoreline fringes are gradually being replaced by three species of *Avicennia* or *Excoecaria agallocha*. Interestingly *Excoecaria agallocha*has been referred as back mangrove in earlier literatures while it is now signature species of high saline degraded islands along with *Avicennia* spp. members. Under this backdrop, our group is trying to find out ecologically as well as with scientific evidence the main reasons behind the gradual extinction of these rare plant species apart from anthropogenic factors.A thorough investigative comparison of parameters like sediment salinity, texture, pH,nutrient load, microbial abundance, osmotic adjustments by osmolyte accumulation, species assemblage and topography,pathogenic and endophytic microbe analyses etc. among the natural habitats where these species are flourishing, the human assisted plantations of them and degraded mangrove habitats, unworthy of colonization of these threatened species is expected to resolve this enigma.

A comparative account of Reproductive biology of mangroves in different habitat conditions indicating cross-pollination as preferred mode of reproductive success in Indian Sundarbans

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Abstract:

Mangroves have been recognized as highly productive, ecologically important, and unique intertidal ecosystems. Reproductive hindrances on sexual reproduction of mangrove species are caused by degradation factors like increased salinity, anoxicity rise and the effect of cyclones which lead towards species loss in the long run. The success of sexual reproduction in mangroves is linked to flowering timings, pollinator abundance, variability development through strong selfincompatibility causing outbreeding. Our studies on the reproductive ecology of Sundarban mangroves since 2017 establish that despite reduced frequency of pollinators in different habitat conditions, mangroves in Indian Sundarbans are mainly self-incompatible, preferring xenogamous nature of outcrossing. We generated data on reproductive ecology of major species of mangroves in Sundarbans viz. floral morphology, success of artificial pollination (autogamous, geitenogamous and xenogamous modes) as well as a comparative time-dependent data of histology of ovary after pollination through xenogamy, geitenogamy and autogamy using *Bruguiera gymnorrhiza* as a model species. It becomes evident from all these results that cross-pollination through xenogamy is the preferred mode of sexual reproduction in Sundarban mangroves. Due to their self-incompatibility (SI), uncovering the molecular basis of SI in mangroves may unravel interesting yet unknown features of reproductive ecology of mangrove species.

Study of photosynthesis and photosynthates as osmotic stress warriors in mangroves of Indian Sundarbans

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Abstract:

Among the various metabolic processes in plants, photosynthesis is the key to plant productivity, and to flourish in such harsh environment mangroves must show a significant rate of CO_2 fixation. In our study, on the activity of the two key CO_2 fixing enzymes ribulose 1, 5-bisphosphate carboxylase (RuBPC) and phosphoenolpyruvate carboxylase (PEPC) to study the photosynthetic efficiency in mangrove species across pristine and degraded habitats, we have observed that in pristine forests the RuBPCactivity is higher than that of the degraded areas. On other hand, the PEPC enzyme activity is more or less similar in both pristine and degraded regions among various mangrove species. RuBPCactivity suffers under salinity stress, and high temperature causes stomata to remain open for a shorter period under the mangrove environment to conserve water. To compensate for this, we observed some of the mangroves are gradually shifting towards PEPC enzyme mode, a slow but gradual advancement from C3 to C4 mode only in terms of photosynthetic enzyme activity, a significant acclimative response without showing any Kranz anatomy. During the salinity stress,major osmolytes (i.e. proline, free amino acids, glycine betaine, soluble sugars, sugar alcohols etc.) provide osmoprotection to the mangrove species, with mangrove associate legumes showing exorbitantly high pinnitol accumulation. Whether high osmolyte accumulation also could be positively correlated to higher RuBPC/PEPCactivity, is also an area under our study. The members of Rhizophoraceae like *Rhizophora* spp., *Ceriops* spp. and *Bruguiera* spp., the species showing best hitherto known mangrove ecosystem adaptative features were surprisingly known to have the least acclimative responses in terms of osmotic adjustment. We are in the process of resolving this riddle also.

Diversity of root endophytic bacteria of mangroves, plant growth promotion at lab and at rice fields of Indian Sundarbans

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Abstract:

Mangrove roots are abode of diverse endophytic microbes that interact with root cells, and promote growth, facilitating nutrient availability to the cells even under an external anoxic ambiance. We have been successful in the establishment of 78 pure isolates of cultivable endophytic bacteria (NCBI Accession no. MT421976 to MT422053) from roots and pneumatophores of different mangroves and associate species of Indian Sundarbans like Avicennia alba, A. marina, A. officinalis, Heritierafomes,Rhizophoramucronata, Excoecariaagallocha, Bruguieragymnorrhiza, B. cylindrica, Ceriops sp., Xylocarpus sp., Dalbergiaspinosa, Derris trifoliata, Myrostachyawithiana, Porteresiacoarctata. The culturable community of endophytes comprises species of 12 genera viz. Bacillus, Aeromonas, Pseudomonas, Staphylococcus, Vibrio, Gallacimonas, Serratia, Enterobacter, Pseudocitrobacter, Citrobacter, Acinetobacter, Mangrovibacter. Bacterial endophytes were selected repeatedly on differential nutrient cycling media. All endophytic bacteria were tested for their plant growth-promoting potential under laboratory conditions through assays for indole-3-acetic acid production, phosphate solubilization, siderophore production, free nitrogen fixation, 1-aminocyclopropane-1-carboxylate deaminase (ACC) synthesis. 3 combinations of 18 selected growth promoting bacteria out of these 78 accessions were applied to the rice field of Dudheswarlandrace (IC No. 593998), widely cultivated at Sundarbans and also known to be an ideal salt tolerant variety for growing at low lands.Our field experiment performed for once till date, indicated significantlyincreased yield with respect to the control where bacteria were not added and also compared to theyield data collected from several other rice fields grown by local farmers. Field application of Combination 1 comprising of Aeromonasdhakensis strain HPR7, Mangrovibacterplantisponcer strain BCRP5,Pseudomonas stutzeri strain BCY5, Pseudomonas stutzeri strain BCY7,Bacillus subtilis strain AOR5,Serratiamarcescens strain AOR4 showed an yield of average 9.58 quintal/bigha, Combination 2 comprising of Aeromonasallosaccharophila strain DAL2,Pseudomonas sp. strain DER1, Pseudomonas sp. strain DER1,Pseudomonas putida strain DER3,Pseudomonas fulva strain DER9,Aeromonasveronii strain POT3,Aeromonasveronii strain POT7,Serratiamarcescens strain HPR4showed an yield of average 11.2 quintal/bigha, Combination 3 comprising ofBacillus subtilis strain AMR4,Aeromonashydrophilia strain HER3,Bacillus altitudinis strain XYL1,Pseudocitrobacterfaecalis strain HRR5,Serratiamarcescens strain HPR4,Enterobacterkobeistrain HRR1showed an yield of average 11.3 quintal/bigha in comparison to control fields (without bacteria) yielding average 7.52quintal/bigha. The data collected from local farmers' field in the Sundarban western part in Patharpratima block exhibited only an yield of average 3.7 quintal/bigha.

Bacterial diversity in native halophytic grass rhizospheres in Indian Sundarbans-Culture independent and Culture dependent scenario

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Abstract:

Native halophytic grasses growing in Sundarbans have good potential to survive under hypersaline conditions (EC>4 dS^{-m}).Under the rhizosphere microbiome engineering approach to increase tolerance of rice towards high salinity, a comparative study of culture independent and cultivation dependent isolation, characterization, and molecular identification of bacteria from four halophytic grasses' rhizospheres from Sundarbans (*Porteresiacoractata*, *Myriostachyawightiana*, *Paspalumvaginatum*, and *Sporobolusvirginicus*) vis-a-viscultivated rice rhizospherefrom hinterland rice fields wasinitiated to establish the uniqueness of different rhizosphere microbiomes.For cultivation independent studies, the metagenomic DNA was isolated from the rhizospheres of the four native halophytic grasses' as well as cultivated rice rhizospheres from the field of Sundarbans by commercially available soilkit (Nucleospin Soil), the isolated metagenomic DNA samples were quantified using Qubit fluorimeter, first amplicon PCR was set up using the isolated metagenomic DNA along with bacterial 16S V3-V4 region-specific primer set;amplicons were cloned in libraries. 16S amplicon libraries from respective rhizospheres werethen sequenced on Illumina MiSeq platform and analysed for 16S abundance through picking Operational Taxonomic Units (OTUs) based on sequence similarity within the reads, that picks a representative 16S sequence for bacteria from each OTU against Greengenes database (version 13_8). The metagenomic library accessions of grass rhizospheres in NCBI appear as SRX14283045 (*Porteresiacoarctata*), SRX14283004 (*Myriostachyawithiana*), SRX14297712 (*Paspalumvaginatum*), SRX14273128 (*Sporobolusvirginicus*).The cultivation dependent studies were based ondifferential screening of serially diluted soil samples from all rhizospheres for nutrient cycling activities, established as pure-isolates, and identified through 16S rRNA gene sequencing. Total 137 pure strains (accession nos. MT145945-MT145991 and MT145456-MT145545)from both grasses' and rice rhizosphere were established.Comparison between diversity and abundancesof cultivation independent and cultivation dependant bacterial communities/strains among cultivated rice rhizosphere and native grasses' rhizospheres revealed distinguishable differences of significant ecological importance.

Ecological aspects of Planctomycetes and Actinobacteria in mangrove forest ecosystem in Indian Sundarbans

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Abstract:

The ecology of mangrove forest sediments is an important field of research due to the role of forests as carbon sinks. Although most studies have focused on fungi, forest soil bacteria also play important roles in this environment. Members of planctomycetesare generally known for having large genomes, which might indicate large phenotypic plasticity and the ability to quickly adapt to extreme changes in their environment.Planctomycetes encode wide repertoires of carbohydrate-degrading enzymes including many unclassified putative glycoside hydrolases, which suggests the presence of extremely high glycolytic potential in these bacteria. Experimental tests confirmed their ability to utilize xylan, pectin, starch, lichenan, cellulose, chitin and several other exopolysaccharides. In our studied 16S abundances of bacteria by next generation Illumina sequencing sediment microbiome of different degraded, semi restored and pristine mangrove habitats of Indian Sundarbans shows significant abundance of planctomycetes, proving this bacterial group an integral microbial community of mangrove sediments contributing significantly in bio-geochemical cycling as efficient decomposer. Whether this genomic abundance of Planctomycetes in mangrove sediments could be used as an effective metric to evaluate the success of mangrove ecosystem restoration is also being studied by our group. NGS data also confirmedactinobacterial abundancesignificantly in less fertile sediments as decomposers of plant residues in an attempt to making the soil richer in blue carbon. Actinobacteria play a key role in preparing the soil and promoting the growth of plants in various ways. Ashalophytic actinobacteriaare also known as good source of bioactive compounds, we aim to find out if these secreted bioactive compounds positively or negatively influence the seedling colonizationat different mangrove habitats at Indian Sundarbans.

'Phenylpropanoid' pathway as a biomarker for screening Sigatoka Leaf Spot disease-resistant*Musa* germplasms

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Abstract:

Sigatoka leaf spot disease caused by *Mycosphaerellaeumusae*, a fungal pathogen, is a serious threat to banana production worldwide and Leaf Spot disease-resistant strain selection is an important prerequisite for utilization in banana improvement programmes. Fourteen Indian banana cultivars were collected from different parts of India namely 'Simolu Manohar', 'Bhimkol', 'SaporJahaji' (Jahaji Dwarf), 'BorJahaji' (Jahaji Big), 'G9', 'AmritSagar', 'Panch', 'Chatim', 'Champa', 'Robusta', 'Rasthali', 'Karpuravalli' and 'NeiPoovan' were artificially inoculated in detached leaf assay with a conidial suspension of the causal fungal pathogen for Sigatoka leaf spot disease, *Mycosphaerellaeumusae*. The identity of pathogen was confirmed by sequencing ITS (Internal Transcribed Spacer) region lying between 18S and 28SrRNA genes (F/R primers ITS1/ITS4**).** The morphology of the infective conidial spore and ascocarp/ascosporewas considered as well for pathogen identification. Cultivars have been screened for fungal resistance in subsequent post-infective period through chlorophyll retention, activity assays of key enzymes of the "core" phenylpropanoid pathway and Quantitative PCR (Q-PCR) for some genes for key enzymes.Observation based on chlorophyll retention during post-infective period followed by the assay of defence induced level of phenylpropanoid pathway enzymes like PAL (L-phenylalanine ammonia lyase), PTAL (bi-functional Phe/L-tyrosine ammonia-lyase), C4H (cinnamate 4-hydroxylase), CAD (cinnamoyl alcohol dehydrogenase) and PX (coniferyl alcohol peroxidase) along with gene expression study of some of these enzymes at post-infective periods were analysed till date.Transcriptomics by enabling RNA-Seq analysis based on NGS platform is being planned for the next step.This laboratory-based approach holds great potential for resistant cultivar selection at farmer's fields.

Revisiting the molecular cross-talk between denitrification and phosphate uptake byPAO bacteria for efficient phosphate bioremediation

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Abstract:

Poly-phosphate Accumulating Organisms (PAO) are a group of microorganisms including bacterial generathat actively take up soluble phosphorus from the environment and store as poly-phosphate (Poly-P) granules inside their cellsand have significant role in EBPR (Enhanced Biological Phosphorous Removal) process for wastewater treatment. But usual phosphate (P) bioremediation by PAO is controlled by external P concentration and negatively regulated by PhoU protein encoded by *PhoU* gene of PHO regulonconsisting of more than 30 genes including phosphate-transporter genes*PstS, PstC, PstA, PstB,* and a metal-binding *PhoU* gene. Therefore, the higher the phosphate present in the external media, the lower is the P –uptake by PAO. This was observed both in laboratory and in P-rich wastewater also by our group.PAOs in EBPR remove P by passing through alternate carbon-rich anaerobic phase and a carbon-poor aerobic/anoxicphase. Some bacteria known as DPAOs (Denitrifying Poly-phosphate Accumulating Organisms) demonstrate simultaneous PO_4^{3-}-P and NO_2^-/NO_3^--N remediation in a single anoxic phase in presence of external carbon sources. This display ofsingle stage simultaneous N and P removal makes the wastewater treatment by these DPAOs a sustainable process, if suitable technologies can be adopted. Our earlier study have established that a group of DPAOs isolated from parboiled rice mill wastewater, could accumulate 1000 times more PO_4^{3-}-P inside their cells by down-regulating the expression of the *PhoU* gene and simultaneously removing the NO_3^--N from the media by denitrification.in presence of a specific range of NO_3^--N (100-1000 ppm). Surprisingly, the same was observed for normal non-PAO bacteria also like *E.coli* K-12 and *E. Coli* DH5α strains. Whether this enhancement in P-uptake by nitrate addition in the media and overcoming of the negative control of PhoU negative regulator protein is an universal phenomenon for bacteria is now under investigation in our laboratory. Our lab hosts more than 300 cultivated bacterial isolates belonging to 37 genera. With these isolates we are now trying to find out the universality of NO_3^--N mediated enhancement of PO_4^{3-}-P uptake by defying the negative control of *PhoU* gene.

Characterization and Taxonomic implication of spores in Fern and fern-allies from West Bengal

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Abstract:

Over the years numerous works have established the implications of spore morphological characters in fern taxonomy. In this communication we extensively studied 25 species of fern and fern-allies under 19 families and subjected to qualitative and quantitative analysis to resolve them into groups based on the degree of similarity. The study was conducted with the aid of light microscopy and scanning electron microscopy techniques for gathering the qualitative and quantitative traits. The qualitative characters of spores like spore type, shape in polar and equatorial axis, colour, class and surface ornamentation were examined. The spore shape varied from ellipsoidal to tetrahedral with monolete or trilete aperture and mostly medium sized. The polar diameter ranges from 17.76±1.1µm to 858±16.8µm while the equatorial diameter varied from 22.20±1.1 µm to 799±15.8µm with surface ornamentation varying from granulose to verrucate and tuberculate. The data were subjected to multivariate analysis and an artificial dichotomous key were prepared. Principal component analysis was performed to comprehend the covariance among the variables followed by hierarchical clustering to deduce the patterns of correlation.

Key words: Spore, fern, fern-allies, taxonomy, West Bengal

Plant's biodiversity,miraculous co-operation network and impact on ecosystem-A review

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Abstract:

Biological systems encounterlots of obstacle from nature; plantitself is not exception to this rule. Researchers found that genetically more diverse plant species could maintain a stabler ecosystem. A single "Keystone gene"*AOP2*responsible for theproduction aliphatic glucosinolates, which protect the plantsfrom aphids,could change an entire ecosystem by controlling the extinction rate of insects, if other variant alleles of this particular gene is lost from the ecosystem.Plants maintain a wonderful network among themselves that helps them to survive under difficult environmental conditions and have a significant role in biodiversity too.Plants transport water and nutrient, prevent attack from different sources through chemical signals, even induce ripening in other plants also through cross-talk signals.How plantscommunicate among themselves is a major area of research, where devoted scientiststalk mainly about volatile organic compounds (VOCs) and effects of it on nature. Plants release VOCsin response to threat alert sent by nearby plants and reflect the plant's current physiological status. Plants constantly monitor these cues and change their growth pattern according to that.Plant-plant interaction is dynamic; one major challenge of plants is to detect a true cue, which tells about impending danger. Experiment suggests communication occurs only within a limited distance from damaged plants and requires a specific concentration. Emission of these secondary metabolites inhibit the growth of other plant species, many invasive species using these strategy to survive on a foreign environment thus can destroy a plant community by creating negative impact on surroundings. Nevertheless, these plants can also be used in agriculture to destroy the weeds naturally without application of weedicides. So can't we tell everything on nature have a dual role??

Pollination biology in the perspective of Biodiversity Conservation

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Abstract:

The conservation of biodiversity has been the focus of mankind since a long time. With the progress of urbanization and industrial growth leading to ruthless plunder of nature, man has been forced to accept that the conservation of biodiversity is of utmost importance, not only for the survival of other species but also for the survival of man himself. Various aspects of plant-animal interactions have been a burning topic of research among both plant and animal scientists and one of the frontier areas of plant-animal interactions is pollination biology, better termed pollination ecology. Pollination ecology is a very fascinating domain, more so in case of zoophilous plants, where the successful pollination of a flower involves a multitude of factors involving the floral architecture, floral longevity, floral attractants, floral rewards (if any) offered to visitors, stigma receptivity, mode of anther dehiscence,pollen viability and so on. Pollination of a zoophilous flower involves a very intimate interaction between the flower and its visitors.

The floral characteristics in case of biotic pollination may either be very specialized so that the flower of a certain species can be pollinated only by a specific group of pollinators, such as bees, flies, butterflies, moths, etc., giving rise to a specific pollination syndrome or somewhat generalized, allowing the flower to be pollinated by diverse types of biotic agents, whom pollination biologists call "opportunistic pollinators". Pollination syndromes may even be more specialized, allowing the flower to be visited and successfully pollinated by only a particular species of pollinator. In such cases, the flower is said to be monophilic.Successful pollination usually leads to fertilization, seed-set and hence, successful propagation of the species. Monophilic plants face a greater risk of extinction if by any chance, its pollinator becomes threatened. The case of monophilic pollination of the semi-trap lantern flowers of *Abroma augusta*(L.) L. *f*., belonging to Sterculiaceae, by the fly *Japanagromyza indica*Ipe, belonging to the family of leaf-miner flies Agromyzidae, is presented here.

Modeling a high-value medicinal plant *Aconitum lethale* Griff. (Ranunculaceae) in Darjeeling Himalaya

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Abstract:

Aconitum lethale Griff. is a highly valuable medicinal plant found in the sub-alpine regions of Darjeeling Himalaya. Due to its importance in the global drug trade, this species faces many threats from over-harvesting to climate change. The present study investigates the potential distribution of *A. lethale* in Darjeeling Himalaya for the current and future climate scenarios. The MaxEnt algorithm was used for species distribution modeling. AUC (area under the curve) value of the models was 0.99 making the models robust. Current potential habitat of the species shows a narrow range of 51 km^2. In all the future scenarios, no any suitable habitat is reflected within the study area. The results thus highlight the vulnerability of the species towards extinction in the near future.

Keywords: Distribution modeling, *Aconitum lethale*, MaxEnt, Darjeeling Himalaya

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Pollination, plant diversity and role of salinity in pollinationsuccess: A review

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Abstract:

Plant diversity and sodium concentration in floral nectar are the two important factors that can control the pollination success of flowering plants. Plant-pollinator interaction studies are gaining momentum in this era of climate change when pollinators, critical for 35% of the world's crops are fast declining leading to crop failure. Two very important recent studies have contributed new findings on the role of plant diversity and salty nectar on positive output on pollination success. The facilitative role of plant diversity on pollination is unexplored yet under natural conditions. Gavini et al, 2021, examined a total of 9371 stigmas of 88 species from nine high-Andean communities in NW Patagonia for same species pollen

receipt and heterospecific pollen diversity, and evaluated whether conspecific (same species pollen) pollen receipt by flowers increased with heterospecific pollen diversity on stigmas. Their findings suggest that plant diversity enhances pollination success. Similarly, in another study by Finkelstein et al, 2022, authors supplemented some flowers of some species with an artificial nectar containing 1% salt and the other half of the flowers of the same species retaining a non-salty wild type nectar. They found that, compared with flowers containing nectar without added sodium, flowers with sodium rich nectar had almost twice as many visits from pollinators and attracted nearly twice as many species of pollinator. This work suggests that sodium in nectar could be an important factor of plant–pollinator interactions. This opens up the possibility of research in studying the nectar of mangrove flowers, that are known to attract pollinator honey bees in large number leading to formation of bee-hives and honey storage in them in mangrove forests world-wide. As mangrove plants inhabit hypersaline environment, it may be possible that they gather some amount of sodium salts also in their nectar, which might be the attraction of bees, hence leading to pollination success as well as making our mangrove forests rich sources of wild honey.

Ethno-botanical study of COPD medicinal plants used by the people of Indian Sundarban with special references to phytochemical and pharmacological understanding

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Abstract:

Chronic obstructive pulmonary disease (COPD), which is on the increase, affects millions of people throughout the world. Disease symptoms and exacerbations are treated with medications, which may be effective but have limits. Despite expanded research efforts to identify novel therapies for this condition, the relative frequency of this disease is increasing exceedingly. To ease the current crisis and avoid future crises, it is advised that these COPD medicinal plants be recorded and that feasible formulations and Indian medicinal plants be investigated as soon as possible. During ethno-botanical study at Indian Sundarban, ten (10) numbers of traditional medicinal plants were recorded. The medicinal plant *Piper longum* L. (Piperaceae) was chosen for phytochemical and

pharmacological study since Kabiraj advised it mostly from Indian Sundarban. Collected fruits of *P. longum* were shed dried for about 30 days and were powdered in a laboratory grinder. The size of powdered particles was determined by measuring their diameter. To further understand the compositional and structural features of the biomasses, we were analysed physicochemically and characterised. Bulk density, swelling index, proximate analysis, calorific value or higher heating value (HHV), ultimate analysis, compositional analysis, GCMS, Fourier Transform Infrared (FTIR), X-ray diffraction (XRD), and phytochemical analysis were all studied. COPD diseases are caused by the fungi (*Aspergillus* and *Pneumocystis*) and the bacteria (*Streptococcus*, *Klebsiella*, *Pseudomonas*, and *Bacillus*). The extract of *P. longum* fruits was used in various concentration to test this efficiency. These findings suggested that *P. longum* fruit extracts might be exploited in the biopharmaceutical and biopreservation sectors and possible herbal medication for COPD therapy.

Keywords: Chronic obstructive pulmonary disease, COPD, Traditional Medicinal Plants, GCMS, FTIR, XRD.

Diversity and Species composition of Vascular epiphytes in Temperate zone of Darjeeling Himalaya, India

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Abstract

The present communication focuses on the composition of vascular epiphytic flora in Temperate Darjeeling Himalaya. The zone extends between 1850 to 3200 m asl and provides diversified microhabitat due to wise array of climatic and altitudinal variations. Random sampling method were done keeping in mind the phenological period of the taxa. A total of 90 species under48 genera and 19 families were recorded. Orchidaceae and Polypodiaceae were the most diverse family with 34 and 23 species respectively. Correlation between epiphytic diversity and host tree revealed that CBH was significant and positively correlated and maximum species were sheltered in host tree with rough bark texture. However, no significant relation have been observed between the bark pH and epiphyte diversity.

Keywords:Vascular epiphytes; Temperate; diversity; host tree

Casuarina equisetifolia L. : A soil binder plants at Digha coastal region in West Bengal

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Abstract:

The Digha is the most popular sea beach which is located in the district of Purba Medinipur of West Bengal. *Casuarina equisetifolia L.* is a predominantly monoceious species which distributed along the Digha coastal region of West Bengal. It is commonly known as beach she-oak, coast she-oak, ironwood and Jhau. India is a largest casuarina growing country in the world with an estimated 800000 ha of plantation. This plant has the capability growing in wide range of soil condition particularly on coastal region and on limestone of soils near the shore. It is a tall and fast growing tree that can reach up to height of 20m in 12 years. It has the tolerant of salt spray, light to heavy textured soil and it has often one of the trees growing closer to the coast line (Balusubramanian, 2001). It is also an important species for the control of soil erosion especially on coast region which is its natural habitat. The present paper deals with main importance to prevent soil erosion and uses in coastal region.

Keywords: *Casuarina equisetifolia L*, monoceious, soil erosion.

Nature and Problems of Farmer Suicides in India since Liberalization Era

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Abstract:

Farmer's suicides are not a phenomenon by itself rather it is an acute symptom of the underlying agrarian crisis prevailing within several states of India since liberalization. According to the records of National Crime Record Bureau (NCRB), more than three lakhs farmers (cultivators and agriculture labourers have committed suicides in India since 1995. In this study we have used data

for eleven major states of India for 19 years till 2015 to identify reasons for acute problems of farmer's suicides (FS's) in India. We have grouped the states in terms of higher suicide rate states and low suicide rate states for the purpose of our study. From our study we have found that in the states where farmers' suicide rates are higher; annual net revenue (NR) from cultivation is significantly negative in the short run, while in the lower farmers' suicide rate states we have not found such type of relation in the short run or in the long run. The applications of the VAR and VEC model of co-integration have yielded the above result. Further from Random Work Model of panel data analysis we have found that FS is significantly related with share of non-food crops area, cropping intensity, gross irrigated area, rain-fall difference and yield rates of food crops & oil seeds. If share of non-food crops area and percentage of gross irrigated area are increased by one percent then FS's will increase by 0.56 percent and it will decrease by 1.2 percent, respectively.

ENVIRONMENT, ITS PROTECTION AND — WE THE PEOPLE

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Abstract:

Environment is regarded as the natural surrounding that we live within it. It is having with important components like physical including air, water, soil, etc., biological including all living organisms like plants, animals, microorganisms etc. and social like cultures, rituals, customs, habits, relation and so on. The environment is degraded from a long time by human interferences. Scientist, academicians and the activists as well as many other peoples are now realizing the importance of preserving the natural resources to save the environment. The effects of such degradation is warming of the climate which is definitely occurring that can be visualized by increasing temperature of water and air, widespread melting of ice, rising of global sea level etc. Another important hazard in this regard is the CO_2 emission. The atmospheric greenhouse gases trapping some of the outgoing energy and retaining the heat. This increases the heat-trapping capability of the earth's atmosphere. The effects of degradation may be focused on agriculture, fossil fuel, food, water and forest. The excessive use of chemicals, fertilizer, insecticide, pesticide, herbicide etc. has direct effects on agriculture. Burning of fossil fuel is another cause of pollution. Adulteration of foods and others have direct effects on human

health. It should be restricted through massive awareness. The other kinds of pollution should also be concerned to save our green planet.

নির্বাচিত রবীন্দ্র রচনায় জীববৈচিত্র্য সন্ধান

শংকরদেব মন্ডল

বাংলা বিভাগ

শরৎ সেন্টিনারী কলেজ, ধনিয়াখালী , হুগলী ।

সংক্ষিপ্তসার: :

বিপুল ও বিচিত্র রবীন্দ্র সৃষ্টিতে কত যে মহৎ ভাবনার প্রতিফলন ঘটেছে , তা মননশীল বহু বিশিষ্ট সাহিত্য সমালোচক ও গবেষকের সন্ধানী দৃষ্টিতে উঠে এসেছে । রবীন্দ্রনাথের সাহিত্যসৃষ্টিতে বিজ্ঞান চেতনার প্রতিফলন একটি সর্বজনবিদিত বৈশিষ্ট্য । আরেকটি বিষয়ও ধরে নিচ্ছি সকলেরই জানা যে , প্রায় সব বিষয়েই রবীন্দ্রনাথের মতের ও ভাবনার সারবত্তা আছে । কেউ কেউ অবশ্য একথা জানেন না , তাই মানতে চান না । রবীন্দ্রনাথকে নিয়ে আলোচনার অবকাশ সবসময়ই প্রাসঙ্গিক । যারা রবীন্দ্রালোচনাকে আজকের দিনে বাতিকগ্রস্ততা বলতে চান বা বলেন , কিন্ত পরিপূর্ণভাবে না জেনে যদি এমন মনোক্তি করা হয় সেও তো বায়ু-ব্যাধির লক্ষণ । এইরকম মনোবিকার সরিয়ে রেখে আমরা বলতে চাই রবীন্দ্রনাথ ঠাকুরের রচিত বেশ কিছু কবিতায় , গল্পে , প্রবন্ধে জীববৈচিত্র্য সম্পর্কিত উপস্থাপনা চিরকালের সম্পদ হয়ে আছে ।

সুন্দরের পূজারী কবি । জীবধাত্ ধরিত্রীর সবকিছুতেই কবি আত্মিক যোগ অনুভব করেছেন । বিবিধের মাঝে মিলন সন্ধানে কবি আজীবন ব্রতী থেকেছেন । জীবনের শেষ সীমায় উপনীত হয়ে তাঁর দার্শনিকসুলভ যে ক্ষেদ প্রকাশিত হয়েছে তাতে তাঁর জ্ঞান পিপাসার সমৃদ্ধ পরিসর বুঝে নেওয়া যায় । তিনি যেভাবে জীবনসত্য উপলব্ধি করেছেন,তা হ'ল-

" বিপুলা এ পৃথিবীর কতটুকু জানি !
দেশে দেশে কত-না নগর রাজধানী —
মানুষের কত কীর্তি , কত নদী গিরি সিন্ধু মরু ,
কত-না অজানা জীব , কত-না অপরচিত তরু
রয়ে গেল অগোচরে । বিশাল বিশ্বের আয়োজন;
মন মোর জুড়ে থাকে অতিক্ষুদ্র তারি এক কোণ।"

ঐকতান : জন্মদিনে
শান্তিনিকেতন ১৮ জানুয়ারি ১৯৪১

সমগ্র মানবজাতির কল্যাণ কামনায় রবীন্দ্রনাথ আজীবন নিরলসভাবে চেষ্টা করেছেন। জাতির অহংকার জাগানোর মতো দিক-দিশা রবীন্দ্রসাহিত্যে নতুন প্রজন্ম চিরকাল পাবে। আমরা জীববৈচিত্র্য সম্পর্কিত রবীন্দ্র ধারণায় অবগাহন করলে নিশ্চিত সম্মৃদ্ধ হতে পারবো বলে মনে করি।

Greenhouse Effect, impact on marine life

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Abstract:

Imagine Earth as a Greenhouse chamber, with the outer atmosphere behaving as a glass wall. The approaching sunlight hits the surface of Earth, part of which is reflected back into space. The major portion is absorbed by the "Greenhouse gases" (GHG; CO_2,CH_4,O_3 and water vapour ; mostly in cloud form) and it raises the overall temperature, helps flora and fauna to grow here. Otherwise, Earth would be too frosty for sustaining life. This overall phenomena, known as Greenhouse Effect, is turning into an alarming issue as most of the above said gases are increasing in the atmosphere and making Earth much warmer than needed.

Coral reefs cover less than one percent of the seafloor, yet they create the structures that provide food, shelter on which the entire community of marine species depends. Microscopic plants that live within the tissues of the corals give them both colour and nourishment. Unfortunately most of them are missing nowadays. The increasing level of CO_2 in the deep sea makes seas more acidic. If the sea's temperature rises by just a degree or two, corals expel their plant partners. They lose their main source of food and turn white. Here, on Australia's Great Barrier Reef, between 2016 and 2017, usually warm seas have caused many of the reefs to bleach in this way and eventually die.

Increased GHG emissions worsen the impact of already existing stressors on coastal and marine environments from land based activities(e.g Urban Discharges, Industrial runoff and Plastic Waste) and the ongoing unsustainable exploitation of these systems (e.g overfishing, deep-sea mining and coastal development). These cumulative impacts weaken the ability of the oceans and coasts to continue a healthy hydrosystem.

The rise in sea surface temperatures is causing more severe hurricanes and El Nino events bringing floods, destroying civilization on a broader scale.

Surprisingly, the remedies are in nature. The shallow seas are vitally important in the fight against climate change. Within that, Seagrass absorbs 35 times as much CO_2 as the same area of rainforest and that reduces damage caused by the recent warming of our seas.

Mangroves often border the seagrass meadows. These remarkable trees are the only ones that can cope with the varying saltiness of coastal waters. They not only protect our coasts from the destructive force of hurricanes, but also, like seagrass, capture CO_2.

There is an urgent need to achieve the mitigation targets set by the Paris Agreement on climate change and hold the expansion in the global average temperature to below 2ºC above pre-industrial

levels. This will help prevent the massive and irreversible impacts of growing temperatures on ocean ecosystems and their services.

Misool, an island in Indonesia, where biodiversity is actually served. Since protection, there are three times more fish than just ten years ago. We need to turn a third of all our coastal seas into properly protected areas which will help to sustain both humanity and the rest of the natural world.

Degradation of Biodiversity and force Migration in the Indian Sundarbans-A study

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Abstract:

The environment of earth is incessantly changing over time. The effects of environmental change have been felt more or less in every nooks and corners of the globe. Some parts of the world, especially low –laying coastal regions (the Indian Sundarbans) are the most adversely affected zone. The Inter governmental Panel on Climate Change (IPCC) has attributed this phenomenon of global warming induced climate change largely to the anthropogenic activities.

The deltas are nowadays considered important food baskets that have increasingly become vulnerable to food insecurity due to environmental changes. The Sundarbans is highly inhospitable terrain for human and other forms of life. The marshy islands are lashed by tides twice a day. Non-saline water or sweet water is highly scarce, ground sweet water is either not available or is very deep. In spite of all the odds the human population density is highest. The inhospitable terrain with such high population density has resulted in immense anthropogenic pressure on natural resources of Sundarbans, threatening the existence of its biodiversity.

Mangroves ecosystem and embankments are both of the life lines or backbones of the Sundarbans. It protects coast, especially low-laying coastal regions and coastal people from heavy wind; intense periodical cyclones, tidal waves, coastal erosion and sea water ingress, engenders substantial quantities of fishery resources and makes available many useful forestry products. Inhabitants of the Sundarbans, who live in the small islets of the coastal fringe area, are continuously affected by the impact of climate change and displacement. Here the word "Environmental degradation" has been used primarily to indicate the effects of climate change on lives and livelihoods options, health status, eco-systems, economic, social and infrastructure (embankment) owing to the interaction of climate hazard that occur within a specific time and exposes vulnerability of the society or systems. The adverse effects of nature on livelihoods followed by natural changes in livelihoods and environmental changes hit the present pattern of livelihoods and compel people to take up other occupations and drudgeries will be discussed.

SOLAR GEOENGINEERING – JEOPARDISING THE GLOBAL BIODIVERSITY

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Abstract:

Sun oriented geoengineering, or sun powered radiation alteration (SRM) is a proposed kind of environment designing in which daylight (sun based radiation) would be reflected back to space to restrict or switch human-caused environmental change. Sun based geoengineering includes infusing vapor sprayers into the upper stratosphere to reflect daylight back into space thus diminish temperatures on the planet. Such measures have never been tried in nature and the effects of geoengineering on biodiversity had remained to a great extent obscure up to this point. Geoengineering programmes that inject aerosols into the atmosphere to cool the planet may harm wildlife. Suddenly starting or stopping geoengineering programmes may prevent species from successfully tracking changes in climate. The quick temperature increments from an abrupt end of geoengineering would almost certainly dominate the limit of numerous species to relocate to adapt to the temperature change, expanding annihilation risk. In the event that, this wasn't a sufficient battle, the fast changes in environment welcomed on by halting geoengineering projects would cause significant environment fracture - making natural surroundings a mosaic of okay and distressing conditions. This could produce obstructions to dispersal, further diminishing the capacity of species to move to a cooler environment asylum. Species that neglect to follow changing environments could go terminated, regardless of whether appropriate circumstances can be found somewhere else. While the minimal expense of sun based geoengineering comparative with different strategies for managing environmental change makes it an appealing possibility, the expenses for biodiversity are possibly colossal.

Mathematical Modeling of Biodiversity Evolution: A Review

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Abstract:

Mathematical modelling and simulation plays an important role in Science and Technology. Along with other model, ordinary differential equation (ODE) based models are widely used to study ecology, epidemiology and in general to study multispecies population dynamics. In this review work, some ODE based models (predator- prey type) are discussed to depict how mathematical models help us to study the interaction of different species and to study the transmission mechanism of some highly infectious diseases. Though such models provide a greater insight into the problems but the model has limitations too. Value of model parameters play an important role in this regard.

Microbe degrading oil into methane-a review

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Abstract:

Methanogenic archaea bacteria is receiving discernible attention as a hydrocarbon degrading microbe to methane in subsurface, anoxic oil reservoirs and marine sediments. However, 50-60% of oil remains unremovable from these sites of oil reservoirs which can be recovered via methanogenic degradation, converting oil into methane which can be used as fuel.Various anaerobic hydrocarbon degrading bacteria in association with methanogenic archaea performing fermentation, provide degraded substrates for methanogenic archaea to thrive at the same habitat. Interestingly in some recent years the discovery of non-syntrophic archaeon *Candidatusmethanoliparia* reveal its efficiency in carrying both degradation of hydrocarbon and methanogenesis catalysed by MCR (methyl coenzyme M reductase) via three major pathways viz. hydrogenotrophic,aceticlastic and methylotrophic. Although holding 50-70% constituent of biogas & its contribution in treatment of organic waste, sewage sludge and alternative source of energy, high concentration of methane contributes to the green house gas. To overcome this, ANME (anaerobic methanotrophic archaea) developed AOM (anaerobic oxidation of methane) mechanism to oxidize CH_4 into CO_2 and yield

energy. This observation suggests that methanogenic hydrocarbon degradation by bioremediation will be helpful in cleaning oil spillage due to tectonic plates movements in marine seep sediments, industrial effluents, in addition to the broader aspect for the application of microbial enhanced sustainable energy sources from depleted oil reservoirs.

Use of Geospatial Techniques to Estimate Availability of Surface Water Resources in Burdwan Municipality

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Abstract:

An attempt has been made to evaluate the availability of the surface water in this particular research work within the Burdwan Municipality using geospatial techniques. As per 2011 Census of India, the population and the area of Burdwan Municipality are 314,265 and 26.30 sq. km. respectively. Presently the municipality has 35 wards. Burdwan is the principal town and district headquarters. Most of the piped water of this municipality is groundwater and it is used for all purposes like domestic, drinking, washing and others. Individual tube wells have also been installed where the piped water is not available. We understand groundwater is deplating fast and sustainability is threatened. So we need to think alternatively to reduce the pressure or burden on ground water resources by using surface water to meet the daily water demand as an alternative means of water resources. Studying the satellite image of Sentinel -2 (January 2022) and employing various image rationing techniques - NDVI, NDBI and MNDWI, we could identify the land use land cover with special emphasis on surface water resources of the study area. There are almost 375 water bodies in the Municipality area and they have been identified using Geospatial techniques. The ward no. 26 holds the maximum number of ponds i.e. 78 whereas ward no. 19 has the least number of water bodies, i.e. 1.In this municipality the ward no 26 occupied the maximum area with surface water i.e.387456.54 m^2 whereas the ward no 12 occupied the least area i.e 106.29 m^2. .We have sampled 10 ponds randomly for estimating their depth. Estimated average depth of the ponds is 3 metres and it has been used for calculating the volume of the wetlands. Estimated volume of the surface water bodies of different wards ranges from 1162369.62 cubic metres (ward no. 26) to 318.87cubic metres (ward no. 12). If we consider the ward wise per capita availability of water with 70 litre per day demand, we found that all the

wards have sufficient surface water to fulfil their daily water demand except ward no12. We understand the surface water is polluted with various pollutants. If any proper treatment process is adopted to supply the surface water (for non drinking purpose), we can reduce the burden on groundwater. Groundwater can be used in a sustainable way.

Keywords: Surface Water Bodies, NDVI, NDBI, MNDWI, Sustainability

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By Virtue Of What Plants Memorized Environmental Stress Through Epigenetic Regulation??-A review

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Abstract:

Plants are sessile organisms which have to adjust their physiology and development along with climatic changes. At present,dramatic industrialization throughout the world causes a drastic change in global environment resulting transformation in marine and terrestrial ecosystem leading to a worldwide penalty for crop yield. Scientists are trying to address the plant responses to environmental stresses like UV light, and cold tolerance by amalgamating the major findings from different studies on *Arabidopsis thaliana*. Light energy is needed for growth of plants via photosynthesis but high light and more specifically its integral UV light has higher potentiality for serious damage to DNA, proteins and other cellular components due to the formation of specific flavonoid glycosides resulting from UV-irradiation. A recent identification of UVR8(UV RESISTANCE LOCUS 8) receptor for UV-B light mainly acts on *CHALCONE SYNTHASE* gene that regulates the flavonoid biosynthetic pathway along with a group of enzymes. Another epigenetic regulation in plant is studied through vernalization during prolonged cold stress. It involves Polycomb silencing of *FLOWERING LOCUS C* gene during exposure in cold stress by formation of a PHD-PRC2 complex in a localized region of *FLC* gene with help of transcriptional regulator *FRIGIDA*, the main activator of *FLC* expression. Subsequent spreading of *PHD-PRC2* complex leads to high level of *H3K27* methylation over the whole locus. Though there are evidences that the relation between DNA methylation and enhanced level of stress tolerance through epigenetic memorization is directly proportional but what are the molecular mechanism for that are yet unknown.

Keywords: Environmental stress, UV-B light, epigenetic regulation, vernalization, cold stress, polycomb silencing, DNA methylation.

New records of Hymenochaetaceae (Basidiomycota) from Arunachal Pradesh

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Abstract:

The order Hymenochaetales of phylum Basidiomycota currently contains 4 families. The family Hymenochaetaceae contains 34 genera and 672 species out of which 12 genera and 120 species have been reported India. Members of Hymenochaetaceae are saprophytic or parasitic and well known for causing wood degradation (white-rot). They are mainly characterized by brown; stipitate, resupinate, and effused-reflexed to pileate fruit-bodies that darken in KOH. In the present study, six new records of Hymenochaetaceaefrom Arunachal Pradesh are being reported {*Coltriciellasubglobosa*, *Hymenochaetecyclolamellata*, *H.microcycla*, *.rheicolor*, *Phellinusgilvus*, and *P.caryophylli*}and described on the basis of morphological characters along with their hosts/substrata.

Conservation of potent microbial isolates from high altitude lakes of Sikkim and its biological activities

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Abstract:

All over the world the high altitude lakes provide the important study site for microbial communities. Indian Himalaya is a biodiversity hotspot both for its unmatched geographical/biological resources and vulnerability. North eastern regions of India are full of

floral and faunal biodiversity; especially the state of Sikkim having eastern Himalayan ecological hotspot region. The entirely mountain-locked state harbors many lakes which are believed to have therapeutic and spiritual values. However, most of the Sikkim Himalayan lakes are yet to be explored for studying microbial gene pools, especially on genomic potentiality with respect to evolution of antibiotic resistance development. Under different climatic conditions, spontaneous mutations and horizontal gene transfer drive the evolution of antibiotic resistance in bacteria. Strategies for antimicrobial treatments are required that could manage and even reverse the advancement of resistance mutations. In this study we aimed to produce insights into the control on advancement of resistance development in different clinically important bacteria using antibiotics or alternatively microbial derived capsular substances.

Keywords: Biodiversity hotspot; Biological resources; Microbial communities; Evolution of antibiotic resistance; Antimicrobial treatments.

Genetic diversity in scented rice

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Abstract:

Genetic diversity of various scented mutants and their parent Tulaipanja was carried out in the M_5 generation following D_2 statistics. The mutants are categorized into eight clusters. The largest group was the Cluster 1 having with eight mutant genotypes. Most of the Clusters had single genotype. The inter-cluster distance was less between the Cluster 3 and Cluster 8. The inter-cluster distance was high between Cluster 7 and Cluster 8. So, mutants from these clusters may be used as parent to get desirable segergants for evolving high yielding lines of scented rice. Plant height, panicle number, panicle length, number of grains per panicle and test weight had maximum contribution, whereas, harvest index, dry matter production and grain yield showed minimum effects on genetic diversity. So, in this present investigation, the mutants with the highly contributed characters towards genetic diversity may be utilized for future crop improvement programme.

Key words : Genetic diversity, mutants, scented rice, quantitative characters

Disrtribution and Change of Agricultural Landuse: A Case Study on Tarakeswar Town in Hooghly Distict, West Bengal

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Abstract:

Land is one of the most important aspects of life. In agricultural production, the role of land is the main input and irreplaceable also. Economically, land is the most efficient wealth-generating asset for farmers and is also an important factor for economic growth. However, the limited and unrenewable nature of land supply creates a fierce land-use competition, usually between the agricultural and non-agricultural sectors. This gives rise to agricultural land conversion, which significantly reduces the agricultural land availability and threatens food supply. Agricultural land losses are the impacts of Non-agricultural (Commercial. Economic, Residential and industrial) land uses and rate of urbanization which reduces the highly productive agricultural land. My study area is Tarakeswar town of Hooghly district, West Bengal. Agricultural land use is one of the dominating land use patterns of the stated study area till now. The present study concerns about the distribution pattern and rate of change of agricultural land use in Tarakeswar during last two decade in spatial and temporal aspects. Modern technique like G.I.S and remote sensing has been applied for mapping and data analysis regarding agriculture of the study area.

Keywords:Agricultural production, irreplaceable, unrenewable, wealth-generating, Non-agricultural land uses, urbanization

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Heavy Metal Toxicity and its Impact on Human Health

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Abstract:

Heavy metals are naturally occurring elements that have a high atomic weight and a density at least 5 times greater than that of water. Their multiple industrial, domestic, agricultural, medical and technological applications have led to their wide distribution in the environment; raising concerns over their potential effects on human health and the environment. Their toxicity depends on several factors including the dose, route of exposure, and chemical species, as well as the age, gender,

genetics, and nutritional status of exposed individuals. Because of their high degree of toxicity, arsenic, cadmium, chromium, lead, and mercury rank among the priority metals that are of public health significance. These metallic elements are considered systemic toxicants that are known to induce multiple organ damage, even at lower levels of exposure. They are also classified as human carcinogens (known or probable) according to the U.S. Environmental Protection Agency, and the International Agency for Research on Cancer. This review provides an analysis of their environmental occurrence, production and use, potential for human exposure, and molecular mechanisms of toxicity, genotoxicity, and carcinogenicity.

Keywords: Heavy metals, production and use, human exposure, toxicity, genotoxicity, carcinogenicity

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Plastic Pollution and its Impact on Wildlife and their Habitats as well as for Human Populations

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Abstract:

Plastic pollution, accumulation in the environment of synthetic plastic products to the point that they create problems for wildlife and their habitats as well as for human populations. In 1907 the invention of Bakelite brought about a revolution in materials by introducing truly synthetic plastic resins into world commerce. By the end of the 20th century, plastics had been found to be persistent polluters of many environmental niches, from Mount Everest to the bottom of the sea. Whether being mistaken for food by animals, flooding low-lying areas by clogging drainage systems, or simply causing significant aesthetic blight, plastics have attracted increasing attention as a large-scale pollutant. Plastics a polymeric material—that is, a material whose molecules are very large, often resembling long chains made up of a seemingly endless series of interconnected links. Natural polymers such as rubber and silk exist in abundance, but nature's "plastics" have not been implicated in environmental pollution, because they do not persist in the environment. Today, however, the average consumer comes into daily contact with all kinds of plastic materials that have been developed specifically to defeat natural decay processes—materials derived mainly from petroleum that can be molded, cast, spun, or applied as a coating. Since synthetic plastics are largely nonbiodegradable, they tend to persist in natural environments.

Keywords: Environmental Pollution, Plastic Pollution, Polymeric Material, Nonbiodegradable

An analysis of Protective Legislation on biodiversity in India

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Abstract:

India is one of 17 mega-biodiverse countries in the world. With only 2.4 percent of the earth's land area, it accounts for 7-8 percent of the world's recorded species. Home to 96,000 species of animals, 47,000 species of plants and nearly half the world's aquatic plants, India's management of its natural resources is crucial to protecting global biodiversity. The unregulated urbanization, the swift increase in industrialization and other human activities resulted in consequential damage to the environment. This deterioration of the ecosystem led to the constitution of a legal statute, focused on the restoration and survival of the biological diversity in India. India has made a legal policy and framework regarding biodiversity which enables it to address some crucial issues about protection of biodiversity. But the present policy is far from being adequate, the only way to overcome such a situation is by making amendments in the legislation and adopting a stronger pro-active community participation. The civil society organisations should also try to create awareness among the local communities about the Biodiversity Act and the rights it guarantees to them. Also, since change cannot be achieved through isolated efforts, it is essential to build formal and informal networks among farmers, civil society associations, grass root organisations, scientific and academic institutions, and government organisations. This would lead to better conservation and protection of biodiversity.

Spatial Assessment of Ambient Air Quality of Guwahati City during COVID-19 Pandemic: A Geographical Study

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Abstract:

Pollution causes degradation and significant changes in every component of the ecosystem.Pollution harms almost all the four realmsof the earth e.g., Hydrosphere, Lithosphere,

Atmosphere, and Biosphere, as the population grows and developmental activities such as Industrialization and Urbanization take place. Despite all of the pollutants, Air pollution is the most serious environmental threat to human health and is a major concern for the international community.

Both human interference and natural occurrences contribute to air pollution. It's made up of a variety of contaminants, including solid, liquid, and gaseous elements. Because of increased anthropogenic activity, pollution has become a hot topic of controversy in India at all levels, notably air pollution. The major air pollutants have been divided into two categories: outdoor and interior pollutants. Airborne Particulate Matter (PM) and the gaseous pollutants Ozone(O3), Nitrogen Dioxide (NO2), Volatile organic compounds (including Benzene), Carbon Monoxide (CO), and Sulphur Dioxide (SO2) are the most harmful from a health standpoint Outdoor air pollution can aggravate asthma and chronic obstructive lung disease (COPD), as well as the cardiovascular system. Several recent studies have ranked Guwahati as one of the most polluted cities in not only in India but also in the world. The analysis of ambient air quality data from before and after COVID19 lockdown period shows that the levels of Respirable Suspended Particulate Matter (RSPM) and Suspended Particulate Matter (SPM) in almost all of Guwahati's monitoring stations are alarmingly high, exceeding the National Ambient Air Quality Monitoring Programme's prescribed standards and how it is changes during the lockdown period.

This paper is an attempt to investigate the comparative spatial changes of ambient air quality of Guwahati city before and during Covid-19 Lockdown period.

Key Words: Air Pollution, Ambient Air Quality, Suspended Particulate Matter, Respirable Suspended Particulate Matter, Vehicular Emission, Health Risk, Air Quality Index.

Flood Hazard in Amta-II Block of Haora District, West Bengal: Causes, Consequences and Management

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Abstract:

Damodar basin specially the lower Damodar basin area is one of most flood affected geographical region of West Bengal. The people of this lower damodar basin area are suffering seriously from this hazardalmost every year.Damodar Valley Corporation was established in

1948 to reduce flood in this area. Some other steps have also been taken to reduce flood hazards. But flood is still a serious problem for this region.My study area is Amta II block which is situated to the north western part of Haora District.It is one of the most affected block of the district. Damodar River flows through the middle portion of the stated study area. The present study concerns about the causes, affected area,prone area, damage assessment,remedial measures of flood inAmta-II Block of Haora District.

Keywards:basin area, geographical region, affected area, prone area, damage assessment, remedial measures.

Environmental Protection and Sustainable Development

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Abstract:

The paper titled "Environmental Protection and Sustainable Development" attempts to probe into important aspects of environmental protection ranging from various types of environmental pollution, their impact on our environment and the necessary actions taken by the Government of India in this matter. A detailed and comparative analysis of the types and impact of pollution on air, water, soil and sight resulting in global warming, climate change, sea-level increase, and polar ice melting would enable us to locate solutions to protect the environment and ensure sustainable development. Moreover, "sustainable development is considered central and important challenge for international organisations such as the United Nations and for governments worldwide. It is seen to embrace concerns for environmental degradation, poverty, and exclusion currently and regarding the long-term viability of existing approaches in both environment and development."(Elliott) The present paper will discuss critically the viability and efficacy of the policies and actions taken by the government of India for environmental protection and sustainable development of our nation.

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