LIANAS

Biodiversity Conservation and Climate Change

2023-2024

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COLLEGE PRAYER

संगच्छध्वं संवदधवं
सं वो मनांसि जानताम्
देवा भागं यथा पूर्वे
सञ्जनाना उपासते ॥

समानो मन्त्रः समितिः समानी
समानं मनः सह चित्तमेषाम्
समानं मन्त्रमभिमन्त्रये वः
समानेन वो हविषा जुहोमि ॥

समानी व आकूतिः
समाना हृदयानि वः ।
समानमस्तु वो मनो यथा
वः सुसहासति ॥ (ऋग्वेदः)

(एक पद गति, एक वाणी चित्त मन सब एक हो
संकल्प अविरोधी, सदा परहित लक्ष्य हो जन का, रहें सुख से सभी)

अस्तो मा सद् गमय
तमसो मा ज्योतिर्गमय
मृत्योर्मा अमृतं गमय (बृहदारण्यकोपनिषद्)

(हों अग्रसर सत् पर असत् से, ज्योति में तम से प्रभो
मर्त्यत्व से अमरत्व की ही ओर ले चलिये प्रभो)

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Preface

Welcome to this edition of our journal the Lianas, a platform dedicated to celebrating the curiosity, creativity, and scholarly endeavors of budding botanists.
Botany is a discipline that makes us understand the complexities of life on Earth. From the towering trees of dense forests to the delicate wildflowers that dot the countryside, plants play a crucial role in shaping ecosystems, sustaining biodiversity, and supporting human well-being.
A web of life under threat
The theme of this edition of Lianas is Biodiversity and Climate Change.
Biodiversity, the variety of life on Earth, is both a testament to the planet's resilience and a source of its vitality. From the lush rainforests of the Amazon to the icy expanses of the polar regions, biodiversity underpins ecosystem functioning, provides essential ecosystem services, and sustains human well-being. However, this rich tapestry of life faces unprecedented threats from human-induced climate change.
Climate change, driven primarily by the combustion of fossil fuels, deforestation, and other anthropogenic activities, is altering Earth's climate systems at an alarming rate. Rising temperatures, changing precipitation patterns, and more frequent extreme weather events are already having profound impacts on ecosystems and species worldwide. The consequences of these changes extend far beyond the natural world, affecting human societies, economies, and cultures
We believe that fostering a deeper understanding of the connections between biodiversity and climate change is essential for addressing the urgent environmental challenges of our time. By providing a platform for interdisciplinary dialogue and collaboration, we hope to facilitate the exchange of knowledge, ideas, and solutions that will help shape a more sustainable and resilient future for all life on Earth.
Presented this year are a collection of original research, insightful reviews, and thought-provoking essays from faculty and students passionate about the fascinating world of plants -- a diverse array of contributions that reflect the breadth and depth of botanical inquiry reflecting fresh insights, raise thought-provoking questions, and inspire curiosity about the natural world.
Many best wishes for all your future endeavours

Prof (Dr.) Rama Pasricha

Contents

From the Principal's Desk

Prof. Savita Roy

I congratulate the Convenors of Vasundhara, The Botanical Association and the Department of Botany for the successful compilation of Botanical facts & events in the form of Lianas. It gives me immense pleasure to acknowledge the release of Lianas 2023 -2024. With the theme Biodiversity Conservation and Climate Change. This publication is the result of the hard work and dedication of our students and teachers, who strive to showcase their knowledge and creativity. Lianas has offered a platform for our students to express their ideas, research, and artistic talents in the field of Botany. It has served as a source of inspiration and knowledge for our readers. I hope that Lianas will continue to provide a space for students to explore the fascinating world of plants and their ecological significance. I will encourage our readers to join in on this journey of discovery and appreciate the marvels of nature through the eyes of our young botanists.

HOD's Message

Prof. Rekha Kathal

Botany department is the one of best Science departments of Daulat Ram College. It has completed 50 years of its glory. Department was awarded “Star College Status” by Department of Biotechnology, Government of India. We are proud of our faculty members and students. Department is offering B.Sc. Botany Hons. and B.Sc. Life Science courses in addition to interdisciplinary courses like Environmental Science, SEC, VAC and G.E. Papers. We have many distinguished alumni who have achieved high positions in diverse fields.

"Laina" is the annual botanical compilation of scientific reviews and articles contributed by the students and teachers. It provided the platform to the young enthusiastic minds to showcase their skills, express their creativity and explore the world of botanical wonders. Last year, we released “LIANA” 2023 with International Standard Book Number (ISBN) at the occasion of Annual Day of the College and we are happily continuing the same this year. I congratulate the staff advisors of “Vasundhara” DrAsmita Gupta and Dr Shagun Danda along with students for the same.

From the Editor's Desk

Dr. Asmita Gupta

Dr. Shagun Danda

Lianas, the annual publication of Vasundhara, the Botanical Association of Daulat Ram College, University of Delhi, is a compilation of scientific reviews and articles contributed by students and teachers. It is a platform for the inquisitive and creative minds to showcase their intellectual and creative skills and explore the world of botanical wonders through words and art. This year, Lianas 2023-2024 with the theme of Biodiversity Conservation and Climate Change has been released with the International Standard Book Number, ISBN. The cover page of this year's Lianas was released on 24th April, 2024, on the occasion of the Annual Co-curricular event of the Botanical Association, Orchidz' 2024 by the distinguished guest and invited speaker Padma Shri Prof. Sudhir Kumar Sopory Sir and our Principal Ma'am, Prof. Savita Roy Ma'am. The complete publication was released on the college annual day, 26th April, 2024.

Lianas 2023-2024 offers an insightful journey into the Natural world, highlighting the urgent issues of biodiversity conservation and climate change through its scientific articles, students' creative expression in the form of prose, paintings and photography and the various events of the Botanical Association. This year's publication has a special feather in its cap in the form of the photographs contributed by the students of the skill enhancement course Viewing and Capturing Diversity in Nature, semester –II and IV, including the cover photo. We hope that the readers of Lianas 2023-2024 experience the wonders of the natural world and the associated challenges in its conservation from the perspective of the thoughtful minds that have created this kaleidoscope of words and artistic works.

Teachers' Section

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Daulat Ram College

Invasive Alien Species in India and their Impact

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1. Introduction

Invasive alien species, often referred to simply as invasive species, are plants, animals, or other organisms that are introduced into a new environment where they are not native and have the potential to cause harm to the ecosystem, economy, or human health. These species can out compete native species for resources such as food, water, and habitat, disrupt natural ecosystems, alter fire regimes, spread diseases, and even lead to the extinction of native species.

Invasive species are typically introduced to new environments through human activities such as trade, travel, and transportation. They can be accidentally transported in cargo shipments, as stowaways on ships or planes, or deliberately introduced for agricultural, horticultural, or other purposes. The impact of invasive species in India is significant and multifaceted, causing harm to the environment, economy, and even human health. Core areas of negative effects of Invasive species are:

2. Ecological Damage

• Loss of Biodiversity: Invasive species compete with native plants and animals for resources, disrupt ecological processes like pollination, and can even predate on native species. This can lead to population decline and even extinction, especially for species with limited ecological niches.

• Habitat Degradation: Some invasive species physically alter their new environment. For example, fast-growing plants can smother native vegetation, while herbivores can overgraze and damage ecosystems. This habitat degradation further reduces biodiversity and ecosystem resilience.

• Disruption of Ecosystem Services: Healthy ecosystems provide a variety of services like water purification, flood control, and carbon sequestration. Invasive species can disrupt these services, impacting human well-being.

3. Economic Costs

• Losses in Agriculture: Invasive species can damage crops, reduce yields, and increase the need for pesticides. This translates to economic losses for farmers and impacts food security.

• Infrastructure Damage: Certain invasive plants can damage infrastructure by blocking waterways, disrupting power lines, and even affecting buildings. This requires repair and maintenance costs.

• Loss of Tourism Revenue: The spread of invasive species can degrade scenic areas and reduce tourism appeal, leading to economic losses in tourism-dependent regions.

4. Impact on Human Health

• Spread of Disease: Invasive species can carry diseases and parasites that are new to the environment. This can pose a threat to human health and veterinary health, requiring investment in disease control measures.
• Allergic Reactions: Some invasive plants can trigger allergic reactions in humans, impacting public health.
• Competition for Resources: Invasive species can compete with humans for resources like water, especially in areas already facing water scarcity.
• Climate change can exacerbate the problem of invasive species by creating new opportunities for them to establish themselves and spread.

5. Spread of Invasive Alien Species (IAS)

Invasive Species are adept hitchhikers, spreading across vast distances through various mechanisms, spreading through various pathways, primarily facilitated by human activities.
Accidental introductions are the most common way invasive alien species (IAS) spread to new environments. The other mechanism is unintentional introductions and the various ways humans contribute to the problem. Sometimes, invasive species are introduced deliberately, such as for newer high yield breeds of food, feed and non-food crops, pets, gardening, or pest control.
Some of the common ways invasive species spread include:

5.1. Natural Dispersal

5.1.1. Wind

Lightweight seeds or spores of invasive plants can travel long distances on wind currents, establishing themselves in new areas. Examples include dandelion seeds and fern spores.

5.1.2. Water Currents

Aquatic invasive species like plankton or fish eggs can be carried by rivers, streams, or ocean currents, reaching new water bodies.

5.1.3. Animals

Birds and mammals can unintentionally transport seeds or plant fragments on their fur or feathers, establishing invasive plants in new areas. Squirrels, for instance, might cache seeds far from the parent plant.

5.2. Factors Contributing to Spread

5.2.1. Lack of natural enemies

Invasive species introduced to a new environment may not have predators or diseases that keep their populations in check, allowing them to reproduce rapidly and spread unchecked.

5.2.2. Trade and Transportation

Invasive species can be transported across continents through global trade routes. They may hitchhike on ships, airplanes, trucks, or other vehicles, either as stowaways or intentionally introduced for commercial purposes. Goods such as agricultural products, ornamental plants, and even packaging materials can harbor invasive species.

The increase in international trade and travel has created more opportunities for IAS to be transported unintentionally. This can happen in several ways:

• In ballast water: Ships discharge large volumes of ballast water to maintain stability. This water can contain organisms from the origin port that are then released into a new ecosystem when the ballast tanks are refilled.

• On cargo and containers: Soil, seeds, or insects can hitch a ride on cargo containers or other goods, traveling long distances and establishing themselves in new environments.

• On clothing or luggage: People can unknowingly transport seeds or plant fragments on their clothing or luggage.

5.2.3. Travel and Tourism

People traveling for leisure or business can inadvertently carry invasive species with them. These species may be transported in luggage, clothing, footwear, or personal belongings. Recreational activities such as boating, fishing, and camping can also contribute to the spread of invasive species if equipment is not properly cleaned and sanitized.

5.2.4. Agriculture

Imported agricultural products or contaminated crop seeds can introduce invasive plants or insects into new regions.

5.2.5. Horticulture and Gardening

Intentional introduction of non-native plants for landscaping, gardening, or ornamental purposes can lead to the spread of invasive species. Plants that escape cultivation can establish themselves in natural habitats and out-compete native vegetation.

5.2.6. Aquaculture and Fisheries

Aquatic invasive species can be spread through aquaculture facilities and fish farms. Escape or release of non-native fish, mollusks, or crustaceans into natural water bodies can result in the establishment of invasive populations.

5.2.7. Recreation

Boating and fishing activities can unintentionally transport invasive species between water bodies on boats, trailers, or fishing gear. People can also spread aquatic plants by improperly cleaning their equipment.

5.2.8. Gardening

Planting non-native ornamental plants that can escape cultivation and spread into natural areas is a common way for invasive species to establish themselves. Irresponsible disposal of unwanted garden plants can further exacerbate the problem

5.2.9. Illegal Activities

Illegal trade in wildlife and plants, such as smuggling of exotic pets or rare species, can introduce invasive species into new environments. These activities often bypass regulations and inspection protocols, increasing the risk of introducing harmful species.

5.2.10. Climate Change

Changing environmental conditions due to climate change may create new opportunities for invasive species to expand their ranges. Warmer temperatures, altered precipitation patterns, and changes in habitat suitability can favor the establishment and spread of certain invasive species.

5.2.11. Natural Disasters

Events such as floods, hurricanes, and wildfires can inadvertently transport invasive species to new areas. Floodwaters, wind-blown debris, and soil erosion can carry seeds, spores, or organisms to locations where they were previously absent.

6. Accidentally introduced invasive alien species in India

India, with its diverse ecosystems and flourishing trade, is susceptible to the introduction of invasive alien species (IAS) through various accidental pathways. Some prominent examples of accidentally introduced IAS causing problems in India:

• Water Hyacinth (*Eichhornia crassipes*): This fast-growing aquatic plant, native to South America, was likely introduced as an ornamental plant. However, it has become a major problem in freshwater bodies across India. It forms dense mats that block waterways, hinder navigation, and disrupt aquatic ecosystems by depleting oxygen levels.

• Water fern - *Salvinia molesta* (Giant Salvinia): Another accidental introduction, probably through contaminated aquarium plants. This fast-growing fern forms thick mats over water bodies, hindering light penetration, impacting fish populations, and affecting irrigation.

• Nile Tilapia (*Oreochromis niloticus*): Introduced for aquaculture purposes, the Nile Tilapia is an aggressive fish that competes with native fish species for food and habitat. It can also disrupt breeding grounds and alter food webs.
• Lantana camara *(Lantana)*: Introduced as an ornamental plant, Lantana has become a widespread invasive weed in India. It forms dense thickets, crowding out native vegetation and hindering regeneration of forests. Lantana is also allelopathic, meaning it releases chemicals that suppress the growth of other plants.
• Parthenium weed (Congress grass): This aggressive weed, native to tropical America, was likely introduced through contaminated agricultural goods. It invades pastures, agricultural lands, and wastelands, reducing land productivity and causing respiratory problems in humans due to pollen allergies.
• Caspian Sea Mytilus (Black mussel): These mussels are believed to have been introduced through ship ballast water. They attach themselves to underwater structures, causing damage to boats, pipelines, and other infrastructure.
• African Catfish (Clarias gariepinus): Introduced for aquaculture, the African catfish is an aggressive predator that can compete with native fish and disrupt aquatic food webs. They can also survive in low-oxygen conditions, giving them an advantage in some polluted water bodies.

7. Some harmful invasive species in India

A. Lantana camara (Lantana): This flowering shrub is native to South America and was introduced to India as an ornamental plant. It has become a major invasive species, spreading rapidly and smothering native vegetation. Lantana disrupts forest ecosystems and reduces grazing land for wildlife.
B. Chromolaena odorata (Siam weed): This fast-growing weed is native to Central and South America. It was introduced to India as a potential source of biomass fuel. However, Siam weed has become invasive, forming dense monoculture stands that crowd out native plants and hinder forest regeneration.
C. Parthenium hysterophorus (Carrot grass): This aggressive weed is native to tropical America. It was likely introduced to India as a contaminant in imported wheat. Carrot grass is a prolific seed producer and can invade a wide variety of habitats, including agricultural fields, pastures, and wastelands. It displaces native vegetation and reduces crop yields.
D. Eichhornia crassipes (Water hyacinth): This free-floating aquatic plant is native to the Amazon basin in South America. It was introduced to India as an ornamental pond plant. However, water hyacinth has become a serious invasive species, clogging waterways and hindering navigation, fishing, and irrigation. The dense mats of vegetation also deplete oxygen levels in the water, harming aquatic life.
E. Prosopis juliflora (Mesquite): This thorny shrub is native to Central and South America. It was introduced to India in the 19th century for firewood and soil stabilization. However, mesquite has become invasive in many areas, forming dense thickets that crowd out native vegetation and reduce grazing land. It can also alter soil chemistry and make it difficult for native plants to grow.
F. Salvinia molesta (Giant Salvinia): This fast-growing aquatic fern is native to South America. It was likely introduced to India accidentally in the aquarium trade. Giant salvinia can form dense mats that cover the water surface, blocking sunlight and depleting oxygen levels. This can lead to fish kills and disrupt aquatic ecosystems.

G. Rudolfus fulvus (Red-eared slider): This freshwater turtle is native to the Mississippi River and Gulf Coast regions of North America. It has been introduced to India as a pet and has established itself in some freshwater bodies. Red-eared sliders can compete with native turtles for food and resources, and they may also carry diseases that can harm native turtle populations.

H. Ctenopharyngodonidella (Grass carp): This large fish is native to eastern Asia. It was introduced to India in the 1950s for weed control in aquaculture ponds. However, grass carp can escape from ponds and establish themselves in rivers and lakes. They can then disrupt aquatic ecosystems by consuming large amounts of aquatic plants, including native species.

I. Gambusia holbrooki (Eastern mosquitofish): This small fish is native to the eastern United States. It was introduced to India in the 1920s for mosquito control. However, eastern mosquitofish can be predatory on native fish species, including the eggs and fry of commercially important fish.

J. Achatina fulica (Giant African snail): This large land snail is native to East Africa. It was likely introduced to India accidentally in the 19th century. Giant African snails can be agricultural pests, feeding on a variety of crops. They can also carry parasites that can be harmful to humans and animals.

8. Intentionally Introduced Invasive Alien Species in India

While accidental introductions are more common, there have been instances where invasive alien species were deliberately introduced to India, often with unintended consequences.

9. Motivations for Intentional Introductions

• Agriculture: Introducing plants or animals for food production, such as rabbits brought to Australia for meat.
• Horticulture: Introducing ornamental plants for landscaping, like Kudzu vine in the southern US for erosion control (it quickly became uncontrollable).
• Pest Control: Introducing predators or pathogens to control unwanted pests, like the introduction of the cane toad to Australia to control cane beetles (the toads had a much wider diet and became a bigger problem).
• Pets: Keeping exotic animals as pets, with some escaping and establishing wild populations, like the Burmese python in Florida.
• Fishing and Hunting: Introducing fish or game animals to create new recreational opportunities, potentially disrupting the existing ecosystem.
• Aquaculture: Introducing fish species for commercial fish farming, with some escaping and impacting native fish populations.

10. Problems with Intentional Introductions

• Lack of understanding: Sometimes, the introduced species' ecological impact isn't fully understood, leading to unintended consequences.
• Escape and establishment: Introduced species may escape captivity or spread beyond intended areas, establishing themselves in the wild.
• Competition with native species: They can compete with native plants and animals for resources, leading to population decline.
• Predation: Introduced predators may have no natural enemies in the new environment, allowing them to prey heavily on native species.
• Disease transmission: Introduced species can carry diseases that can harm native species or even humans.

Some glaring examples and the problems they are creating are as below:

• *Prosopis juliflora* (VilayatiKikar): Introduced in the 19th century for its fast growth and ability to thrive in arid regions, VilayatiKikar was seen as a solution for reforestation and soil stabilization. However, it proved to be highly invasive, displacing native vegetation, depleting groundwater due to its deep root system, and reducing land productivity.

• *Opuntia Dillenii* (Prickly Pear Cactus): Introduced in the 18th century as a potential cochineal insect host (used for red dye production), the prickly pear cactus became invasive in many parts of India. Its spines hinder grazing and land use, and its dense growth can crowd out native plants.

• *Gambusia affinis* (Western Mosquitofish): Introduced in the 1920s for mosquito control, the western mosquitofish turned out to be a predator of native fish species and amphibian larvae. This disrupted aquatic food webs and contributed to the decline of amphibian populations.

• Rainbow Trout (*Oncorhynchus mykiss)*: Introduced for recreational fishing in the Himalayas, rainbow trout compete with native fish species for food and habitat. They can also alter spawning grounds and disrupt aquatic ecosystems.

These examples highlight the importance of careful evaluation before intentionally introducing any new species. Why these attempts backfired?

• Lack of ecological understanding: The potential ecological impacts of these introductions weren't fully understood at the time. The focus was on the intended benefits, like reforestation or mosquito control, without considering the broader ecological consequences.

• Unforeseen consequences: Introduced species can have complex interactions with the existing ecosystem. They may compete with native species for resources in unanticipated ways, or predate on organisms that weren't considered vulnerable.

11. Preventing Accidental Introductions

• Stricter biosecurity measures: Increased inspections at borders and regulations on the import of certain goods can help prevent the introduction of new invasive species.
• Public awareness campaigns: Educating the public about the risks of transporting invasive species and encouraging responsible pet ownership can help reduce accidental introductions.
• Improved ballast water treatment: Technologies for treating ship ballast water to remove organisms are crucial in preventing the spread of aquatic invasive species.
• Careful gardening practices: Choosing native plants for landscaping and properly disposing of unwanted plant material can help prevent the spread of invasive species.

11.1. Prevention and Control

• Biosecurity measures: Stricter regulations and inspections can help prevent the introduction of new invasive species.
• Habitat restoration: Restoring native habitats can make them less vulnerable to invasion.
• Eradication and control programs: In some cases, it may be possible to remove or control established invasive populations.

12. Conclusion

By implementing preventative measures and raising awareness, we can significantly reduce the risk of accidental introductions and protect our ecosystems from the harm caused by invasive alien species. Careful planning and a focus on preventing the introduction of invasive species are essential for protecting ecosystems and preventing future environmental problems. Invasive Alien Species are a serious global problem, but by taking action to prevent their introduction, control their spread, and restore native habitats, we can help to protect our planet's biodiversity and well-being.

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Bio composting and manuring: A way towards sustainable agriculture

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Abstract

The most economical and environmentally beneficial way to turn agricultural waste into a product that improves soil and feeds plants is through composting technology. Among the many advantages of composting are improved soil fertility, enhanced soil micro-biodiversity, increased agricultural productivity with less ecological dangers and suitable environment. A series of diverse microbial communities with specialized roles carry out the microbiological process of composting. A native population of microorganisms from the environment is present in the majority of agro-wastes.

1. Introduction

1.1. Manure and its preparation

The word "manure" originated from the "manoeuvrer," a French verb which means to operate, manipulate to produce a crop. Manure can be defined as an organic substance that comprises decomposed crop waste, fruit, vegetable peels, animal manure, etc. (Wu and Ma 2015). These decomposed material are source of variety of nutrients to the plants.

They are chemical-free, boost soil productivity and increase crop yields. In Indian agriculture, manure has traditionally been the main approach for soil enrichment before the green revolution. The non-selective use of fertilizers of chemical origin adversely affects the soil health, structure and microbiota in soil (Erisman et al. 2008). The bioaccumulation of inorganic fertilizers in plants and animals may have detrimental impacts on human health.

Therefore, the organic manure is one of the best alternatives to enhance production and improvement of soil health. It is not only cheaper, but easily available and ensures sustainable agriculture too.Because of the outbreaks of diseases, many farmers are switching to organic farming.

Organic manure is divided into two categories: light organic fertilizers and heavy organic fertilizers. These categories are used to categorize the many types of organic fertilizers that are sold on the market (Das 2020)

A. Bulky Organic manure
a) Compost, Farm Yard Manure,
b) Green Manure
c) Vermicompost
B. Concentrate Organic manure
a) Oil cakes
i) Edible Cake: Sunflower cake, Peanut cake, Mustard cake.
ii) Non-Edible cake: Castor cake, Neem cake, mahua cake,
b) Blood Powder
c) Bone Powder

2. Farm Yard Manure, Compost

The FYM is a mixture of litter or crop straw, waste of farm animals, mainly cattle, sheep, poultry, leftover fodder of cattle's and other domestic waste such as ash etc. The FYM composition consists N (0.5%), P2O5 (0 .25 %) and K2O (0.5 %).

Composition of compost is affected by many factors like:
1. Manure source
2. Animals feed
3. Animal age
4. Animal condition
5. Storage and handling
6. Use of litter etc.

The method of collection and storage compost material decides final composition of the manure. Common methods of storing FYM are as follows:

1. Heap method
2. Pit method

3. Beneficial Soil Microorganisms

Several microorganisms play important role in manure formation. These includes *Pseudomonas*, *Bacillus*, *Azotobacter*, *Flavobacterium*, and *Corynebacterium* isolates. In addition to *Rhizopus*, *Aspergillus*, *Penicillium*, *Trichoderma*, and Mucor, other fungal isolates are also present in farm yard manure.

Depending on the source of organic wastes manure can be classified as follows:

A. Sheep and goat manure: Faeces of sheep and goats are used to make manure. It is considered to havemore nutrients than chemical fertilizers. This manure reported to consists N2(3 %), P2O5 (1 %) and K2O (2 %).

B. Poultry manure: - Excreta of birds fermented very quickly and is thus used for making manure. Poultry manure contain high amount of nitrogen and phosphorus as compared to other heavy organic manures. It is reported that if poultry manure is left uncovered, it loses around 50 percent of its nitrogen within 30 days. Average nutrient composition of poultry manure consists of N (1.2 %); P2O5 (1.4 %) and K2O (0.8 %). Other manures of animal origin are horse manure and swine manure.

C. Green manure

Green manure crops are raised as separate crop in the field or as an intercrop with the primary crop and are suppressed there before maturing. The green twigs and leaves, are spread out over the field and covered with soil. The plants that are used for making green manure known as green manure crops. Plants of leguminous family, are commonly used for green manure. It is reported that the application of phosphate fertiliser enhance the nitrogen fixation in leguminous green manure crops. There are two categories of green manure:

a) In situ manuring: In situ manuring the green manure crops are grown and buried in the same field, either as a pure crop or as an intercrop with the main crop. The common green manure crops grown under this system are Cowpea *(Vignasinensis)*, Daincha *(Sesbaniaaculeata)*, Green gram *(Vignaradiata)*, sunnhemp (*Crotalaria juncea*), Berseem *(Trifolium)*, Khesari *(Lathyrussativus)*, Pillipesera *(Phaseolustrilobus),and* guar *(Cyamopsistetragonoloba)*.

b) Ex-situ manuring: In this type of practiceshrubs, herbs, twigs of trees, green leaves are collected from elsewhere. Green leaves are collected from shrubs and trees grown on wastelands, bunds, and forest areas. The common shrubs and trees used are Karanj *(Pongamiapinnata)*, *Glyricidia*, *Sesbaniaspeciosa*, etc. Other plants used are *Azollafiliculoidea*, , *Azollapinnata*, *Aeschynomeneaspera*, *Cassia auriculata*, *Calotropis gigantean*, *Cyamopsistetragonoloba,Cassia siamea*.

Important points of green manure: -

1. Green manure is inexpensive and effective method to improve soil fertility.
2. Legumes are the best source of green manure. It used as a cover crop.
3. Optimum dosage is 4 to 5 t/ha.
4. Green manure used as a source of ammonium sulphate or urea.

4. Compost

Compost is a useful humus-like material obtained through the process of decomposition of organic wastes. Organic wastes are microbiologically transformed into humus and mineral nutrients by the combined action of bacteria, fungi, and actinomycetes (including agricultural residues, city garbage, industrial wastes, and animal wastes). The quality of compost is primarily determined mainly by four factorsie type of organic material, air, moisture, and temperature.
Generally, the term compost refers to compost created from agricultural waste, like paddy straw, sugarcane waste, weeds and other plant debris. Farm compost consists of 0.15% P_2O_5, 0.5% N and 0.5% K_2O.By adding rock phosphate orsuperphosphate at a rate of 10-15 kg/t of raw material, the nutrient component of farm compost can be enhanced.Town compost is another type of compost prepared from municipal waste such as street sweepings and trash from dustbins. Itmainly consists of N (1.4%), P_2O_5 (1.00%) and K_2O (1.4%).

Microbial inoculates other than the natural strains of substrate materials have been used to enrich the compost and to make it efficient. It is not possible to meet the ecological and physiological demand of the phosphate and nitrogen fixing bacteria in natural environmentsand thus specific requirements are provided to them. Hence inoculates are added to the heaps of compost. The addition of low cost nitrogen and phosphate solubilizing microb
es improves the nutrient status of product multiple times. These microbes are helpful in breaking down of the organic material into smaller fragments. Specific growth conditions with 50% humidity and 50% aeration of total pore space of the substrate is provided. Stacking and regular turning of the compost helps in the accomplishment of the above. Enough quantity of nitrogen is required to the microbes to multiply and reproduce. 20:1 to 30:1 is the optimum C:N ratio of the composting material.

5. Materials Needed to Make Compost

5.1. Waste

a. Green waste

Green waste is highly rich in nitrogen and includes the young weeds, droppings of chicken, rabbit and pigeon manure,grass cuttings etc. It also includes fruits, vegetable scraps, rot remains of vegetables, flowers and plant materials. Basically it triggers the heat process in the compost.

b. Brown waste

Brown waste being rich in carbon includes the dry litters, dead remains of plants, dry leaves and weeds without seeds, straw, hay and old dry flowers. It is highly rich in carbon and includes the fiber part of the manure.

5.2. Air

To digest the organic matter, the microorganisms, need oxygen. The oxygen is needed both for the survival and to carry the other necessary functions in microbes. The microorganisms release carbon dioxide which must be expelled in the air. Proper aeration is needed for the beneficial organisms to carry out the decomposition because theanaerobic ones will thrive well in the absence of air and slow the process of decomposition. The anaerobic digestion of compost will lead to unpleasant odour.Thus to allow an influx of air, a layer of coarse material or twigs is added at the bottom of the heap.

5.3. Water

Moisture is the utmost requirement for the microorganisms,present in the heap to flourish, survive and proliferate. The activity of organisms may slow down or cease if the heap is too dry. In other case if the heap becomes too damp the composting microbes perish due to lack of oxygen. Instead of decomposing the heap gets fermented. So appropriate amount of water and moisture is needed for the proper decomposition of heap.

5.4. Temperature

A very crucial role is played by the temperature prevailing in the compost which helps in decomposition. Temperature is also a good indicator of the microbial activity. In total four phases are significant during the composting process.
1. The first one is the mesophilic phase-100 to 420 C, where the temperature rapidly rises and organic matter decomposition gets initiated.
2. Second one is the thermophilic phase-450-700 C which is undertaken by endogenous microorganisms for prolonged high temperatures and marked by extensive metabolic activities.
3. The middle phase accounts for the mesophilic phase (650-500C) in which the temperature gets decreased allowing the heat resistant microbes to carry the function.
4. The finishing phase 500-230 C, in which there is stabilization of organic matter and biological heat production.

5.5. Soil or starter compost
It is not technically necessary, but a thin dusting of garden soil or freshly finished compost between layers will assist to introduce the beneficial bacteria and start the compost cycle a little more quickly.

6. Advantages of using a compost
1. The soil structure, porosity, and density is increased thus a better plant root and soil interaction is achieved.
2. Erosion and run-off of the soil is curbed by increasing soil infiltration and permeability.
3. Enhances water holding capacity of the soil, reducing water loss and leaching in sandy soils.
4. Macro and micro-nutrients are readily supplied to the soil making it nutrient rich.
5. Suppression of soil borne plant diseases.
6. Organic matter is added to the soil in large amounts.
7. Soil ability to hold large number of nutrients is increased.
8. Improvements and stabilization of soil pH.
9. Healthy microbial activity.
10. Plants survive in healthy and good environment increasing their yields.

7. Conclusion

Environmental deterioration and poor soil health are allconsequences of mismanaged farms and misuse of agrochemicals. Microbes can replenish the soil nutrients and vanish the waste by simply digesting and giving a sustainable solution for agriculture. Bio composting and manuring is one such cost-effective technology that has implications on the economy, environment, and society at large. It works by converting kitchen and agricultural waste into a valuable product that improves crop growth and quality. The production procedure does not include the use of chemicals and has no after-effects upon application.

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Alien Invasive Species, Biodiversity Loss and Climate Change: A Viral Trinity of Disaster in the Making

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1. Introduction

Invasive alien species (IAS) are organisms that are introduced by humans into a place that is not their natural habitat, and negatively affect the environment, economy, or even human health. They are considered one of the major threats to biodiversity loss globally.

IAS can be introduced unintentionally/accidentally through things like contaminated cargo or on the hulls of ships. While most introductions of invasive alien species (IAS) are accidental, there are instances where humans deliberately introduce them for various reasons, often with unforeseen consequences.

2. Ecological impact of Invasive Alien Species in India

India is a host to incredible biodiversity but now faces significant threat from invasive alien species (IAS). These introduced species wreak havoc on native ecosystems, causing a multitude of problems.

The ecological impact of invasive alien species in India is a complex issue with cascading effects. The loss of biodiversity, altered ecosystem processes, and threats to water resources all contribute to the degradation of natural ecosystems and can have negative consequences for human well-being.

Here's a closer look at the specific ecological impacts of IAS in India:

2.1. Loss of Biodiversity

• Competition: Invasive plants like *Lantana camara(Lantana)* and *Parthenium* weed (Congress grass) aggressively compete with native vegetation for light, water, and nutrients. This outcompete native species, leading to their decline and potential extinction, especially those with specific ecological niches.

• Predation: The introduction of the *Nile Tilapia* for aquaculture has resulted in competition and predation on native fish species, disrupting food webs and altering the balance of aquatic ecosystems.

• Habitat Alteration: Invasive aquatic plants like Water Hyacinth and *Salvinia molesta* form dense mats, blocking waterways and hindering light penetration. This disrupts aquatic ecosystems and reduces habitat suitability for native fish and amphibians.

2.2. Disrupted Ecosystem Processes

• Pollination: The spread of invasive ornamental plants can attract pollinators away from native flowering plants that depend on them for reproduction. This disrupts pollination processes and seed production of native plants.

• Nutrient Cycling: The decomposition rates and nutrient cycling processes of invasive species often differ from native species. This can lead to imbalances in nutrient availability in the ecosystem, impacting overall plant growth and health.

• Fire Regimes: Certain invasive grasses like *Chromolaena odorata* (Christmas bush) are more flammable than native vegetation. This increases the frequency and intensity of wildfires, further disrupting ecosystems adapted to natural fire regimes.

2.3. Water Resources

• Water Scarcity: Many invasive plants, like *Prosopis juliflora* (VilayatiKikar), have deep root systems that deplete groundwater resources. This can exacerbate water scarcity issues in arid and semi-arid regions of India.

• Water Quality: Soil erosion caused by invasive plants can lead to increased sedimentation in rivers and lakes. This reduces water quality by affecting aquatic life and hindering its use for drinking and irrigation.

• Soil Erosion: Invasive plants with weak root systems, like Parthenium weed, contribute to soil erosion. This reduces soil fertility and productivity, impacting agricultural yields.

• Public Health: Certain invasive plants can trigger allergic reactions or cause respiratory problems due to pollen allergies (e.g., Parthenium weed).

3. Invasive Alien Species, Biodiversity Loss and Species Extinction

Invasive alien species (IAS) are one of the leading drivers of biodiversity loss around the world and India is no exception. IAS threatens India's rich biodiversity:

They can outcompete and displace native species, leading to the decline or complete elimination of native populations. The IUCN states that the impacts of invasive alien species are "immense, insidious, and usually irreversible", causing the irretrievable loss of native species and ecosystems. Hundreds of extinctions have been directly caused by invasive alien species.

3.1. Disruption of Native Ecosystems

Invasive species can alter the physical and chemical properties of habitats, disrupting the structure and function of native ecosystems. They can act as predators, herbivores, or parasites, fundamentally changing the dynamics of food webs and energy flows. The introduction of new diseases and pathogens by invasive species can also devastate native wildlife populations.

3.2. Direct Competition

• Resource Depletion: IAS compete with native plants and animals for essential resources like food, water, and space. This can lead to population decline and even extinction of native species, especially those with specialized niches or limited resources.

• Predation: Invasive predators can have a devastating impact on native prey populations. For example, the Indian mongoose, introduced to control snakes, now preys on a variety of native birds, reptiles, and small mammals.

3.3. Habitat Alteration

• Physical Changes: Invasive plants can physically alter habitats, making them unsuitable for native species. For example, fast-growing climbers like Lantana camara can smother trees, reducing light penetration and altering the forest structure.

• Chemical Changes: Some invasive plants release allelopathic chemicals that suppress the growth of other plants. This can prevent native species from regenerating and create monocultures dominated by the invasive species.

3.4. Disrupted Ecological Processes

• Pollination: The spread of invasive ornamental plants can attract pollinators away from native flowering plants that depend on them for reproduction. This disrupts pollination processes and seed production of native plants.

• Seed Dispersal: Some invasive plants rely on animals for seed dispersal. This can alter dispersal patterns and disrupt the regeneration of native plant communities.

• Nutrient Cycling: The decomposition rates and nutrient cycling processes of invasive species often differ from native species. This can lead to imbalances in nutrient availability in the ecosystem, impacting overall plant growth and health.

3.5. Cascading Ecological Impacts

• The loss of native species and disruption of ecosystems can trigger cascading effects, impacting other interdependent species and the overall health of the environment. This can lead to a downward spiral of further biodiversity loss and ecosystem degradation.

• Invasive species can also have significant economic impacts, reducing the productivity of agriculture, forestry, and fisheries. They can also harm human health by transmitting diseases, causing allergies, or being poisonous.

The long-term effects of invasive alien species on biodiversity are severe and far-reaching, leading to the irreversible loss of native species and the degradation of entire ecosystems. Addressing this growing threat is crucial for protecting global biodiversity.

4. Some examples of significant damage to biodiversity

• Parthenium Weed: This aggressive weed outcompetes native vegetation and releases allelopathic chemicals, suppressing the growth of other plants and reducing biodiversity in grasslands and wastelands

• Zebra mussels (*Dreissena polymorpha*): Native to the Caspian and Black Seas, zebra mussels have affected fisheries, mollusc diversity, and electric power generation in the Great Lakes in North America and the Mississippi basin.

• Water hyacinth (*Eichhornia crassipes*): Originating from the Amazon basin, water hyacinth has invaded tropical habitats worldwide, spreading to more than 50 countries on five continents. It blocks waterways, decimates aquatic wildlife, affects local livelihoods, and creates ideal conditions for disease and its vectors.

• Ship rat (*Rattus rattus*): Native to the Indian sub-continent, ship rats have caused extinctions and catastrophic declines of native birds on islands and have spread globally.

• Avian influenza A (H5N1):This deadly new disease organism attacks humans and animals in both temperate and tropical countries, posing a significant threat to biodiversity and human health.

These examples highlight the diverse range of invasive alien species that have had detrimental impacts on ecosystems, wildlife populations, and human well-being around the world.

5. Invasive Alien Species and Climate Change

Invasive species and climate change are two environmental threats that create a vicious cycle, amplifying each other's negative impacts. Here's how they interact:

5.1. Climate change creating opportunities for invasive species

• Warmer temperatures: Rising temperatures can expand the geographic range of invasive species, allowing them to move into areas that were previously unsuitable for them. For example, with warmer winters, some insects that were limited by cold temperatures can now survive and establish themselves in new regions.

• Changes in precipitation: Altered rainfall patterns can create opportunities for invasive species adapted to drier or wetter conditions to thrive. This can disrupt existing ecosystems and make them more vulnerable to invasion.

• More extreme weather events: Increased frequency and intensity of storms, floods, and droughts can damage native ecosystems, creating openings for invasive species to establish themselves in the disturbed areas.

• Melting glaciers and sea ice: As polar regions warm, new shipping routes open up, increasing the risk of accidental introductions of invasive species through ballast water discharge or on hulls of ships.

5.2. Invasive species worsening climate change

• Reduced carbon sequestration: Invasive plants can be less efficient at capturing and storing carbon dioxide compared to native species. This can contribute to higher atmospheric CO_2 levels and accelerate climate change.

• Disrupted natural processes: Invasive species can disrupt natural processes that regulate climate, such as nutrient cycling and water flow. This can make ecosystems less resilient to the effects of climate change.

• Increased wildfires: Some invasive plants are more flammable than native species, increasing the risk and intensity of wildfires. Wildfires release greenhouse gases back into the atmosphere, further worsening climate change.

• Soil erosion: Invasive plants with aggressive root systems can increase soil erosion, which can release stored carbon into the atmosphere and degrade land quality.

5.3. Invasive species Reduce natural carbon sequestration

Invasive species can significantly reduce carbon sequestration, hindering our fight against climate change. Here's how:

5.3.1. Mechanisms of Reduced Carbon Sequestration

• Competition with Native Plants: Invasive plants compete with native vegetation for light, water, and nutrients. Native plants, particularly trees, often store more carbon than invasive species. When invasive plants outcompete natives, the overall carbon storage capacity of the ecosystem declines.

• Changes in Ecosystem Processes: Invasive species can disrupt the natural processes that govern carbon sequestration. For example, they may alter soil composition, nutrient cycling, and water flow. This can lead to a decrease in the ability of the ecosystem to absorb and store carbon dioxide from the atmosphere.

• Increased Disturbance: The spread of invasive species can destabilize ecosystems, making them more prone to disturbances like wildfires and insect outbreaks. These disturbances release stored carbon back into the atmosphere, further reducing overall carbon sequestration.

• Reduced Forest Health: Invasive species can damage native trees and forests. This can weaken trees, making them less efficient at capturing carbon dioxide. Additionally, invasive plants that are more flammable than native species can increase the frequency and intensity of wildfires, leading to large-scale carbon losses.

6. Specific Invasive Species Impact

• Kudzu Vine: This invasive vine smothers trees in forests, preventing them from reaching their full growth potential and reducing their ability to store carbon.

• Brown Marmorated Stink Bug: This insect damages agricultural crops, leading to deforestation for new planting areas. This deforestation reduces overall carbon storage capacity.

• Emerald Ash Borer: This invasive beetle kills ash trees. Ash trees are a valuable carbon sink, and their loss significantly reduces carbon sequestration in affected areas.

Healthy ecosystems dominated by native plants are much more effective at storing carbon than ecosystems invaded by non-native species. Protecting and restoring native ecosystems is crucial for maintaining and enhancing their carbon sequestration potential.

The impact of invasive species on carbon sequestration varies depending on the specific species and the invaded ecosystem.Controlling invasive species populations and restoring native ecosystems are essential steps to mitigate their negative effects on carbon sequestration.Invasive species management can be a powerful tool in the fight against climate change, alongside efforts to reduce greenhouse gas emissions directly.

7. Invasive species and Increased Wildfire Risk

Invasive species are a major factor contributing to the increased frequency and intensity of wildfires, creating a dangerous feedback loop. Here's how they contribute to the problem:

7.1. Fueling Fires:

• Increased Biomass: Many invasive plants are fast-growing and produce large amounts of flammable material like leaves and twigs. This creates a heavy fuel load that dries out quickly and burns hotter, leading to more intense wildfires. Examples include cheatgrass in the western US and gamba grass in South Africa.

• Greater Fuel Continuity: Invasive plants often grow in dense stands, creating a continuous layer of fuel across the landscape. This allows fires to spread more easily and quickly, making them harder to contain. Cheatgrass, for instance, creates a continuous fine fuel layer that replaces native bunchgrasses which burn less intensely.

• Altered Fire Regimes: Some invasive plants can change the natural fire cycle of an ecosystem. For example, they may be more flammable than native species, leading to more frequent fires. Additionally, they can prevent the establishment of fire-resistant native plants, making the ecosystem more susceptible to future fires.

Examples:

• Cheatgrass: This invasive grass has transformed fire regimes in the western US. It dries out earlier in the season than native bunchgrasses, creating opportunities for earlier and more frequent wildfires.

• Buffelgrass: This invasive grass in arid regions like Australia increases fire risk by creating a dense fuel layer and promoting more frequent fires, which reduces native vegetation and creates a cycle favoring buffelgrass.

7.2. The Invasive Wildfire Cycle:

1. Invasion: Invasive plants establish themselves in an ecosystem.
2. Fuel Accumulation: These plants create a heavy fuel load of dry, flammable material.
3. Increased Fire Risk: The presence of invasive plants makes the area more prone to wildfires.
4. Fire Occurrence: Lightning strikes, human activity, or other factors can ignite wildfires.
5. Post-Fire Advantage: Invasive plants are often adapted to survive fire and can quickly recolonize burned areas, hindering the recovery of native vegetation.
6. Repeat Cycle: The cycle repeats, with invasive plants becoming more established and further increasing fire risk.

7.3. Combating the Threat

• Invasive Species Control: Efforts to prevent the introduction and spread of invasive plants, as well as controlling existing populations, are crucial to reduce wildfire risk.
• Prescribed Burns: Controlled burns conducted by fire professionals can help reduce fuel loads and create firebreaks, mitigating the severity of wildfires when they inevitably occur.
• Native Plant Restoration: Restoring native plant communities can help create more fire-resistant landscapes. Native plants are often adapted to the natural fire cycle of the ecosystem and can help break the cycle of frequent, intense wildfires fueled by invasive species.

8. Invasive species and soil erosion

Invasive species can significantly accelerate soil erosion, harming agricultural productivity, water quality, and overall ecosystem health. Here's how they contribute to the problem:

8.1. Mechanisms of Increased Erosion

• Reduced Plant Cover: Invasive plants can displace native vegetation, leaving the soil exposed to wind and rain. Without the protective cover of plant roots, soil particles are more vulnerable to being washed or blown away.

• Weak Root Systems: Some invasive plants have shallow or weak root systems that don't hold soil in place as effectively as native plants. This can lead to increased erosion, especially on slopes.

• Changes in Soil Properties: Certain invasive plants can alter soil composition and structure. For example, they may decrease organic matter content or disrupt the natural balance of soil microbes. This can make the soil more prone to erosion.

• Increased Fire Risk: As discussed earlier, invasive plants can contribute to more frequent and intense wildfires. These fires can destroy vegetation and organic matter, leaving the soil exposed and vulnerable to erosion.

• Livestock Grazing: Invasive plants may provide less palatable food for grazing animals compared to native species. This can lead to increased pressure on native vegetation, further reducing overall plant cover and accelerating erosion.

8.2. Impacts of Soil Erosion

• Reduced Agricultural Productivity: Erosion removes fertile topsoil, the most productive layer of soil for agriculture. This can lead to decreased crop yields and lower agricultural output.

• Water Quality Issues: Eroded soil can wash into rivers and streams, increasing sedimentation and harming aquatic ecosystems. Excess sediment can also clog waterways and reduce water quality for human use.

• Loss of Biodiversity: Erosion can degrade habitat quality and reduce the diversity of plant and animal life in an area.

8.3. Combating Soil Erosion

• Controlling Invasive Species: As with the other environmental problems we discussed, managing invasive plant populations is crucial.

• Planting Native Vegetation: Restoring native plant communities with deep-rooted species can help stabilize soil and prevent erosion.

• Sustainable Land Management Practices: Techniques like terracing, cover cropping, and no-till farming can help reduce soil erosion caused by agricultural activities.

• Controlled Grazing: Properly managed grazing practices can help maintain healthy vegetation cover and reduce the pressure on native plants.

9. Impact of Alien Invasive Species on Agriculture in india

Invasive species pose a significant threat to agriculture in India, causing substantial economic losses and impacting food security. The economic impact of invasive species on Indian agriculture is substantial. The impact is not uniform across India. Different regions and crops are affected by varying invasive species.Climate change is likely to worsen the situation by creating favorable conditions for the spread and establishment of invasive species.

9.1. Reduced Crop Yields

Invasive plants compete with crops for vital resources like water, sunlight, and nutrients. This competition can significantly reduce crop yields, impacting the income and livelihoods of farmers. For instance, Parthenium weed (Congress grass) is a major agricultural pest that can decrease crop yields by up to 40%.

9.2. Increased Crop Damage

Some invasive herbivores, like locusts and grass carp (introduced for weed control but escaped into waterways), can directly damage crops by feeding on them. This can lead to significant losses of agricultural produce.

9.3. Spread of Plant Diseases

Invasive plants can act as alternate hosts for plant pathogens and diseases that harm crops. This can necessitate increased use of pesticides, raising production costs and potential environmental concerns.

9.4. Increased Need for Weed Control

The presence of invasive plants necessitates additional weed control measures. This can involve increased labor costs, use of herbicides, and potential harm to beneficial insects and other organisms if not managed carefully.

9.5. Clogged Irrigation Systems

Fast-growing aquatic weeds like water hyacinth can clog irrigation canals and waterways, hindering water flow and disrupting irrigation practices crucial for agriculture.

9.6. Reduced Land Availability

Invasive species can take over pastures and grazing land, reducing the availability of land for livestock rearing. This can impact milk and meat production, affecting food security and livelihoods dependent on animal husbandry.

10. Health Impact of Invasive Alien Species

Invasive species can have a surprising impact on human health in India, affecting people in several ways:

• Spread of Diseases: One of the most concerning ways invasive species impact human health is by introducing new diseases or parasites. These organisms may not have natural predators or controls in the new environment, allowing them to spread rapidly and infect humans or livestock. For example, the giant African snail, an invasive species in India, can carry parasites that cause meningitis in humans.

• Allergic Reactions: Many invasive plants produce pollen or other substances that can trigger allergic reactions in people. This can lead to symptoms like hay fever, asthma, and skin irritation. Parthenium, commonly known as Congress grass in India, is a notorious invasive weed that causes widespread allergic respiratory problems.

• Indirect Impacts on Food Security: Invasive species can significantly reduce agricultural yields and disrupt food production. This can lead to food insecurity and malnutrition, which can weaken immune systems and make people more susceptible to diseases.

• Competition for Resources: Invasive species can compete with humans for vital resources like water. This can be particularly problematic in areas already facing water scarcity, where invasive plants can consume large quantities of water, impacting drinking water availability.

• Increased Risk of Injuries: Some invasive species, like certain types of aggressive fish or stinging insects, can pose a risk of injuries to humans. This can range from bites and stings to more serious injuries depending on the species.

• Children, elderly people, and those with compromised immune systems are often more vulnerable to the health risks posed by invasive species.

11. Solving the Problem of Invasive Alien Species spread

To address the problem of invasive alien species, it is crucial to implement a combination of prevention, control, and management strategies. Here are key solutions based on the provided sources:

11.1. Prevention

Preventing new introductions of invasive species is essential. This can be achieved through stricter regulations on international trade, inspections at ports to detect stowaway organisms, and tougher penalties for illegal trade in exotic pets.Avoiding the movement of potential invasive species through measures like not transporting firewood and cleaning hiking and fishing gear can also help prevent their spread.

Here's a breakdown of some key steps:

11.1.1. Preventing Introduction:

• Stricter Biosecurity: Implementing stricter regulations and inspections at borders can help prevent the introduction of new IAS. This includes inspecting cargo, ship ballast water, and personal belongings for signs of unwanted organisms.

• Public Awareness Campaigns: Educating the public about the risks of transporting or releasing exotic plants and animals is crucial. Campaigns can raise awareness about responsible pet ownership, avoiding the planting of invasive ornamentals, and proper disposal of unwanted plant material.

• International Cooperation: Collaboration between countries is essential for effective biosecurity measures. Sharing information about invasive species and implementing common standards for border control can significantly reduce the spread of IAS.

11.2. Controlling Established Populations:

• Early Detection and Rapid Response: Early detection of new infestations allows for quicker action to contain and potentially eradicate the invasive species before it becomes widespread. Regular monitoring programs are vital for this purpose.

• Eradication Programs: For newly established populations, eradication efforts can be attempted using various methods like mechanical removal, targeted herbicides or pesticides, or the introduction of biological control agents.

• Control Methods: For widespread infestations, complete eradication might not be feasible. The focus then shifts to controlling the population through a combination of methods mentioned above. This can help minimize their impact on the ecosystem.

11.3. Restoration of Impacted Ecosystems

• Habitat Restoration: Restoring degraded habitats can make them less vulnerable to invasion by IAS. This may involve planting native vegetation, removing invasive plants, and restoring natural processes like fire regimes.

• Species Reintroduction: In some cases, reintroducing native species that have been driven out by IAS can help restore the balance of the ecosystem and create a natural defense against future invasions.

• Research and Development: Investing in research on effective control methods, potential biocontrol agents, and the ecological impacts of specific IAS is crucial for developing better management strategies.

• Public Participation: Encouraging citizen involvement in monitoring programs, volunteer efforts for removing invasive plants, and supporting organizations working on IAS control can significantly contribute to the fight.

11.4. Controlling invasive species populations involve

• Eradication or control programs to reduce invasive species populations.

• Improved sanitation and hygiene practices to reduce the spread of diseases associated with invasive species.Medical research to develop better diagnostics and treatments for diseases introduced by invasive species

11.5. Efforts to manage invasive species in agriculture involve a combination of approaches

• Preventative measures: Stricter biosecurity controls to prevent new introductions.

• Mechanical and manual removal: Removing invasive plants physically.

• Biological control: Introducing natural predators or competitors of invasive species.

• Herbicide use: Careful and targeted use of herbicides to control invasive plant populations.

11.6. Combating invasive alien species (IAS) requires a multi-pronged approach that involves preventing their introduction, controlling established populations, and restoring impacted ecosystems. By implementing a comprehensive strategy fostering a collaborative approach to manages invasive specieswe can significantly reduce the threat posed by invasive alien species and protect our planet's precious biodiversity, ensure food security, and safeguard the livelihoods.

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Sea buckthorn (Hippophae rhamnoides L.)-a wonderful stress-resistant and ecologically adaptable medicinal plant of the Himalayan cold desert region

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Abstract

The Himalayan region, including the cold deserts, contains India's richest storehouse of medicinal herbs. Cold deserts of India occur mainly in Lahaul-Spiti regions, upper parts of Chamba and Kinnaur in Himachal Pradesh, Uttarakhand and Ladakh region in Jammu and Kashmir. The thorn plant naturalizes during snowfall period in upper Himalays. In Himachal Pradesh, it is locally known as 'Chharma' and grows wild in Lahaul-Spiti and upper parts of Kinnaur. The plant is a shrub that produces an orange-yellow edible berry. The berry has a sour taste, but is rich in vitamins, especially vitamin C, E and K. This thorn plant contains various bioactive components including vitamins, carotenoids, flavonoids, phenolic acids, flavones and fatty acids etc. These components have a wide range of health benefits due to their antioxidant, anti-inflammatory, anti-cancerand antimicrobial properties. In addition, the thorn plant is a soil-binding plant that helps preserve floral diversification and stops river siltation and soil erosion.

1. Introduction

Sea buckthorn, a deciduous shrub of the genus *Hippophae* in the family Elaeagnaceae, is also referred to as vinegar willow, sour thorn, and blackthorn. The plant is a pioneering species of tree for improving soil, reducing wind and sand, and conserving water and soil. The Sea buckthorn Association of India estimates that this plant covers over 15,000 hectares of land in Himachal Pradesh, Uttarakhand, Sikkim, and Arunachal Pradesh. There are numerous ecological, medicinal and economic benefits associated with the seabuckthorn plantation. Fruits, leaves, stems, branches, roots, and thorns- are all parts of this plant that have historically been utilized in medicine, as dietary supplements, for preserving soil and moisture, and to provide habitats for wildlife. As a result, sea buckthorn is also referred to as "Gold Mine," "Wonder Plant," or "Golden Bush" (Stobdan et al., 2013). Sea buckthorn is a plant of significant ecological and commercial value. The International Sea Buckthorn Association (ISA) was founded in 1999 by China, India, Canada, and other nations to promote the benefits of sea buckthorn for human health, economic development, and environmental conservation. The medicinal benefits of sea buckthorn have become more widely known in recent years, and numerous nations are starting to acknowledge and establish a sea buckthorn business.

2. Morphology

Seabuckthorn is a member of the Elaegnaceae family, which is the largest group of flowering plants. In general, it is 1–8 m high. The lanceolate or linear leaves typically measure 3-8 cm in length and 7 mm in width. The leaves have a distinguishing silver-gray lower surface and a dark gray upper surface. The fruits are 8 mm in diameter and are spherical or ovate in shape. Usually, a number of fruits with ruffled surfaces and an orange-yellow or brownish-red tint are pressed together. The pulp has a soft texture and is greasy. The sea buckthorn seed is obliquely oval, measuring around 4 mm in length and 2 mm in width. The seeds have a longitudinal groove in the middle and are lustrous and brown.

3. Bioactive compounds

Rats treated with standardized doses of Sea buckthorn pulp oil (10 ml/kg) and seed oil (2 ml/kg) had a strong cardioprotective effect against myocardial injury, according to biochemical, histological, and physiological studies conducted by AIIMS, New Delhi. Rich in vitamins (C and E), minerals, and crude protein, Sea buckthorn leaves and fruit waste create high-quality feed for poultry and dairy animals.

Nearly 200 minerals and bioactive components can be found in sea buckthorn (Wang et al. 2021). Numerous ingredients are well known for their beneficial effects on health. One of the most vital nutrients in sea buckthorn is vitamin C. The primary bioactive and antioxidant components of sea buckthorn are carotenoids and polyphenolic chemicals, particularly phenolic acids and flavonoids (Ji et al., 2020).

Sea buckthorn's organic acids, minerals, amino acids and phytosterols, all have significant effects. Sea buckthorn's nutritional value is also influenced by its bioactive components and nutrients (Teleszko et al., 2015).

4. Traditional Uses

The sea buckthorn's medicinal properties were initially discovered by the Thracians, Hindus, Greeks, Chinese, Mongols, Celts, and Slavs. Sea buckthorn's historical use in traditional ethnobotanical and ethnopharmacological applications of plant species was first recorded by Ayurvedic physicians Theophrastus and Dioscorides, who suggested feeding sea buckthorn to race horses to help them gain muscle mass (Brad et al., 2002). The people who live in the trans-Himalayan region historically utilized every component of the plant for a variety of reasons, including building construction, ceremonies related to religion, medicine, nutritional supplements, fuel, fencing, tree guards, wind breaks, and agricultural tools.

In the Tibetan medical system, known as 'Sowa Rigpa',which is practiced in Ladakh, Lahul-Spiti, and the Kinnaur valley of the Himalayas, there are more than a hundred well-known formulations based on seabuckthorn (Stobdan et al.,2013). Despite the plant's significance in people's lives, the traditional knowledge of its uses is gradually vanishing as a result of the region's openness to the outside world and the availability of substitutes from other continents. Sea buckthorn has been widely utilized as a folk remedy for skin, heart and stomach issues. Its leaves and fruit are abundant in omega fatty acids, carotenoids, and vitamins, and they can aid in the troops' adaptation of high altitude.

5. Applications in food

Sea buckthorn is being used in an increasing number of food products, including oil, berry powder, seed oil capsules, fruit juice, wine, milk tablets, fruit vinegar beverages, green tea, preserved fruit, yogurt, jam, and so on (Ma et al., 2022).

6. Nitrogen fixation

Because of the Frankia-actinorhizal symbiosis in its root nodules, it has an exceptional capacity to fix atmospheric nitrogen and contributes around 180 kg of nitrogen per hectare annually to the soil (Jike and Xhiaoming, 1992). By forming a symbiotic relationship with rhizobia, sea buckthorn's root nodules are able to fix nitrogen, which transforms atmospheric nitrogen into ammonia that plants can use as a growth source.

An additional benefit of the plant's deep and extensively branching root structure is that it acts as a soil-binder, preventing soil erosion, controlling river siltation, and promoting floral diversification. It has been used in India to grow on sand dunes and beside rivers to prevent soil erosion brought on by wind and water (Negi et al., (1996), Tewari, 2000).

This resilient shrub is an excellent substitute for willow trees, which are rapidly dying in the Lahaul valley as a result of pest infestation. It also helps to preserve the local environment. It thrives in arid climates and gains significant importance, particularly with the reduction in water flow from the Himalayan glaciers.

7. Revenue Generation

Since 2001, gathering sea buckthorn berries has increased in importance as a source of revenue in the Himalayan region. Sea buckthorn farming helps disadvantaged rural people by providing income while also preventing desertification, which is good for the ecology. The majority of berry gatherers come from indigenous women and the underprivileged segments of society. Because sea buckthorn is used to make nutritional capsules, juices, jams, and other products, it also has commercial value. Nevertheless, large-scale cultivation of the plant is required because wild seabuckthorn cannot provide the industry with raw materials in a sustainable manner.

8. Use as fodder and fencing

The thorn plant is used for a variety of purposes in Ladakh, including fencing, fuel, fodder, medicinal, and improving soil fertility (Doijey, 1997). Seabuckthom foliage is incredibly high in minerals, lipids, and protein (Annon., 2003). It has been discovered to increase goat weight gain, chicken egg laying, and cow milk supply (Rongsen, 1991). A common material for house fencing is Sea buckthorn. It is well recognized that planting Sea buckthorn for fencing around agricultural fields increases soil fertility. To increase soil fertility in the Nubra Valley, earth from heavily populated Seabuckthorn areas is frequently blended with soil from low-fertile fields.

In open spaces, Sea buckthorn windbreaks are a useful tool for reducing wind erosion. Sea buckthorn is an excellent choice for windbreak plants since it can withstand the physical harm and drying effects of wind (Ashour et al., 1995, Jiang et al., 1997).

9. Future Prospects

Because of the health, nutritional, and environmental advantages of sea buckthorn, the plant's future seems bright. Its potential in medicines, nutraceuticals, and functional foods is still being investigated. Consequently, this opens up opportunities for more detailed investigations into how they work and their possible uses in medicines. The plants’ability to thrive in challenging environments, its versatility in application, and its valuable nutritional composition make it an attractive option for sustainable agriculture.

To sum up, Sea buckthorn has a long history, a fantastic nutritional profile, and a host of health advantages. Its cultivation, medicinal applications, and usage in various industries make it a plant of great importance. As research and awareness continue to grow, Seabuckthorn's potential will likely be further explored, leading to new discoveries and applications for this wonderful plant.

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From President Desk

Priya Giri

It is with immense joy and profound sense of belonging that i address you as a President of Vasundhara, The Botanical Association of Daulat Ram college.
For me Vasundhara has been a sanctuary a nurturing space that has shaped me and doubtless others into the individuals we are today.As a president of society I am committed to preserving and enhancing this unique spirit of VASUNDHARA, ensuring that it Continues to be a home to all those who seek knowledge, inspiration and personal growth.
It is a place where ideas converge, perspectives collide, and a new path are paved.
It is a place that has witnessed the blossoming of talents, the birth of dreams, and the creation of life long bonds.
As I embark on this incredible journey as your President i am humbled by the opportunity to serve this remarkable community.
I promise to work tirelessly, hand in hand with each one of you, to build upon the legacy of Vasundhara, ensuring that it remains a beacon of inspiration, enlightenment and empowerment.
Vasundhara is not just an Association,it embodies our shared dreams and aspirations. Let us together continue to make Vasundhara a true home a place that forever holds a special place in our hearts.

Students' Section

©Md Salman Raquib, Sem II, BA (Hons.) Spanish, DGRS

Marine Biodiversity and Conservation

Introduction

Marine biodiversity conservation aims to preserve an essential component of the ocean environment, just as all other forms of biodiversity conservation. An ecosystem can have many diverse biotic and abiotic elements, such as mudflats, seamounts, coral reefs, kelp forests, open ocean, and polar ecosystems, all at different levels. Marine biodiversity is essential to the health of ecosystems, the support of coastal livelihoods, and the sustainability of world food security. However, it faces numerous dangers and challenges from human activity, such as pollution, overfishing, habitat destruction, and climate change.

Threats to Marine Biodiversity

Despite its significance, human activities pose a number of dangers to marine biodiversity, such as pollution, overfishing, habitat degradation, and climate change. Fish stocks have decreased, marine food webs have been disrupted, and biodiversity has been lost as a result of overfishing and irresponsible fishing methods. Coral reefs, mangroves, and seagrass beds are examples of important marine habitats that have been negatively impacted by habitat destruction, which includes coastal development, dredging, and bottom trawling. Changes in species distribution,coral bleaching, and habitat loss are some of the consequences of climate change, which also includes rising water temperatures, ocean acidification, and extreme weather events.

Aim and approaches

This is the basic objective of conservation: just as an individual needs many organs, parts, and senses to function correctly, so too does the ocean require all of its constituent parts to sustain its functions and related operations. Programs for conservation have historically concentrated on endangered or threatened species. Government programs were started to conserve those species, whether on a regional, national, or international level. The main goal of these initiatives is to safeguard all threatened species in order to prevent future deterioration or extension in an attempt to preserve all the components. Assessing biodiversity at the seascape level and focusing conservation efforts on high-priority areas is another strategy for conservation.

In order to guarantee the continuous provision of ecosystem services for human well-being, such as seafood production, carbon storage, and water quality regulation, it is also crucial to maintain functional diversity.

Preparing for further climate and global change

The primary obstacle to conserving biodiversity nowadays is the new and growing challenges we face, which necessitates reconsidering long-standing conservation and management strategies. The growth of energy production into the ocean poses numerous risks to fisheries, construction projects, and the Marine Ecosystem Model Intercompanion Project (FISH-MIP).

It is crucial to understand and carry out these conservation planning measures, such as this initiative. In order to maintain marine biodiversity in the future, new MPAs should incorporate it and work to optimize the network of protected areas as a whole. The government should take advantage of the many opportunities the blue economy offers for the preservation and sustainable management of the coastal ecosystem, which also gives rise to indigenous and community-based methods locally.

Solutions

1) Select sustainably farmed seafood: the Biodiversity Council's top recommendation is to
check for the MSC blue fish tick label on seafood products.
2) Reduce the amount of plastic you use: Consider the use of single-use plastics.
3) Recycle: from programs such as Recycle Smart for pickups by the local council
4) Minimize your carbon footprint by consuming less red meat and switching to renewable
energy sources.
5) Pick up trash at the beach; even a small amount each time can have an impact.
6) By contributing to the MSC, you can help us in our effort to put an end to overfishing and
promote sustainable fishing methods.
7)Encourage your neighborhood school to use our free educational tools with an ocean theme
to help promote ocean literacy.

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The Impact of Plastic Pollution on Human Health and Ecosystems

Abstract

Plastic pollution is a significant environmental issue with far-reaching consequences for both human health and ecosystems. This paper examines the diverse effects of plastic pollution, ranging from physical harm to wildlife to potential health risks for humans through the ingestion of microplastics. By exploring the pathways through which plastics enter ecosystems and the potential toxicological effects of plastic-associated chemicals, this paper aims to raise awareness of the urgent need for mitigative actions to address plastic pollution.

Introduction

Plastic is one of the most common materials in the world, but little is known about how it affects human health. The majority of us grew up in a time when the adage "Plastic is amazing or fantastic" greatly influenced our surroundings and made plastic a ubiquitous material. such as containers for food and drink, makeup and toiletries, automobiles, laptop mice, pens, interiors, purses, toys, packaging, flooring, cell phone screens, shoes, and eating utensils, among other things. The effects of plastic pollution are extensive and varied, ranging from the increase in single-use plastics to the buildup of microplastic in our ocean. Despite the fact that plastic has become indispensable to society, we rarely pause to consider the potential health risks associated with this substance.

Plastic with toxic added to it to improve its qualities These addictive substances can enter the body through the skin, evaporate into the atmosphere, or be absorbed through food or beverages.

Plastic and Health at a glance

Humans are contaminated by a wide range of hazardous substances and some microplastics by ingestion, inhalation, and direct skin contact. An average person may be consuming about 5 grams of plastic every week, according to WWF. Plastic has been shown to have harmful health impacts, including the potential to cause cancer and disturb hormone balance, which can impede cognitive function and growth in the reproductive system.
Microplastics serve as a conduit for viruses to penetrate our body, so expediting the transmission of illnesses.

Endocrine disrupting chemicals (EDCs), associated with obesity, diabetes, thyroid issues, prostate or breast cancer, and infertility, also raise the risk of stroke and cardiovascular disease. In addition to the chemical compounds found in regular plastic, there is also a health risk linked to air and water pollution that has recently resulted from the exploitation of coal, oil, and gas, which is the source of 98% of plastic. Burning plastic releases harmful fumes and metal that causes cancer when it is disposed away. Children in the community have the greatest rate of leukemia, and plastic production workers are more likely to get lymphomas, breast cancer, brain cancer, and leukemia.
The manufacture of plastic contributes to air pollution, which causes coughing, curry waste, lung cancer, and other illnesses that result in low birth weight and early birth rates.

Effects of microplastic on marine ecosystem

The most visible impact of plastic debris is suffocation injection and entanglement of hundreds of marines. Marine wildlife such as fishes, turtle, whales, seahorses mistake plastic waste for prey: most of them die of starvation as their stomach filled with plastic. The also suffer from many more things like laceration and reduce ability to swim, internal injury. It is estimated that plastic is causing death of more than 100,000 species ever year.

Effects on terrestrial ecosystem

Plastic alters the chemical composition of soil, influencing processes and physical properties such as evaporation, bulk density, capillarity, wetting process, and pore space. Hazardous contaminants such as heavy metals, organic compounds that are toxic to organisms, and antibiotics can be absorbed by plastic. This leads to soil pollution and adverse effects on various organisms, such as earthworms, which can accumulate and transfer plastic into their intestines and up the food chain.

Habit destruction: - like coral reef, mangroves, and seagrass beds, reducing biodiversity and ecosystem resilience.
Bioaccumulation: - as plastic breaks into smaller particles they can be ingested by wide range of organism which can lead to higher concentration of toxin in organism higher up the food chain in including humans.

Mitigation Strategies

Addressing the health risks associated with plastic pollution requires comprehensive mitigation strategies at the local, national, and global levels. Regulatory measures, such as bans on harmful chemicals and additives, restrictions on single-use plastics, and regulations on plastic waste management, can help reduce human exposure to plastic-associated hazards. Additionally, efforts to promote sustainable consumption and production practices, such as eco-friendly packaging alternatives and plastic recycling initiatives, can minimize the generation of plastic waste and mitigate its environmental and health impacts. Public awareness campaigns, education initiatives, and community engagement are also crucial for raising awareness about the health risks of plastic pollution and empowering individuals to make informed choices. By implementing targeted interventions and adopting proactive measures, we can mitigate the adverse effects of plastic pollution on human health and create healthier and more sustainable environments for current and future generations.

Conclusion

Plastic pollution poses significant risks to human health through various pathways of exposure, including ingestion, inhalation, and dermal contact. Exposure to plastic-associated chemicals and microplastics has been linked to a range of health risks, including endocrine disruption, reproductive disorders, and respiratory problems. Addressing the health risks of plastic pollution requires concerted efforts to reduce plastic production, minimize exposure to harmful chemicals, and promote sustainable consumption and production practices. By raising awareness, implementing regulatory measures, and fostering community engagement, we can mitigate the adverse effects of plastic pollution on human health and create safer and healthier environments for all.

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Hunting is not a game. It's a primal instinct that's still very much alive within us. It's about gathering, it's about the chase, it's about living off the land. And that's what I've tried to do with my life." – Eva Shockey

Why Hunting Should Illegal ?

While opinions on hunting vary, here are some points often cited by those advocating for the illegality of hunting-

Animal Welfare: Many argue that hunting causes unnecessary suffering to animals, as they may not die instantly or painlessly. It's seen as unethical to cause suffering for sport or recreation.

Endangered Species Protection: Hunting can endanger already vulnerable species, pushing them closer to extinction. This is particularly concerning for species with already declining populations.

Ecosystem Disruption: Removing certain animals from an ecosystem can disrupt the balance of predator- prey relationships and alter the ecosystem's overall health and stability.

Conservation of Natural Habitats: By discouraging hunting, there may be greater emphasis on preserving and protecting natural habitats, which benefits not only wildlife but also the broader ecosystem.

These points reflect some of the arguments made by those who believe hunting should be illegal. However, it's essential to recognize that there are also arguments in favor of regulated hunting for purposes such as wildlife management, population control, and sustainable resource use.

How Hunting Hurts Animal?

Pain and Suffering: Animals targeted for hunting often endure pain and suffering, especially if they are not killed instantly or are wounded and left to die slowly. This causes unnecessary distress and cruelty.

Disruption of Social Structures: Many animals, such as deer and wolves, live in social groups with complex hierarchies and familial bonds. Hunting disrupts these social structures by removing key members, leading to stress and disarray within the group.

Orphaned Offsprin :When adult animals are killed by hunters, their dependent offspring may be left orphaned and vulnerable to starvation, predation, or other dangers, disrupting the natural life cycle of the species.

Genetic Impact: Selectively targeting certain animals, such as those with large antlers or impressive trophies, can lead to changes in the genetic diversity and health of populations, potentially weakening them over time.

Unintended Victims: Non-target species, including endangered or protected animals, can become unintended victims of hunting practices, either through accidental shootings or through indirect impacts such as habitat destruction.

Psychological Stress: Animals can experience psychological stress and trauma from the presence of hunters in their habitats, even if they are not directly hunted. This stress can affect their behavior, reproduction, and overall well-being.

Habitat Fragmentation: Hunting activities, such as the construction of roads, hunting cabins, and other infrastructure, can fragment and degrade natural habitats, further threatening wildlife populations and their ecosystems.

Overall, hunting can have significant negative impacts on individual animals, populations, and ecosystems, contributing to their decline and compromising their welfare.

Hunting has nothing to do with Conservation.

The argument that "Hunting Has Nothing to Do with Conservation" contends that the practice of hunting does not inherently contribute to the conservation of wildlife or their habitats.

Commercial Interests vs. Conservation Goals: Critics argue that commercial hunting operations often prioritize profit over conservation. In many cases, the revenue generated from hunting permits or licenses may not be adequately allocated towards conservation efforts.

Focus on Trophy Hunting: Trophy hunting is often criticized for its negative impact on wildlife populations. Critics argue that trophy hunting targets large, mature individuals, which can disrupt natural breeding patterns and weaken genetic diversity within populations.

Sustainability Concerns: While proponents of hunting often argue that it can help control wildlife populations and prevent overpopulation, critics counter that unsustainable hunting practices can actually exacerbate population declines. Overhunting of certain species can lead to imbalances in ecosystems and threaten biodiversity.

The perception of hunting as incompatible with conservation goals can undermine public support for conservation initiatives. Critics argue that promoting non-consumptive forms of wildlife appreciation.

Such as ecotourism or photography, can be more effective in engaging the pupblic and fostering a culture of conservation.Overall, hunting inherently aligned with conservation objectives and may even undermine efforts to protect and sustainably manage wildlife and their habitats.

Conclusion and What you can do!

Advocating for the cessation of hunting requires a multifaceted approach that addresses ethical, environmental, and conservation concerns.

Policy and Legal Reform: Lobbying for stricter regulations on hunting practices, including bans on trophy hunting and the implementation of sustainable hunting quotas. Strengthening enforcement of existing wildlife protection laws and closing loopholes that allow for exploitation of wildlife.

Habitat Conservation: Supporting initiatives aimed at preserving and restoring natural habitats for wildlife. Protecting key habitats such as wetlands, forests, and grasslands is essential for maintaining biodiversity and supporting healthy wildlife populations.

Community Engagement: Working with local communities to develop sustainable livelihood alternatives that do not rely on hunting. Providing education and training opportunities in ecotourism, sustainable agriculture, and conservation management can help reduce reliance on hunting as a source of income.

Public Awareness and Education: Raising awareness about the negative impacts of hunting on wildlife and ecosystems through campaigns, outreach programs, and educational initiatives. Encouraging consumers to make ethical choices by boycotting products derived from hunting, such as fur and ivory.

By taking these steps, we can work towards ending hunting practices that harm wildlife and promote conservation efforts that prioritize the protection and welfare of animals and their habitats.

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Guardians of the Forest: Exploring the Mysteries of Sacred Grooves

Sacred groves- a name when heard reminds us of the long lush green forests with a significant religious connotation.
Sacred groves are the forest areas that are rich in flora and fauna, serving as sanctuaries of nature and spiritual havens. These sacred sites are found across the globe and thrive under the protection of the locals. They are the mystical guardians that guard our culture, heritage and biodiversity.

Amid the concrete jungles and bustling city streets, there is something that is undeniably appealing which is the tranquillity and beauty of nature. Hidden within this vast realm lies the enchanting wonder of sacred groves that are the ancient pockets of untouched wilderness that have captivated human beings for centuries. These sacred groves are a testament of our deep-rooted connection to the natural world. It acts as an escape from the chaos of modern life and help to reconnect with our roots.

Sacred groves are important symbols of human culture and spirituality. They are considered sanctified grounds, inhabited by divine spirits or gods. Within these groves various herbs and medicinal plants flourish acting as a gene pool for future generations.
Ancient civilizations such as the Greeks, Romans, and Celts held these natural spaces in high regard, viewing them as earthly gateways to the heaven. Even the Hindu, Jain and Buddhist cultures believe the same. These societies recognized the importance of preserving natural environments and believed that these groves were the symbol of harmony between humans and nature.

Sacred groves are also a vital biodiversity hotspot and a religious ground for many Indian tribal communities. These communities regard them as sacred places and often worship them in religious ceremonies. The interconnectedness of all living beings is acknowledged, reinforcing the importance of preserving nature.
In India, sacred groves are often associated with the concept of the presiding deity. They are known to contain natural spirits like yakshas. These beliefs are also depicted in various folklore, ritualistic dramatizations and religious texts.

But beyond their spiritual significance, they play a vital role in preserving our biodiversity. These protected areas provide a haven for countless of plant and animal species, some of which may be rare or endangered. By shielding these ecosystems from human interference, sacred groves act as living museums, showcasing the stunning diversity of life on our planet.

Sacred groves demonstrate the web of interdependence that sustains our planet's ecosystems. Within these groves, every plant, animal, and microorganism plays a vital role. Every species has its own role in balancing the ecosystem and help in its regulation . These sacred groves show unique ecological features that make them different from other natural ecosystems like ancient and majestic trees and vibrant understory vegetation. They are a symbol of resilience and adaptability.

When it comes to safeguarding the precious ecosystems of sacred groves, local communities are often at the forefront. They are the real guardians of the forests and nature who understand the value and relevance of these sacred spaces and try to protect them through various community-led programs and campaigns such as reforestation, wildlife protection, banning hunting and poaching practices and promoting sustainable harvesting practices. The Bishnoi movement of Rajasthan was a successful community-led movement that was done to protect Khejri trees which were a sacred entity for the Bishnoi community. In the same way, a lot of movements have been launched and also succeeded in their mission.

In recent years, sacred groves are under threat of being extinguished due to various reasons such as urbanization, industrialization, mining, land use changes etc. To protect them government has launched various programs and made them a biodiversity hotspot. They are an important source of in-situ conservation. Their preservation would not only protect the environment but also save millions of plant and animal species from becoming homeless.

Since these groves act as powerful reminders of our deep connection to the natural world, we must recognize the importance of protecting and preserving these sacred groves. We should support community-led conservation efforts and ensure the continued existence of these mystical havens.

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What if waste,wasn't wasted....

For too long, we've viewed waste as an unwanted consequence of progress, something to be thrown away and forgotten. But what if we shifted our perspective? What if, instead of seeing waste as a burden, we see it as a resource - a hidden treasure? What if waste wasn't wasted and instead turned into solutions that saves our planet or climate.

Every year 100 billion items of clothing are produced and nearly 600 million of those items are tossed into landfills within the first 12 or 14 months.

We have the ability to take resources traditionally thought to be waste like discarded clothes,breaking them again into fibres in its basic form and build it up again into a new one.

If wastewater is utilised at its full potential, it could provide electricity for around half a billion of people per year, and irrigate around 40 million hectares.

We have an area in our college in which all the plastic waste is collected and then utilised. Imagine plastic bottles transformed into benches like the ones we are having in our own Daulat Ram College. This not only reduces waste but also our environment, our economy and our future.

Waste generated from plants like leaves or deteriorated fruits and vegetables as well as from animals like cow dung can be used as organic compost in fields.

Embracing waste as a resource isn't just a solution to our waste crisis; it's an opportunity for us to build a more sustainable and prosperous future.

The government has now taken up the cause of waste-energy plants again to move towards garbage-free cities. Biological Treatment Technologies (BTT):

BTT are designed and engineered for various natural biological processes working with the organic rich fraction of Municipal Solid waste and uses microorganisms to break down organic matter.

Waste-to-energy projects uses non-recyclable dry waste to generate electricity and ease the Solid Waste Management burden.

Municipal and industrial solid trash is now a days converted into power or heat for industrial processing at waste-to-energy plants.Here the trash is burnt at higher temperatures andsteam,hot water or electricity is produced as a resultof heat. Burning trash is not only involved in generating power but also reduces the waste on our mother Earth.

These methods not only reduces waste but also reduces green house gases emissions which in order prevents global warming.These are the best ways to prevent waste from polluting the environment.

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Conservation of biodiversity

We are all aware with the definition of biodiversity, but how many of us are familiar with the word conservation? The likelihood is that if we were, we would have taken the appropriate action to preserve biodiversity. The biodiversity that exists today includes each and every one of us. Because everything in our ecosystem is interconnected, preserving biodiversity encompasses not just the preservation of the plant and animal kingdoms but also the preservation of all living creatures, including bacteria, whether or not they are beneficial to humans. As everyone has heard, the food web is made up of many different organisms that are interdependent and help each other to survive in this world. As a result, if we disturb even one organism in the environment and attempt to take control of everything, we actually end up losing everything that is necessary for our survival. This also contributes to the loss of biodiversity, which in turn causes environmental conditions to become disturbed.

Excessive exploitation, habitat loss and fragmentation, and the invasion of alien species are the primary causes of biodiversity losses. We refer to these reasons for the decline in biodiversity as "the evil quartet." We take over the land and utilise it for various purposes, but we often forget that the land supports millions of organisms. Occasionally, this also results in the complete extinction of a species; similarly, the eradication of alien species is done for our own benefit, but it also has the same effect. The rate at which biodiversity is disappearing has increased due to anthropogenic activities.

One of the biggest threats to our future is the loss of biodiversity, which we are mostly to blame for because we overuse natural resources for our own benefit without considering the needs of future generations. This brings us to the concept of sustainable development, defined as development that satisfies present needs without threatening the potential of future generations to satiate their own needs. The World Summit held in the year 2002, which focused on sustainable development, brought together numerous governmental and non-governmental organizations , focused global attention, and cleared the path for the need for sustainable development.

The government has launched numerous initiatives to protect biodiversity and educate the public about how our actions would have a knock-on effect on the natural world if we manage to destroy it and its delicate equilibrium. Since we benefit greatly from nature, we have a moral obligation to preserve it, and we ought to endeavour to return at least 10% of what we take from it. To put their management recommendations into practice, conservation biologists employ "in situ" and "ex situ" conservation.

Two strategies are available for conserving biodiversity: ex-situ and in-situ methods. While ex-situ conservation focuses on moving the organism into an well protected habitat, in-situ conservation mainly focuses on protecting the organism in its natural habitat. These both types of conservation focus on the protection of an organism however utilizing different means.

The term "in situ conservation" refers to the method used when we preserve and safeguard the entire ecosystem, or all levels of biological organizations . This protects species conservation in their native environments. For instance, we save the entire forest in order to save the tiger. Sacred Groves, national parks, biosphere reserves, and wildlife sanctuaries are examples of protected areas where in situ conservation is practiced. Sacred grooves are areas of forest land which is under the local community's protection. The community values the protected forest land for its religious or cultural significance. Numerous rare, endangered, and native plant and animal species—such as those present in Meghalaya's Khasi and Jantia hills—are protected by it.

Ex-situ conservation involves eliminating endangered animals and plants from their natural environment and resettling them to a designated location where they can receive extra care and protection. The aforementioned goals are fulfilled by cryopreservation, botanical gardens, gene banks, and zoological parks. A biorepository that conserves genetic material is called a gene bank. It is an assortment of potentially useful species' seeds, plants, tissue cultures, etc. Similar to the National Animal Gene Bank in Karnal , it preserves the genetic variety of both wild and tamed plants and animals. The process of freezing live cells, tissues, and other biological materials at below freezing temperature for preservation and storage is known as cryopreservation. Typically, the selected specimen is stored at -196°C. It maintains the biological specimen and stores it with the same genetic integrity as that found in IARI, New Delhi. Preserving the genetic variety of the population is one of the main benefits of ex situ conservation.

Edward Wilson coined the term biodiversity, which is composed of the terms "bio" that indicates life, and "diversity," that indicates variety. Although there are a great number of organisms that have not yet been found, the approximate number of species on Earth is thought to be around 1.7 million. As a result, species ought to be preserved before going extinct.

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CONSERVATION GENETICS: Preserving Genetic Diversity in Threatened Species

In a world where biodiversity is facing unprecedented threats, genetic conservation emerges as a pivotal tool in preserving the subtle equilibrium of our ecosystems. From the vast rainforests to the depths of the ocean, genetic conservation stands as a beacon of hope, safeguarding the irreplaceable treasures of our planet's diverse species. By damaging or changing the habitats of plants, animals, and other living beings, we are bringing them closer to be endangered. Effective management of these ecosystems can help preserve threatened and endangered species. Conservation Biology + Genetics = Conservation Genetics, i.e. conservation genetics is a multidisciplinary field that focuses on applying genetic methods to the conservation and management of endangered species and ecosystems. It involves studying genetic diversity, population structure, gene flow, and the effects of genetic factors on population viability. This information helps in making informed decisions about strategies for preserving biodiversity and preventing species extinction. Preserving genetic diversity in threatened species is important for a species' ability to adapt to environmental changes. Also, it avoids inbreeding. Inbreeding occurs in small, isolated populations and can reduce a species' ability to reproduce and survive.

Being "threatened" describes species or ecosystems that face significant risks of extinction or degradation. These species have some threat to their population, which may result in them becoming endangered. The advancements in the genomics revolution have made it possible to cheaply and quickly sequence entire genome. There are several ways by which we can conserve genetic diversity. These include in situ conservation, ex situ conservation, plant breeding, preserving the gene pool, protecting natural habitats ,establishing protected areas, sustainable agriculture, seed banks and gene banks, conservation breeding programs etc. In addition to this, by avoiding the select ion of closely related individuals, by minimizing the average co-ancestry, and by reducing the loss of favorable alleles we can add more to the preservation of genetic diversity.

Genetic diversity plays a crucial role in the survival and adaptability of populations and species. By taking these steps, we can contribute to the conservation of our planet's genetic wealth. As we embark on the journey of preserving genetic diversity, let us remember that the power to protect our planet's genetic treasures lies in our hands.

Together, we can ensure a future where every species thrives and the tapestry of life remains vibrant and resilient. In the face of mounting challenges, the preservation of genetic diversity becomes not just an obligation but a testament to our commitment to the Earth and its inhabitants. Let us embrace this responsibility and forge a path towards a future where biodiversity flourishes.

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2nd Year

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Environmental Health

The Environment, which encompasses all living and nonliving things around us, is an integral part of our lives. We are physically, mentally, socially, and emotionally connected to it. The environment includes everything from human beings to plants and animals, as well as microbes and insects.

However, over the years, technological advancements and our unconditional exploitation of the environment have led to the loss of our precious connection to it. As a result, we have failed to understand the significance of the environment in our lives. We spend most of our time on digital devices, and we seem to forget the beauty of nature around us.

The environment is an increasingly discussed topic, with issues such as environmental deterioration, global warming, environmental pollution, environmental health, and others being brought to the forefront. Environmental health is a critical issue that addresses not only the health of our environment but also the health of our communities.

The health of our environment is equally important to its proper functioning.

Unfortunately, due to industrialization, urbanization, and unsustainable practices such as air, land, water have been polluted. Deforestation, overfishing, habitat loss, and construction have led to significant biodiversity loss. Greenhouse gas emissions and global warming have resulted in climate change and exacerbated environmental health problems.

The deterioration of our environment has forced people and governments to take notice, and various programs. It is crucial to maintain a healthy environment for several reasons.

Firstly, the changing environment directly affects human health and has contributed to the spread of various diseases. Secondly, a deteriorating environment poses a threat to biodiversity, disrupting the natural ecosystem. Lastly, environmental degradation has led to man-induced floods, landslides, formation of sinkholes, earthquakes, frequent loss of agriculture, and degrading soil quality.

Despite the various programs and campaigns launched in the past few decades, the environment's condition remains the same. The increasing warmth of the earth's atmosphere, melting of glaciers, irregular seasons, and disturbed natural ecosystems are evidence that we still need to do more to protect our environment.

To protect our environment and its health, we should use renewable resources such as solar, hydropower, and biogas instead of non-renewable resources like fossil fuels. Reforestation and planting more trees can improve the quality of the atmosphere and promote the greenery of the earth. Conservation of natural resources and minimizing waste production can help in the preservation of natural resources and reduce environmental degradation.

The government has implemented policies such as the Earth Summit to reduce environmental degradation. A healthy environment ensures a healthy lifestyle for individuals and economic prosperity for the nation. We should learn from tribal groups how to protect our environment even after using its resources. We should work towards creating a planet that is thriving, diverse, and resilient for future generations.

Writer
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Landuse Change

Our planet is unique as it is the only planet to sustain life. And for the sustainance of this life, evolution has been taking place where land has always been a major factor.

As humans have also evolved from apes to bipeds, the land which belonged to all, have now been segregated with boundaries because of man's greed and need.

Environment is always dynamic to secure its existence, however, humans are now forcing changes in the nature for his own benefit. With encephalization of the brain, humans have utilized land for agriculture and residence. But now with population explosion, man has now begun to exploit this resource. India too is facing this problem with 1.42 billions mouths to feed while having a limited

area of 3.28 million km sq. It's population density is three times that of China. With such challenges, the rate of

urbanization and conversion of forests to cultivable lands is taking place at unprecedented rates. To curb its own

hunger and have a roof, man is compromising with the nature as well as arrogating the homes and food of other earthlings. Urban sprawl, deforestation, horticulture etc. Have altered 'more than three-quarters' of the Earth's landscape.

As we are loosing our forests seeing nature's wrath on our are not only loosing our biodiversity but also climate, soil quality, food, our health and our environment. With time humans have realized their mistake and we are now taking steps to rectify our mistake. However, if not done properly, even our attempt for afforestation may cause further land use changes.

Thus to sustain ourselves and our nature, worldwide awareness is required. Reducing our meat intake, donating to rewilding efforts, planned construction, sustainable agricultural practices etc. may be helpful for saving our environment and meeting our needs without compromising with our nature. We have limited resource of this land, and it is our ethical and environmental responsibility to utilize it wisely and safeguard it by keeping a balance between personal and environmental requirements.

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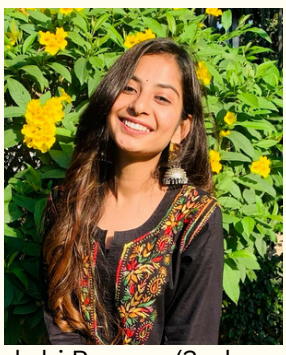

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Creative Section

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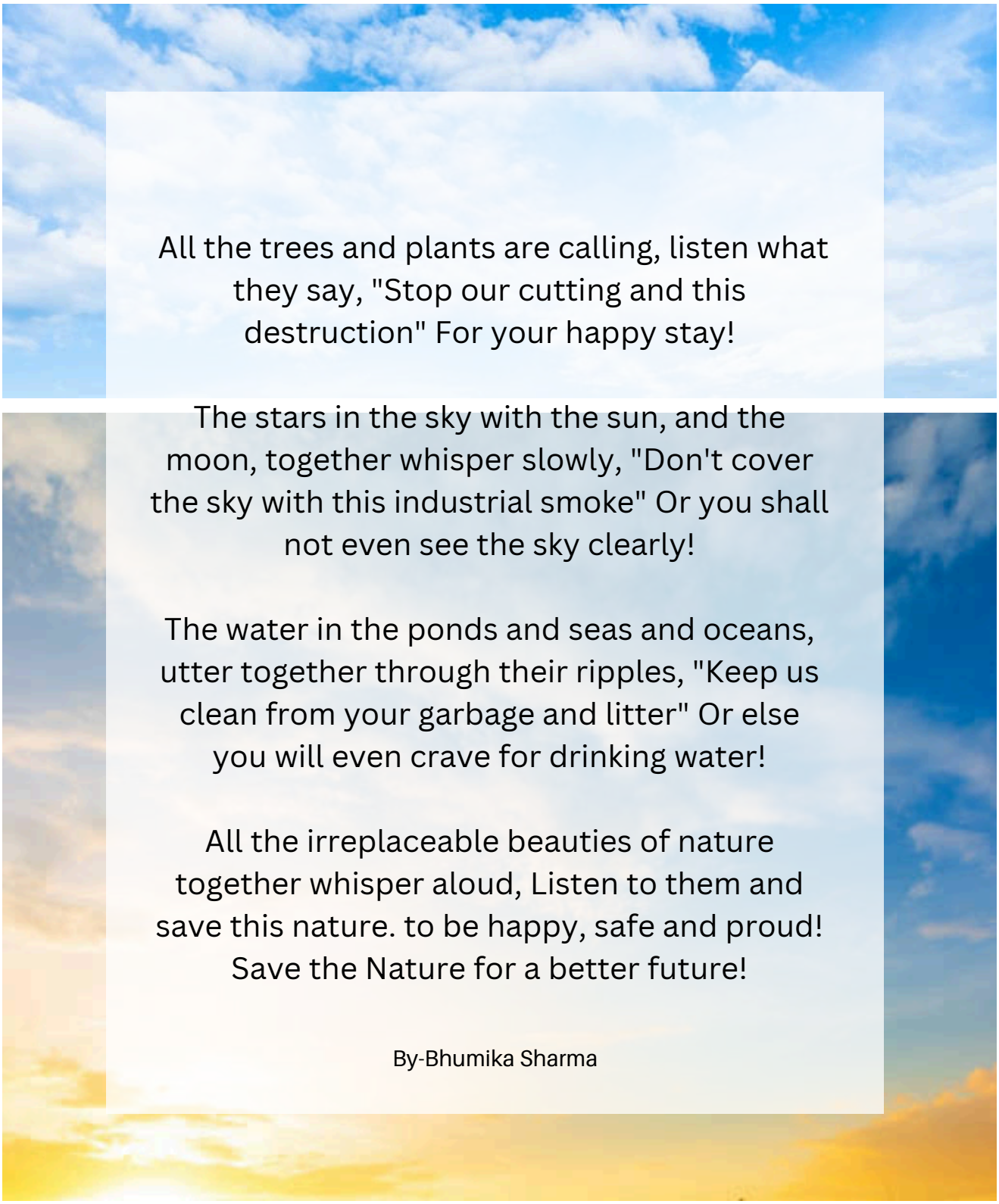
Nature Poetry

P.C: Ariha 2nd year

WHISPERS OF NATURE



All the trees and plants are calling, listen what they say, "Stop our cutting and this destruction" For your happy stay!

The stars in the sky with the sun, and the moon, together whisper slowly, "Don't cover the sky with this industrial smoke" Or you shall not even see the sky clearly!

The water in the ponds and seas and oceans, utter together through their ripples, "Keep us clean from your garbage and litter" Or else you will even crave for drinking water!

All the irreplaceable beauties of nature together whisper aloud, Listen to them and save this nature. to be happy, safe and proud! Save the Nature for a better future!

By-Bhumika Sharma

Nature Painting

P.C: Anandita Singh
3rd year

Preeti Yadav
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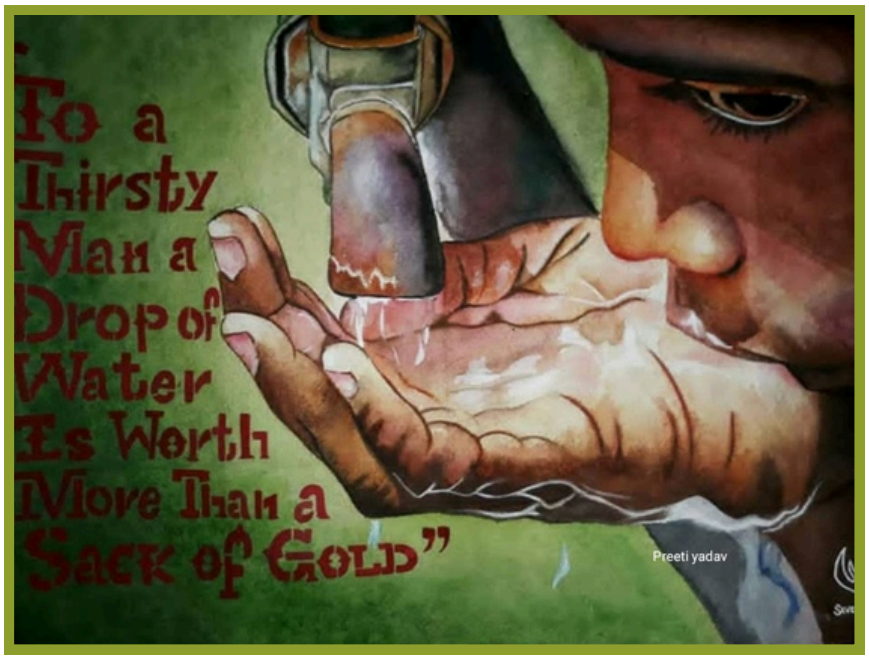

Preeti Yadav
2nd year

Preeti Yadav
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Aakrati Singh
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Nandini Prajapati
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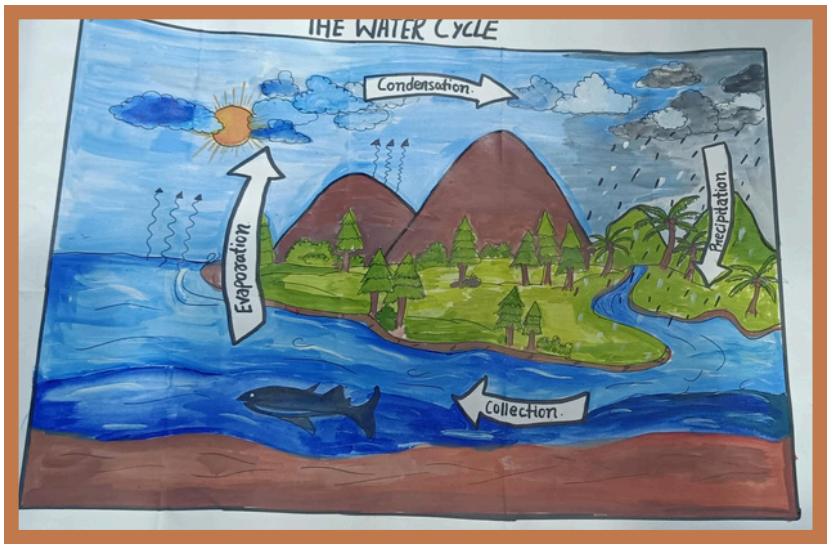

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2nd year

Ritu Jha
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Ritu Jha
2nd year

Ritu Jha
2nd year

Ritu Jha
2nd year

Seema
2nd year

Aakriti Singh
2nd year

Suhani Dua
1st year

Suhani Dua
1st year

Debasrita Das
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Aakriti Singh
2nd year

Preeti Yadav
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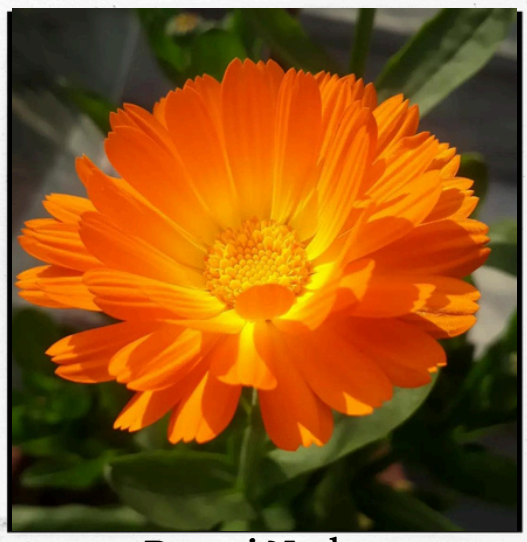

Preeti Yadav
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Preeti Yadav
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Events : Vasundhara

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About Vasundhara

The Botanical Association

Daulat Ram College is a premier educational institution in Delhi founded by an educationist late Shri Daulat Ram Gupta in 1960.It imparts education towards degrees at the bachelor's level in arts, commerce and science and Masters level in arts.Currently the college has add-on courses in foreign languages. At present there are 19 departments with about 4200 students on rolls. The Botany Department of Daulat Ram College was established in 1968, and is one of the leading Departments of the University in the field of teaching in plant sciences and life sciences. The department was awarded "star status" by the Department of Biotechnology, Govt. of India in 2013. Along with academics, the students also get a chance to exhibit their creativity by participating in various inter-college competitions and extra-curricular activities organised by the Botanical Association "Vasundhara" during "Orchidz" the annual botanical Co-curricular event. .

Union
2023-2024

The Botanical Association

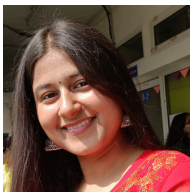
Prof. Rekha Kathal

Dr. Asmita Gupta
Staff Advisor

Dr. Shagun Danda
Staff Advisor

President
Priya Giri

Vice President
Satya Sood



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Creative Head
Anandita Singh

Social Media Head
Mahima Thapa

PR Head
Annu Kumari

Social Media Secreatary
Aditi Rajput

Creative Secreatary
Deeksha

Creative Secreatary
Nandini

CR 3rd Year
Anchal Patel

CR 2nd Year
Seema

CR 1st Year
Aqsa

INAUGURAL CEREMONY

Vasundhara's inaugural ceremony was conducted on12th October 2023. It kickstarts with astounding welcomespeech by president Priya Giri and CR 3rd year Anchal patel. It then followed by auspicious lamp lightening ceremony . Moving forward,. Staff advisor Dr. ASMITA GUPTA MAM introduce our speaker guest and then invite him to elaborate about today's talk. He address the audience on the topic of "GREEN BIOREACTORS AND BIOLOGICALS : STRATEGIES AND WAY FORWARD. He shares the unique information about how plant are useful from research point of view. How we can bioreactors and biofuel could serve as one of the important resource for future. The talk then followed by badging ceremony for Union 2023-24.

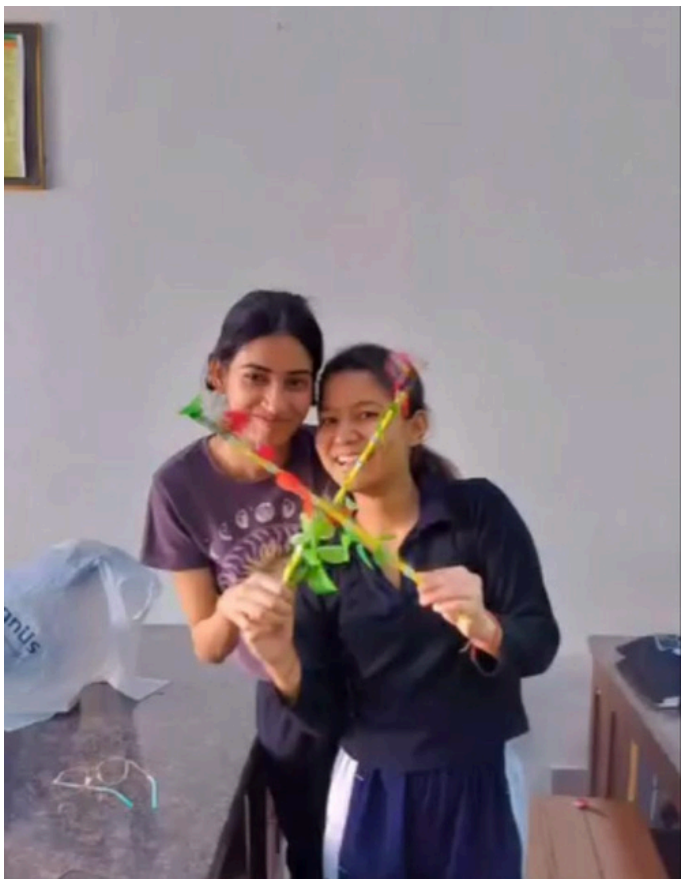

VASUNDHARA


VASUNDHARA

WEDNESDAY ACTIVITY

- Diya Decoration
- Earthern pot decoration
- Dandiya decoration

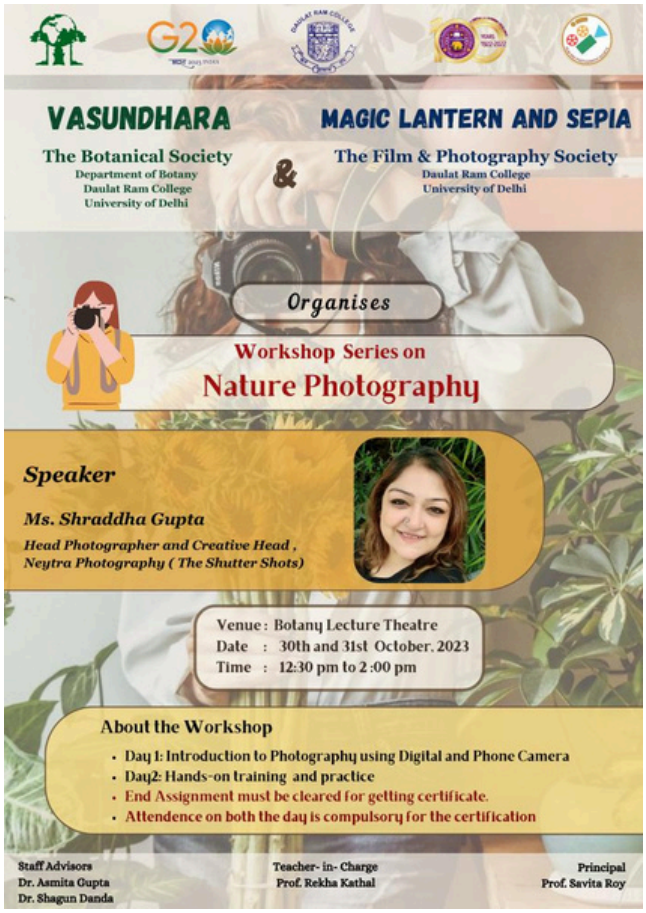
WEDNESDAY ACTIVITY



Nature Photography Workshop

Series 1

DAY 1

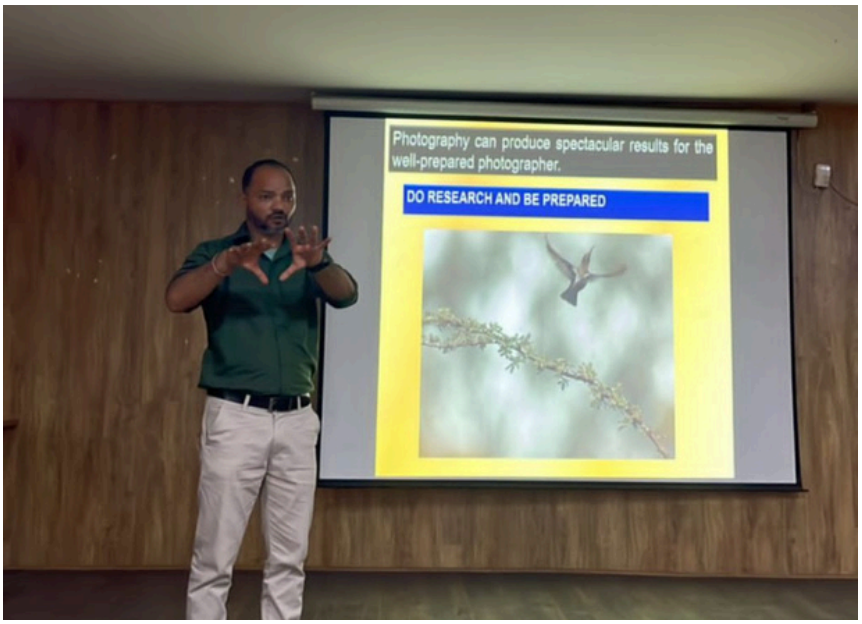


DAY 2

Nature Photography Workshop

Series 2


MAGIC LANTERN AND SEPIA: FILM & PHOTOGRAPHY SOCIETY
in collaboration with
YASUNDHARA: THE BOTANICAL ASSOCIATION
DAULAT RAM COLLEGE
NATURE PHOTOGRAPHY


Photography can produce spectacular results for the well-prepared photographer.
DO RESEARCH AND BE PREPARED

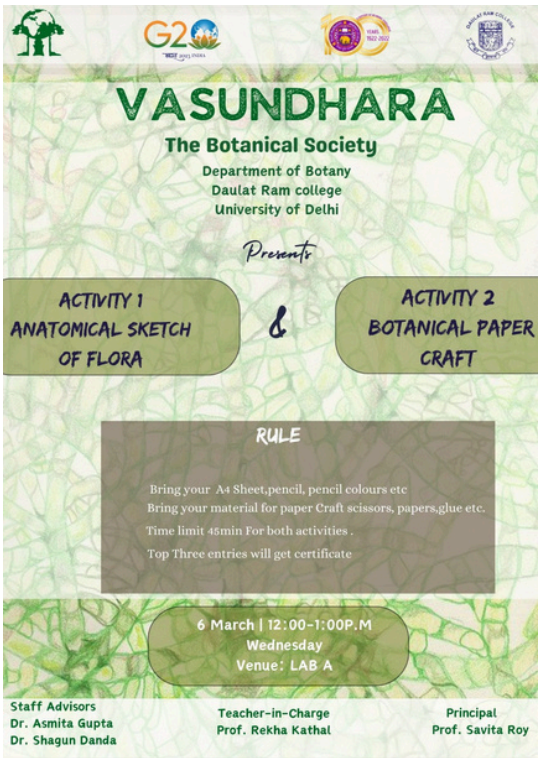
CAREER COUNSELLING SESSION

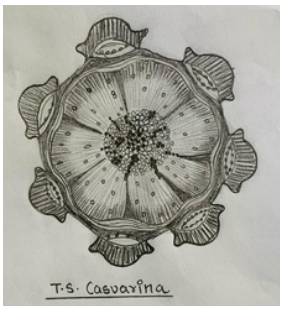
UPSC SCHOLARSHIP TEST

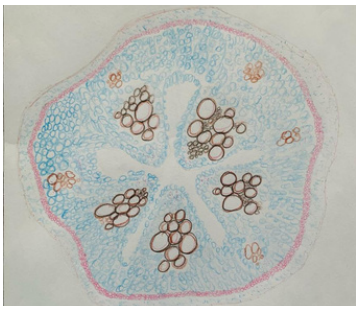
WEDNESDAY ACTIVITY

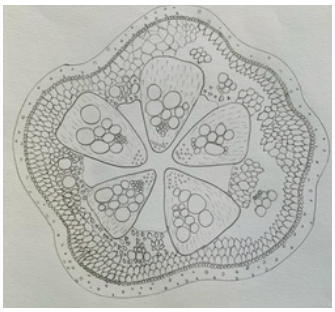
- Anatomical Sketch of Flora

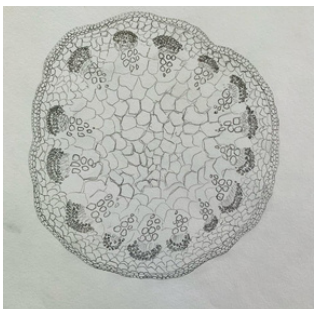
- Botanical Paper Craft









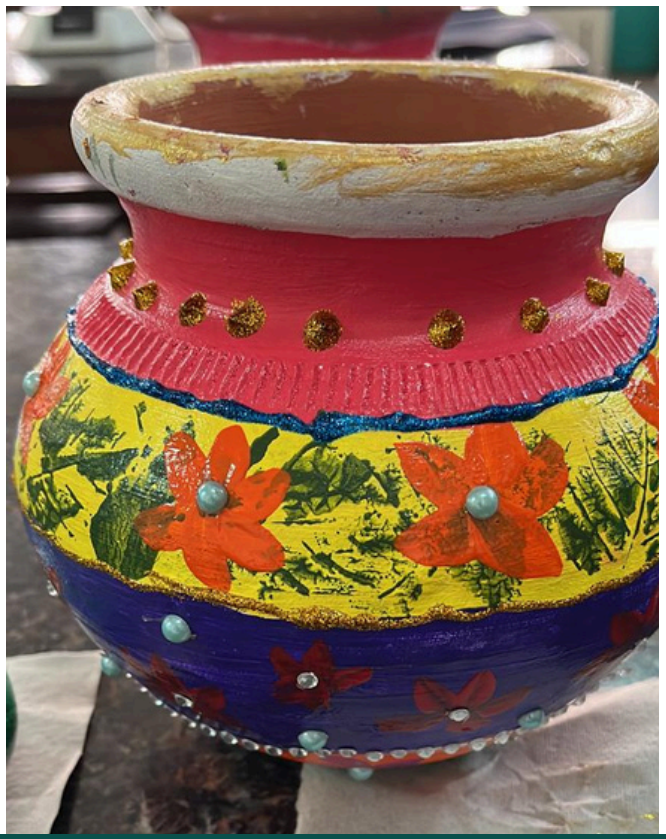


WEDNESDAY ACTIVITY

- Pot painting
- Wild Flora Lanscape
- Best out of Waste


B3


PREPARATION ROOM



ORCHIDZ'24

Glimpse

Front Page Launch of

Liana 2023-24

Department of Botany

Faculty Members

"Lianas", The Botanical Association's Annual publication of scientific articles and association activities, provides a unique platform for faculties and students alike to showcase their academic and creative talents. Lianas 2023-2024 is a compilation of insightful articles on the theme of Biodiversity Conservation and Climate Change.