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The ecological importance of plant diversity: A study of the Campus Flora at Government College, Ani, District Kullu, Himachal Pradesh, India

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Abstract
Biodiversity is a vital element in maintaining ecological health, providing essential ecosystem services that support human existence and environmental stability. The present paper provides an inventory of the flora found on and around the premises of the Government College, Ani at Haripur, District Kullu, Himachal Pradesh. The college has a total land area of 7250 sq. mts., with 2742.52 sq. mts. of building space. Most of the plants are planted for campus beautification and biodiversity conservation. The study aims to assess the composition, distribution, and ecological significance of these plant species, besides inculcating a sense of appreciation for local biodiversity among students and faculty as well as the community in the surroundings. It explores the ecological importance and roles of select plant species on campus, particularly their impact on air quality and mental health. The study focuses on trees, shrubs, herbs, grasses, and weeds commonly found on the college premises, analyzing their contributions to ecological balance, air purification, and improved psychological health. Some sustainable practices for conserving plant diversity on the campus are proposed to enhance air quality and mental well-being.

Keywords: Campus Flora, plant diversity, biodiversity, trees, shrubs, herbs, grasses, weeds

Introduction

"Bio" means life and "diversity" means variety; so, biodiversity refers to the incredible variety of living organisms in nature and how they interact with one another. Biodiversity refers to the variability of living species from all sources, including terrestrial, aquatic, and marine habitats. Biodiversity comprises diversity within species, between species and of ecosystems (Agapow *et al*., 2004) [6]. Plant diversity refers to the overall number of plant species in a given ecosystem as well as their variability. Diversity is vital for providing ecosystem services (Tahmasebi *et al*., 2017) [7]. Plants adapt to a variety of biotic and abiotic factors, including temperature, soil, extremely low temperatures, daylight hours, pollination method, altitude, competition with other plants, and more. The list is limitless. The plant species found in the same habitat differ in their genetic makeup (Gaujour *et al*., 2012) [1].

Biodiversity encompasses the variety of life on the earth, which includes a range of species, genetic variation, and environmental diversity. Understanding and protecting biodiversity is critical to maintaining ecological equilibrium and encouraging sustainable living (Botkin, D. B. *et al*., 2010) [2]. College campuses, which are frequently rich in vegetation, offer a unique opportunity to study and interact with biodiversity. This information has aided in the utilization of the earth's biological resources for the benefit of humanity and has played an important role in the development process. Indigenous and local groups have great knowledge of the flora, which includes sustainable harvesting procedures, therapeutic plant uses, and methods for protecting and conserving local species. Some of the trees, shrubs, and herbs are ornamental species, and these plants contribute significantly to the global economy (CBD report, 2009). Owing to incessant global warming and climate change, many species of flora as well as fauna are under mounting pressure to acclimatize with these fast-changing environmental conditions, in addition to multiple challenges from existing anthropogenic activities (Agrawal, 2011) [5]. This study examines the flora found on and around the premises of Government College, Ani at Haripur, District Kullu, Himachal Pradesh, preparing a comprehensive inventory and discussing the ecological roles these plants play on the campus.

The present paper discusses the importance of green spaces on the college campus, to examine how it sustains plant biodiversity, and improves air quality and mental health. It underscores specific species of trees such as guava (*Psidium guajava*) and peepal (*Ficus religiosa*), shrubs like white indigo berry (*Randia aculeata*), herbs like aloe (*Candelabra aloe*), and grasses like lantana (*Lantana camara*), and their ecological importance and impacts.

Materials and methods

1. Study area

The present study was conducted at Government College, Ani at Haripur, District Kullu, Himachal Pradesh, India, examining a range of habitats through varying seasons to understand the full spectrum of plant life on the campus, including gardens, flower beds, wooded portions, grassy turf, and green cover, as shown in Figure 1.

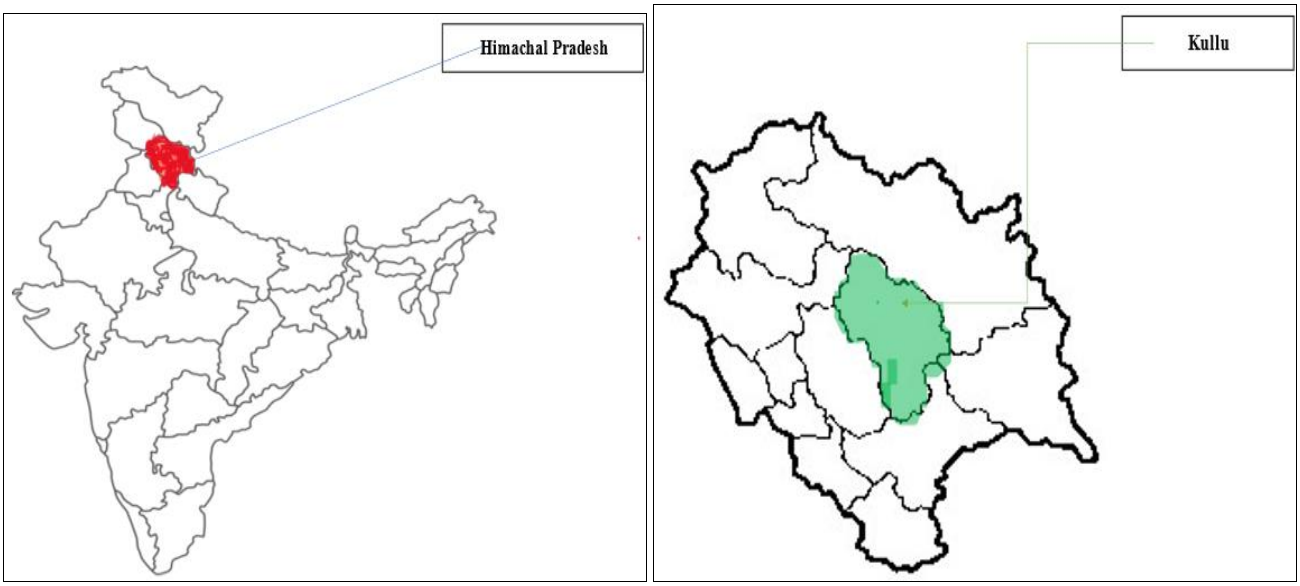

Fig 1: [A], [B] and [C] show map of the study area. Images are taken from https://en.wikipedia.org/wiki/HimachalPradesh and Google Lens

2. Data collection

Field Survey: A comprehensive and systematic survey of the campus was undertaken, concentrating on various zones such as landscaped premises, natural habitats, and building perimeters.

Identification: We were already familiar with local plant species, but we sought help from local residents to learn their names and uses/applications. We were able to easily locate the Botanical names of plant samples on the internet using their local/common names.

Inventory: Data on species' richness, abundance, and distribution were collected and recorded, along with other ecological parameters.

3. Final Identification

The plants were finally identified using a variety of morphological and floral characteristics, including inflorescence, flower type, leaf morphology, and leaf arrangement, among others. For species-level identification, we relied on previous publications describing plants reported from or near Himachal Pradesh. Taxonomic classification adhered to standard Botanical Nomenclature. The plant specimens were identified using Field Guides and Google Lens.

Observations and results

The campus floras under study include a variety of plants, shrubs, herbs, grasses, and weeds from different angiosperm, gymnosperm, and pteridophyte families. The majority of the trees are young and tall, with a lush, green canopy as shown in Figure 2. In the lowest group, plants such as lichens, bryophytes, and many forms of mushrooms grow on tree bark during the late rainy season. The flora inventory was created using a combination of field observations, photographs, and consultations with local botanical experts. The following plant categories have been documented:

1. Trees

Trees are huge, perennial woody plants that provide shelter, oxygen, and aesthetic value on campus. A diversified collection of trees adds to the diversity of the campus environment.

Common name and botanical name

1. Guava (*Psidium guajava)*
2. Peepal (*Ficus religiosa)*
3. Bottle Brush (*Callistemon)*
4. Rudraksha (*Elaeocarpus ganitrus)*
5. Pomegranate (*Punica granatum)*
6. Northern White Cedar (*Thuja occidentalis)*

7. Cedar *(Cedrus deodara)*
8. Indian cherry (*Cordia dichotoma)*
9. Grewia (*Grewia salicifolia)*
10. Noni (*Morinda citrifolia)*
11. Bedu/Fig (*Ficus palmata)*
12. Pinheiro (*Retrophyllum spp.)*
13. Araucaria (*Araucaria heterophylla)*
14. Safeda (*Eucalyptus longifolia)*
15. Pongami Tree (*Pongamia pinnata)*
16. Pinus (*Pinus roxburghii)*
17. Silver Oak (*Grevillea robusta)*
18. Red Silk Cotton Tree (*Bombax Ceiba)*
19. Kamala Tree (*Mallotus philippensis)*
20. Amla (*Phyllantus emblica)*

Fig 2: Some Trees and Shrub Plants on the College Campus

2. Shrubs

Shrubs enhance habitat variety and provide valuable ecosystem services.

Common name and botanical name

1. White Indigo Berry (*Randia aculeata*)
2. Glossy Privet (*Ligustrum lucidum*)
3. Golden Dewdrop (*Duranta erecta*)
4. Aralia (*Aralia cachemirica*)
5. Climbing Ylang (*Artabotrys hexapetalus*)
6. Tree Caper (*Capparis grandis*)

3. Herbs

Herbs are an important part of the campus flora, adding to the understory and overall ecosystem.

Common name and botanical name

1. Aloe (*Candelabra aloe*)
2. Edible Canna (*Canna indica*)
3. Velvet Leaf (*Cissampelos)*
4. Basil Leaf (*Ocimum basilicum*)
5. Lemon Grass (*Cymbopogon citratus*)
6. Mint (*Mentha spicata*)

4. Grasses and weeds

Weeds and grasses develop in areas that interfere with human requirements. Grass is a tiny plant with a variety of uses, including food and animal feed.

Common name and botanical name

1. Annual Ragweed (*Ambrosia artemisifolia*)
2. Loop- Root Mangrove (*Rhizophora mucornata*)
3. Lantana (*Lantana camara*)
4. Congress Grass (*Parthenium hysterophorus*)

5. Some indoor and pot plants on campus

Some pot plants and indoor plants help to filter the air around them by absorbing toxic chemicals like benzene and releasing oxygen. The indoor plants are also used for ornamental purposes.

Common name and botanical name

1. Mulberry (*Morus alba*)
2. Lemon (*Citrus lemon*)
3. Marigold (*Tagetes*)
4. Sago Palm (*Cycas revoluta*)
5. Rose (*Rosa rubiginosa*)
6. Rubber Fig (*Ficus elasticsa*)
7. Mango (*Mangifera indica*)
8. Purple Heart (*Tradescantia pallide*)
9. Periwinkle (*Catharanthus roseus*)
10. Fan Palm (*Wahingtonia*)
11. Night Scented Lily (*Alocasia odora*)
12. Canna Lily (*Canna tuerckheimii*)
13. Tarweed (*Cuphea hyssopifolia*)
14. Dwarf Orange Jasmine (*Mini kamini*)
15. Corn Plant (*Dracaena fragran*)
16. Money Plant (*Epipremnum aureum*)

Discussion

The college administration and members of the Eco-Club at Government College, Ani at Haripur, District Kullu, Himachal Pradesh, India, earnestly care for the indoor and outdoor plants on a regular basis in order to preserve the campus flora. Only 55 of more than 100 species on the campus have been identified. The identified species include 20 trees, 6 herbs, 6 shrubs, and 4 grasses and weeds, besides potted and indoor plants. Biodiversity is fundamental to life

on earth. The shifting climate has profoundly altered the environment, putting millions of plant and animal species at risk of extinction (Upreti and Upreti 2002; Meng *et al*., 2019) [8, 9]. These plants carry out important ecological functions such as erosion control because the presence of deep-rooted plants such as Pinus helps in stabilizing the soil and preventing it from erosion. Many plant species provide food and shelter for various animal species. Carbon sequestration, such as photosynthesis by trees, reduces carbon dioxide levels in the atmosphere. Green spaces have their own aesthetic and recreational value, and improve the quality of life and well-being of students as well as staff on the campus. The campus floras are useful in a range of ecological interactions, such as pollination and seed dissemination. The diversity of species enhances the capacity of the ecosystem to adapt to environmental changes. Besides, continuous/regular assessments of biodiversity at various scales and projections of its future condition offer the foundation for various management approaches such as natural area conservation (Heydari *et al*., 2013, Tahmasebi *et al*., 2020) [10, 11].

The diversity of tree species on the college campus is important for environmental health as well as human well-being. Each tree not only adds to the aesthetic beauty of the college premises but also sustains a healthy microclimate. These trees amongst a variety of campus flora have been found to have positive effects on mental health too. For instance: (1) fruit-bearing trees such as guava, mango, fig, noni and Indian cherry surely rejuvenate the senses and stimulate cognitive functions; (2) sacred trees like peepal offer a tranquil space for meditation and religious practices (Prasad PV *et al*., 2006) [12], besides providing cool shade under its large canopy; (3) consecrated trees like rudraksha are associated with spiritual healing, traditionally believed to have positive influence on physical as well as mental health of a person; (4) aroma-laden trees like pongame, north white cedar and eucalyptus yield oils used in stress-relief and holistic healing practices; (5) small-sized trees like pomegranate have anti-oxidant properties and both culinary and therapeutic uses; (6) small to medium-sized trees like amla and kamala tree are traditionally found to have medicinal properties (Jaiswal Y.S *et al*., 2017) [13]; (7) open-canopied and resinous trees like pinus, pinherio and silver oak improve air quality and are conducive to lungs as well; (7) evergreen coniferous trees like cedar and araucaria offer perennial verdure and serene backdrop for mental relaxation and enhance the aesthetic appeal of the college's landscape; and (8) the ornamental trees like bottle brush, marigold and red silk cotton tree have conspicuous flowers that attract birds and thus promote biodiversity and microhabitats helping maintain ecological balance on the premises. According to Raghava (1999) [14], ornamental plants like marigold, red rose have great demand in ornamental trades.

Shrubs have a positive impact on plant diversity, engendering comely spaces for relaxation. For instance: white indigo berry attracts butterflies; golden dewdrop has bright, visually appealing flowers offering a pleasant ambiance; aralia is traditionally believed to have medicinal worth; climbing ylang has aromatic flowers offering olfactory benefits for stress-relief; glossy privet is used for hedging; and tree caper has aesthetic appeal. Herbs add to the ecological worth of the landscape. For instance: basil, mint and aloe are traditionally used for therapeutic purposes; lemon grass has a refreshing and soothing scent; and velvet leaf adds to the aesthetic beauty. Grasses and weeds also have their ecological significance. For instance: annual ragweed supports local ecosystems; lantana attracts pollinators; and loop-root mangrove plays a crucial role in carbon sequestration.

Suggestions

The college needs to implement effectual strategies to enhance green spaces and derive mental health benefits resulting from plant diversity on its campus. For instance: (1) conducting frequent workshops, courses, guided walks, cleanliness drives, and activities focusing on local flora; (2) developing a community garden for participation of students as well as teachers and other staff along with local community in planting and caring for plants; (3) organizing mindfulness/meditation programmes in green spaces for alleviating stress and improving mental health; and (4) holding discussions and symposia on environmental issues.

The college also needs to adopt certain sustainable practices for effective preservation and conservation of plant diversity on its premises. Some of the practices include: (1) landscaping of the college campus with native and non-invasive species, in as much as they augment local plant diversity, lessen pollution, and improve air quality through photosynthesis and pollutant absorption; (2) planting non-invasive indigenous species such as guava and peepal, that help in checking air pollution and improve respiratory health by absorbing carbon dioxide and releasing oxygen; (3) creating habitats for pollinators like honey bees, black bees and butterflies; making use of rooftop and vertical spaces for plants can improve air quality on the campus; (4) developing a herbal garden with medicinal plants such as aloe, basil, mint and edible canna to apprise students of the traditional culinary and therapeutic uses of various herbs; and (5) using sustainable maintenance practices, which include composting, organic fertilizers, and integrated pest control, for proper care of the plant diversity on the campus. Additionally, the college administration can make certain policies to maintain and control the invasive species, which will be helpful in uncovering the emerging threats to local ecology and environment.

Conclusion

The rich plant diversity on the college campus has immense ecological importance, playing a crucial role in maintaining ecological balance and healthy environment amid adverse climatic conditions. The diversity of campus flora certainly offers a range of environmental tune-ups through its copious species, and adds to the air quality and overall human wellbeing in an almost arid topography dominated by high water-absorbing eucalyptus trees and highly allergic congress grass. The college needs to adopt and/or implement effective conservation strategies and sustainable practices to care for the abounding plant diversity on the campus. It is also suggested that community participation may also be ensured to preserve the campus flora, inasmuch as collective commitment to environmental and ecological conservation can save flora diversity and ascertain a sustainable future. In the light of ongoing climate change and global warming, efforts to document, safeguard and sustain plant diversity will definitely help achieve the global sustainability goals. Raising awareness about plant diversity on the campus will inculcate a sense of ecological

responsibility among students as well as faculty and other staff. Everyone on the campus should know local/common as well as botanical names of the plants, and stand committed to care for them, as the conservation and maintenance of biological resources is indispensable for the long-term survival and wellbeing of the humankind.

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