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Understanding the Decline of *Butea monosperma* (Lam.) Kuntze in Gorakhpur District, India: An Ecological Investigation

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Abstract

Butea monosperma, commonly known as the Flame of the Forest or Palash, holds significant cultural, ecological, and economic importance in many regions of India, including Gorakhpur District. This iconic tree species, known for its vibrant red and orange flowers, is now facing a concerning decline in several villages of the district. This article investigates the factors behind the dwindling population of *B. monosperma*, including changing cultural perceptions, lack of conservation efforts, and potential climatic influences. Through a comprehensive survey of the village areas and an exploration of the species' ecology, Present study elucidate the dwindling status and suggest conservation strategy for future monitoring.

Keywords: Conservation, Culture, Decline, Ecology, Tradition

Introduction

Butea monosperma, commonly known as the Flame of the Forest or Palash has been a botanical and cultural jewel adorning the landscapes of Gorakhpur District for centuries [1]. Its seasonal metamorphosis, where lush greenery gives way to a fiery display of red and orange blossoms, has not only mesmerized beholders but also found a deep-rooted place in the traditions of the local communities [2,3]. The current observations have cast a shadow of concern over the once-abundant presence of this revered species in the villages of the district. In this article, we embark on an expedition to unravel the intricate web of factors contributing to the enigmatic decline of this sacred tree. Our quest delves into the findings of comprehensive surveys conducted in the region, the invaluable insights shared by the local communities, and a meticulous exploration of *B. monosperma*'s ecological characteristics. This inquiry is not only a scientific exploration but a testament to the interplay between culture and ecology, where the fate of a botanical icon mirrors the evolving relationship between humanity and the natural world.

Study Area Description

The Gorakhpur district is located between latitude 26°12′ 56″ N to 27°6′52″ N and longitude 83°04′4″ E to 83°40′31″ E, covering an area of 3321 km^2 in the Middle Ganga alluvial plain. Situated in the north-eastern part of the state, the district stretches to the north of the Ghaghara River, forming its southern boundary **(Figure 1).** Geologically, it consists mainly of recent alluvial deposits from rivers. The landscape is gently sloping, tilting from the northwest to the southeast. The district is crisscrossed by rivers like Ghaghara, Rapti, Ami, and Rohin. The Ghaghara is a braided river, while the others meander through the region. The elevations vary from 123 meters above sea level in the northwest to 42 meters in the southeast. Some areas have higher elevations due to sand hills interrupting the flat landscape. In contrast, there are broad river valleys, known as kachhar, which lie lower than the district's general topography and are susceptible to flooding during heavy rainfall.

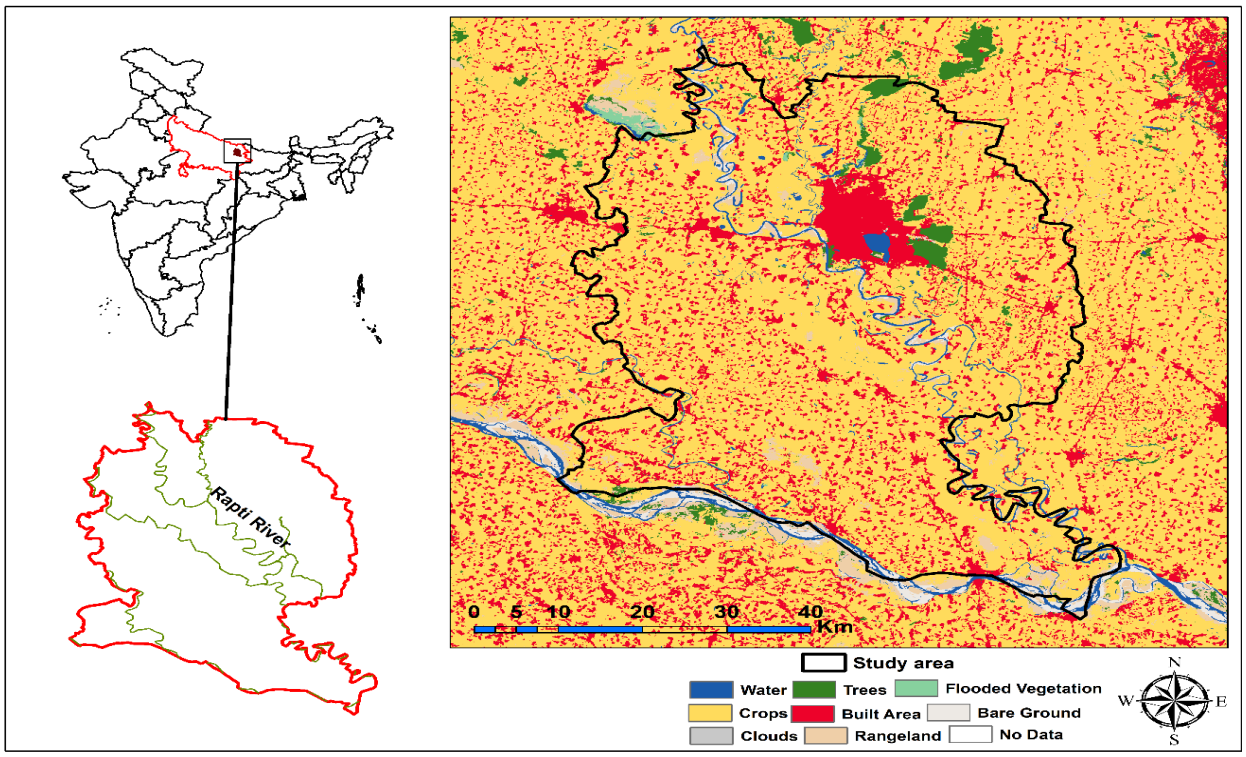

Figure 1: Map showing location of the study area.

Cultural and Ecological Significance of *Butea Monosperma*

B. monosperma has been an integral part of the cultural fabric in many Indian communities [4]. Its vibrant red and orange flowers are closely associated with various festivals and rituals [5]. The tree's timber and gum also have economic value. Additionally, *B. monosperma* plays a vital ecological role, providing food and shelter to numerous species [6]. Some of the bird species that feed on the *B. monosperma* flowers include Indian Peafowl (*Pavo cristatus*), Red-vented Bulbul (*Pycnonotus cafer*), and Purple Sunbird (*Cinnyris asiaticus*). The tree's leaves also serve as a host for the caterpillars of the Common Grass Yellow butterfly (*Eurema hecabe*).

Methodology

Survey Design

The survey aimed to comprehensively assess the factors contributing to the decline of *B. monosperma* in Gorakhpur District's villages. The research focused on understanding the perceptions of different demographic groups, particularly the younger generation and farmers, regarding the cultural significance and factors affecting the tree's population.

Participant Selection

A stratified random sampling approach was employed to ensure representation from various age groups and farming communities. Villages within Gorakhpur District were categorized based on geographical locations and demographics, and participants were randomly selected from each stratum.

Data Collection

Structured interviews and questionnaires were the primary mode of data collection, and they were conducted in-person to maximise engagement. The questionnaire covered three key areas: Understanding the Importance of Culture- Examining participants' awareness of the cultural significance of *B. monosperma*, including traditional practises associated with the tree. Traditional Practises- Investigating the continuance or decline of *B. monosperma* related traditional practises such as ceremonial roping of the tree during festivals. Perceived Factors- Encouraging participants to provide their perspectives on the factors contributing to the decline of *B. monosperma*, including climate change considerations. The survey adhered to ethical guidelines, ensuring informed consent from participants. Confidentiality and anonymity were maintained, and participants were assured that their responses would only be used for research purposes.

Survey Findings

The decline of *B. monosperma* in Gorakhpur District's villages is a complex phenomenon, as revealed by the survey findings:

Lack of Cultural Awareness

The survey identified a lack of awareness among the younger generation regarding the cultural significance of *B. monosperma*. Many participants were unfamiliar with traditional practices associated with the tree, indicating a potential disconnect between generations.

Decline in Traditional Practices

Traditional practices, such as roping the tree during festivals, have significantly declined. The survey highlighted a shift away from cultural rituals involving *B. monosperma*, with fewer participants actively engaging in these practices compared to previous generations.

Farmer Perceptions

Farmers expressed concern about the decline, attributing it to climatic changes. Over the past decade, farmers observed deterioration in the situation, indicating a potential link between environmental factors and the diminishing population of *B. monosperma*.

Ecology

B. monosperma is a deciduous tree that thrives in a variety of ecological settings. Its ecological characteristics are as follows:

- **Habitat:** This tree species is well-adapted to dry and mixed deciduous forests, often found in areas with seasonal climates. It is a hardy tree that can withstand periods of drought.

- **Seasonal Behavior:** *B. monosperma* exhibits deciduous behaviour, shedding its leaves during the dry season to conserve water and energy. As the monsoon season arrives, it bursts into vivid red and orange blossoms, creating a striking visual spectacle.
- **Wildlife Support**: The tree plays a crucial role in supporting local wildlife. Its leaves and flowers are a source of nutrition for herbivores, including various insects and deer. The tree's canopy provides shelter for birds and serves as nesting sites.
- **Economic Significance:** Beyond its ecological value, *B. monosperma* has economic importance. Its timber and gum are utilized for various purposes, contributing to the local economy.

Distribution

The distribution of *B. monosperma* is primarily concentrated in the Indian subcontinent, where it is native. Key aspects of its distribution include:

- **Native Range:** *B. monosperma* is indigenous to the Indian subcontinent, encompassing regions within India, Bangladesh, Nepal, and Sri Lanka. Its distribution extends from the lower foothills of the Himalayas in the north to the Deccan Plateau in the south.
- **Variation within India:** Within India, this tree species is found in various states, including but not limited to Uttar Pradesh, Madhya Pradesh, Maharashtra, and Karnataka. It is prevalent in regions with suitable habitat conditions, including deciduous and mixed deciduous forests.
- **Cultural Significance:** The distribution of *B. monosperma* is closely tied to cultural practices in India. It is revered for its vibrant flowers and is a central element in various festivals and rituals, particularly in the northern and central parts of the country.
- **Conservation Status:** While *B. monosperma* is not currently considered endangered, its conservation is essential due to its cultural significance and ecological value. Efforts are underway to protect and preserve this iconic tree species.

Observation and Discussion

In Gorakhpur District, the culturally significant and ecologically valuable *B. monosperma*, commonly known as Palash, is experiencing a worrisome decline. Over the centuries, this tree has a significant place in Indian cultural heritage. However, the distinctive red and orange blossoms that have been iconic to this tree are now experiencing a gradual decline with in Landscape. Surveys conducted in the region have uncovered several key factors contributing to this decline. Notably, younger generations in the villages are often unaware of the cultural significance of *B. monosperma*, leading to the decline of traditional practices like the ritualistic roping of the tree during festivals. This shift in cultural awareness and practices suggests a broader cultural transformation that may be impacting the tree's conservation. Additionally, a prevalent perception among farmers in the region is that climatic changes have played a role in the decline, particularly over the past decade. The possible influence of climate change on the distribution and health of *B. monosperma* merits further investigation, as shifting weather patterns, including altered precipitation and temperature regimes, may be impacting the tree. Typically found in deciduous forests and mixed deciduous forests, *B. monosperma* is well adapted to the seasonal climate of the Indian subcontinent, displaying deciduous features by shedding its leaves during the dry season and vibrant flowering during the monsoon. To comprehensively address the decline of *B. monosperma*, conservation strategies must include efforts to raise awareness about its cultural significance, particularly among younger generations, and promote traditional practices. Conservation initiatives should also consider the potential impacts of climate change on the species and may include habitat maintenance and restoration efforts.

Threats

The most significant of these threats is habitat loss, primarily driven by urbanization, agricultural expansion, and infrastructure development, resulting in a reduced available habitat for *B. monosperma* [7]. Deforestation, often fuelled by the demand for timber and fuelwood, has significantly impacted *B. monosperma* populations, disrupting natural ecosystems [6]. Climate change, with altered weather patterns and rising temperatures, can disturb the flowering and fruiting patterns of *B. monosperma*, potentially leading to reduced seed production. Invasive non-native plant species are another threat, outcompeting and displacing *B. monosperma* and its associated vegetation, further diminishing its habitat [8]. Additionally, anthropogenic activities such as overgrazing, uncontrolled forest fires, and land clearing for agriculture have direct negative impacts on *B. monosperma* populations. These combined threats underscore the urgent need for conservation and management efforts to protect this iconic tree species.

Conservation Strategies and Management

Conserving *B. monosperma* necessitates a comprehensive set of strategies and management practices. This includes the establishment and expansion of protected areas and reserves with legal protection to safeguard *B. monosperma* populations from habitat destruction. Implementation of programs on the restoration of *B. monosperma* in deforested or degraded areas are emphasizing the use of native tree species [9]. Ensuring the restoration and maintenance of Butea monosperma's natural habitat involves the effective control of invasive species, such as *Ageratum conyzoides*, *Antigonon leptopus*, *Argemone mexicana*, *Cassia tora*, *Datura stramonium*, *Datura innoxia*, *Echinochloa crus-galli*, *Eupatorium adenophorum*, and *Lantana camara*. Additionally, it necessitates the implementation of robust forest fire management strategies and protection measures against illegal logging [10]. Engaging local communities in conservation efforts, encouraging sustainable forestry practices, and offering alternative sources of fuelwood and timber to alleviate pressure on *B. monosperma*. Raising awareness about the ecological and cultural significance of *B. monosperma* through education programs to foster community appreciation and protection of these trees [11]. Conducting scientific research on *B. monosperma*'s biology, ecology, and genetics, alongside regular monitoring of populations to assess their health and guide informed conservation decisions. Developing strategies to enhance the resilience of *B. monosperma* to the impacts of climate change, including the planting of drought-resistant varieties and creating microhabitats [10]. Advocating for and enforcing legislation and policies that provide protection for *B. monosperma* and its habitat, ensuring international agreements, such as the Convention on Biological Diversity, are rigorously upheld. Establishing seed banks to preserve genetic diversity and facilitate future reintroduction and restoration efforts. These combined efforts are crucial for the conservation and long-term survival of this iconic tree species.

Conclusion

The decline of *B. monosperma* in Gorakhpur District's villages is a complex issue involving cultural shifts, a lack of conservation awareness, and potential climatic effects. As we delve into the multifaceted reasons behind this decline, it becomes evident that understanding and addressing these issues are crucial for the preservation of this culturally and ecologically significant tree. The Flame of the Forest has illuminated the lives of generations, and it is our responsibility to ensure its continued presence for the generations to come.

Conflict of Interest

The author declares that there are no conflicts of interest regarding the publication of this article. This research was conducted in an unbiased and objective manner, and the author have not received any financial support or other benefits that could be perceived as influencing the results or interpretation presented in this work.

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