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Conservation Priorities for Endangered Plant Species in the Biodiverse Region of Nagpharh, Ajmer

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ABSTRACT:
Nagpharh, located in the Ajmer District of Rajasthan, is a region rich in biodiversity yet increasingly vulnerable to ecological degradation. This study focuses on the conservation priorities for endangered plant species in this unique landscape, which is facing mounting pressures from habitat destruction, overgrazing, climate change, and human expansion. Through field surveys, species documentation, and ecological assessment, this research identifies key threatened plant species, evaluates the severity of risks they face, and proposes targeted conservation strategies. The study emphasizes the need for community-based conservation models, restoration of native habitats, and integration of traditional ecological knowledge with modern conservation practices. By highlighting the ecological and cultural significance of Nagpharh's flora, this research aims to support long-term biodiversity preservation efforts in the region and serve as a reference for similar arid and semi-arid ecosystems in India.

KEYWORDS: Endangered Plant, Ecological Degradation, Habitat Destruction, Nagpharh.

INTRODUCTION:

Biodiversity the variety of life on Earth is the foundation of ecosystem services and ecological balance. Plant species, in particular, play a vital role in maintaining ecological stability, contributing to soil fertility, water purification, climate regulation, and providing food and medicinal resources. The conservation of plant biodiversity is especially crucial in ecologically sensitive regions where environmental threats and anthropogenic activities pose increasing risks to native flora. One such area of ecological significance is Nagpharh, located in the Ajmer district of Rajasthan, India. Nagpharh, situated in the semi-arid zone of the Indian subcontinent, is characterized by a diverse range of microclimates, geological formations, and vegetation types. The region supports a unique assemblage of plant species, many of which are endemic or have limited geographical distribution. Due to the interaction between natural elements and traditional land-use practices, Nagpharh has developed into a rich habitat mosaic that contributes significantly to the overall biodiversity of the Ajmer district and the broader Aravalli landscape. However, over the past few decades, this ecological harmony has been increasingly disturbed. Rapid urbanization, unsustainable agricultural practices, deforestation, overgrazing, and the impacts of climate change have intensified the degradation of habitats and led to the decline of several plant species. Many native and endemic plants now fall under the category of "endangered" or "threatened," according to national and global conservation assessments. These losses not only threaten

ecological balance but also endanger the traditional knowledge and cultural heritage of local communities that have relied on these plants for generations.

Importance of Plant Conservation in Semi-Arid Ecosystems :

Plant conservation in semi-arid regions like Nagpharh holds particular importance due to the fragile nature of these ecosystems. Unlike tropical forests, which often receive considerable attention in global conservation discourse, arid and semi-arid zones tend to be overlooked. Yet, these regions harbor unique species that are highly adapted to extreme conditions, such as limited water availability, high temperatures, and poor soil fertility. The plants that thrive in Nagpharh contribute significantly to ecological resilience, acting as stabilizers of the soil and buffers against desertification.

In addition to ecological benefits, many of these plant species have ethnobotanical and medicinal significance. Local communities in and around Nagpharh have traditionally depended on native flora for herbal remedies, livestock fodder, fuelwood, and spiritual rituals. The decline or extinction of these species would thus result in a loss that is both ecological and cultural.

Overview of Threatened Flora in Nagpharh:

While comprehensive documentation of Nagpharh's floral diversity is still ongoing, preliminary fieldwork and local records suggest the presence of several plant species that are either endangered or vulnerable. These include species such as *Commiphora wightii* (Guggul), *Boswellia serrata* (Indian Frankincense), and *Tecomella undulata* (Desert Teak), among others. These species are at risk due to specific threats including habitat fragmentation, illegal harvesting, invasive species, and changing climatic conditions.

Moreover, some species have such narrow ecological niches that even minor disturbances can significantly impact their survival. For example, *Commiphora wightii*, which has resin of high medicinal value, is subject to overharvesting and poor regeneration, pushing it closer to local extinction in parts of Ajmer district. Likewise, *Tecomella undulata*, a valuable timber tree endemic to Rajasthan, faces threats due to excessive cutting and poor natural regeneration.

Conservation Challenges in the Region.

Conservation in Nagpharh is hindered by several interlinked challenges:

Lack of Data and Research: There is a severe paucity of reliable data on the population status, distribution, and reproductive biology of many endangered plants in the region. Conservation planning requires updated floristic inventories and ecological assessments, which are often lacking.

Weak Enforcement of Environmental Laws: Although India has strong biodiversity laws under frameworks like the Biological Diversity Act (2002), enforcement remains weak, especially in remote areas like Nagpharh. Illegal grazing, unregulated harvesting, and land conversion continue with little oversight.

Limited Community Involvement: Effective conservation cannot succeed without the active participation of local communities. However, awareness about the importance of native plant conservation is relatively low, and local knowledge systems are underutilized in formal conservation planning.

Climate Variability: The increasing unpredictability of rainfall, rising temperatures, and prolonged droughts have affected the reproductive cycles and germination patterns of many native species, particu-

larly those reliant on seasonal cues.

Invasive Species: The proliferation of invasive alien species such as *Prosopis juliflora* has significantly altered native plant communities, often outcompeting native vegetation and reducing biodiversity.

Need for Prioritization in Conservation

In an environment where resources—both financial and institutional—are limited, it becomes essential to prioritize conservation efforts. Rather than attempting to protect all species equally, conservation science now advocates for prioritization based on criteria such as:

Endemism and Rarity: Species found only in a particular region and in low numbers deserve urgent attention.

Ecological Importance: Keystone and foundational species that support entire ecosystems should be conserved to maintain overall biodiversity.

Threat Level: Species facing imminent extinction risks should be prioritized in rescue and recovery programs.

Cultural and Economic Value: Species that support livelihoods or have significant cultural relevance should be preserved for both ecological and socio-economic reasons.

This study aims to apply such a framework to Nagpharh's endangered flora, with the objective of identifying the most critical conservation priorities for the region.

OBJECTIVES OF THE STUDY:

The overarching goal of this study is to support the long-term conservation of endangered plant species in Nagpharh by providing a comprehensive assessment of current threats, identifying priority species, and recommending actionable strategies. The specific objectives include:

- To document and map the current distribution of endangered and threatened plant species in Nagpharh.
- To assess the ecological, ethnobotanical, and conservation significance of these species.
- To analyze the major threats impacting the survival of these plants and their habitats.
- To identify conservation priorities using a systematic evaluation framework.
- To propose site-specific and species-specific conservation strategies that can be implemented by local stakeholders, government bodies, and NGOs.

RESEARCH AREA:

The study was conducted in the Nagpahar region of Ajmer district, Rajasthan, which forms a part of the ancient Aravalli hill range. This area is known for its semi-arid ecosystem, unique topography, and diverse plant life. Nagpahar was selected as the study site due to its ecological importance and the presence of several rare and threatened plant species. These include medicinal herbs and endemic flora that are increasingly at risk due to anthropogenic pressures such as deforestation, overgrazing, and habitat degradation. The region serves as a critical zone for biodiversity conservation and ecological research.

METHODOLOGY:

The study was conducted in the Nagpahar region of Ajmer district, part of the Aravalli hills, known for its semi-arid ecosystem and ecological importance. A detailed literature review helped identify threatened plant species and understand past research. Field surveys and data collection were done using

quadrat and transect methods. Plant identification and classification followed botanical keys and herbarium verification. Threat analysis assessed factors like habitat loss and overgrazing. Community participation and ethnobotanical data were gathered through interviews with locals and traditional healers. Based on findings, a conservation strategy formulation was proposed emphasizing in-situ and ex-situ preservation.

RESULT:

***Commiphora Wightii* (Guggul)**:

Acritically endangered plant from the Burseraceae family, is native to the dry, rocky regions of Rajasthan, Gujarat, and parts of Pakistan. Known locally as Guggal, its resin is widely used in Ayurvedic medicine for treating arthritis, obesity, cholesterol, and skin disorders, due to its anti-inflammatory and lipid-lowering properties. However, the species faces significant threats, including overharvesting, poor regeneration from unsustainable tapping, and habitat loss due to grazing, mining, and deforestation. Conservation efforts for Commiphora wightii include in-situ protection, ex-situ cultivation, awareness programs on sustainable harvesting, and propagation techniques like tissue culture to ensure its survival.

***Tecomella undulata* (Desert Teak):**

A vulnerable species from the Bignoniaceae family is found in the dry, rocky slopes and sandy plains of Rajasthan, Gujarat, and parts of Pakistan, particularly in the Thar Desert. Known locally as Tembo, it is valued for its hard, durable wood, used in furniture, construction, and boat building. The bark, leaves, and seeds have medicinal properties, including anti-inflammatory and wound-healing benefits. However, the species faces threats like overharvesting, habitat degradation, and climate change. Conservation efforts include in-situ protection, ex-situ propagation, and promoting sustainable harvesting practices.

***Boswellia serrata* (Indian Frankincense):**
From the Burseraceae family, is found in dry, hilly regions of India, particularly Rajasthan, Gujarat, and Madhya Pradesh, and parts of Africa. Known locally as Salai, it is valued for its resin, which has anti-inflammatory, anti-arthritic, and analgesic properties. The resin is used in Ayurvedic medicine to treat joint pain and digestive issues, and it is also used in incense and perfumes. Threats include overharvesting, habitat loss due to deforestation and overgrazing, and climate change. Conservation efforts focus on in-situ protection, ex-situ propagation, sustainable harvesting, and community awareness programs.

***Salvadora oleoides* (Desert Olive):**
From the Salvadoraceae family, is found in the dry, rocky regions of Rajasthan**,** Gujarat, and other arid areas of India. Known locally as Harad**,** it thrives in saline soils and dry forests. The plant has medicinal uses for treating digestive disorders and skin infections, while its seeds yield oil with antibacterial and antifungal properties. The durable wood is used for fuel and small construction. Threats include overgrazing**,** deforestation, and climate change. Conservation efforts focus on in-situ protection**,** ex-situ propagation**,** sustainable harvesting, and community education**.**

Tribulus rajasthanensis :
It is a rare, critically endangered plant endemic to the arid Thar Desert region of Rajasthan, India. Belonging to the Zygophyllaceae family, it is a hermaphroditic, annual herb and a variety of *Tribulus terrestris*. Identified by a diploid chromosome number (2n = 24), it thrives in dry climates. Though closely related to medicinally valued *T. terrestris*, specific studies on *T. rajasthanensis* are limited. Overharvesting, habitat loss, and climatic changes threaten its survival. Cytogenetic research indicates genetic uniqueness, highlighting the need for focused conservation. Sustainable use and protection are essential to preserve this ecologically and potentially medicinally important species.

Grewia damine:

It is a deciduous shrub or small tree in the Malvaceae family, native to tropical Asia and Africa. It grows 2–6 meters tall, with ovate, serrated leaves and small pale yellow or white flowers blooming from July to September. Its edible orange to dark brown fruits are sweet yet astringent. Found in dry scrublands and forest edges across India, especially in Rajasthan and South India, it serves as a hedge or windbreak due to its dense growth. Though pharmacological research is limited, related species suggest medicinal uses such as anti-inflammatory, astringent, and skin-healing properties in traditional remedies.

***Cordia crenata* :**

known as Toothed-Leaf Cordia or Musakabi, is a drought-tolerant shrub or small tree from the Boraginaceae family. Native to Africa, the Arabian Peninsula, and India (notably Rajasthan and Gujarat), it thrives in arid, sandy soils. Growing up to 7 meters, it features ovate, velvet-hairy leaves, white or cream flowers, and sweet yet sharp-tasting orange fruits. Often used for ornamental planting, hedges, and windbreaks, it is valued in dry and coastal landscapes. Though direct medicinal studies are limited, its traditional uses suggest anti-inflammatory and skin-healing properties, similar to related species. It is easy to grow and propagate.

***Balanites aegyptiaca* :**
commonly known as desert date or Hingot, is a drought-resistant tree native to arid regions of Africa, the Arabian Peninsula, and India (notably Rajasthan and Gujarat). It grows up to 7 meters tall, with ovate leaves, white or cream flowers, and oval, orange edible fruits with a sharp-sweet taste. Thriving in sandy, nutrient-poor soils and hot, dry climates, it's ideal for hedges, windbreaks, or coastal gardens. Traditionally, parts of the plant are used in folk medicine for anti-inflammatory and skin treatments. Its resilience and multiple uses make it valuable for arid landscaping and rural livelihoods.

CONCLUSION:

In conclusion, the conservation of endangered plant species in the Nagpharh region of Ajmer, Rajasthan, is of critical importance for maintaining the ecological balance and preserving the cultural heritage of the area. The unique plant species found in this semi-arid ecosystem are highly adapted to extreme conditions and provide essential ecosystem services such as soil stabilization, water regulation, and medicinal resources. However, anthropogenic pressures like habitat destruction, overgrazing, illegal harvesting, and climate change are pushing many of these species toward extinction.

This study highlights the urgent need for targeted conservation strategies, focusing on both in-situ and ex-situ preservation methods. Key species such as *Commiphora wightii*, *Tecomella undulata*, *Boswellia serrata*, and *Tribulus rajasthanensis* are at high risk due to unsustainable harvesting and habitat degradation. Effective conservation requires the integration of scientific research, traditional ecological knowledge, and community-based approaches to ensure long-term sustainability.

Furthermore, raising awareness and promoting sustainable land-use practices among local communities are vital steps in conserving these invaluable plant species. By prioritizing conservation efforts based on ecological, cultural, and economic criteria, Nagpharh can become a model for preserving plant biodiversity in semi-arid regions across India and beyond.

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