

Prosopis cineraria: Integrating Ecological Services, Ethnomedicinal Applications, Livestock Nutrition and Sustainable Land Management with Special Reference to Dudhwakhara, Churu District, Rajasthan

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Abstract—*Prosopis cineraria* (Khejri) is a remarkable tree species widely distributed in the arid regions of Rajasthan and is known for its ecological, medicinal, and socio-economic importance. The present paper focuses on the multiple roles of this species with special reference to Dudhwakhara, Churu District, Rajasthan. Khejri contributes significantly to environmental sustainability and supports the livelihood of local communities in various ways. Its adaptability to harsh climatic conditions makes it an important component of dryland ecosystems. The study highlights the ecological services, ethnomedicinal relevance, livestock support, and role of the species in sustainable land management. Owing to its multifunctional nature, *Prosopis cineraria* continues to be one of the most valuable tree resources of the Thar Desert region.

Key words—*Prosopis cineraria*, Ecology, Ethnomedicine, Biodiversity Conservation, Sustainability, Dudhwakhara

I. INTRODUCTION

Rajasthan, the largest state of India, is known for its vast arid and semi-arid landscapes. A major portion of the state falls within the Thar Desert, which is characterized by low and irregular rainfall, high temperatures, strong winds, and frequent drought conditions. These environmental factors create a challenging habitat for plant growth and survival. However, over time, several native plant species have adapted themselves to these harsh conditions and form an important part of the desert ecosystem. Such vegetation plays a crucial role in maintaining ecological balance, conserving soil, and supporting the livelihoods of rural communities.

Churu district is situated in the north-western part of Rajasthan and is one of the prominent districts of the Thar Desert region. The district experiences an extreme climate, with very hot summers, cold winters, and limited rainfall throughout the year. Sandy plains and dunes dominate the landscape, making the area highly dependent on drought-resistant vegetation. Despite these climatic challenges, Churu supports a variety of native plant species that have evolved special adaptations to survive in water-deficient environments. These plant species contribute significantly to the ecological stability and environmental sustainability of the region.

Dudhwakhara, a well-known village in Churu district, represents the typical environmental conditions of the arid zone of Rajasthan. The village is surrounded by agricultural lands, grazing areas, and natural vegetation that support both local biodiversity and rural livelihoods. The vegetation of Dudhwakhara mainly consists of hardy plant species capable of surviving under extreme climatic conditions. These plants not only provide ecological benefits but also serve as valuable resources for the local population.

Among the different plant species found in Dudhwakhara, *Prosopis cineraria* (L.), commonly known as Khejri, is one of the most common, dominant, and ecologically significant tree species. It is widely distributed throughout the region and can be observed in agricultural fields, village surroundings, grazing lands, and natural habitats. Due to its high abundance and remarkable adaptability, *Prosopis cineraria* forms an important component of the local vegetation. In many parts of western Rajasthan, it is considered one of the characteristic tree species of the desert ecosystem.

Prosopis cineraria is highly valued because of its ability to survive and flourish under harsh environmental conditions where many other tree species cannot persist. Its deep root system and drought-resistant nature enable it to withstand prolonged periods of water scarcity and contribute to ecosystem stability. The species has long been associated with the traditional lifestyle and culture of desert communities and is recognized for its ecological, economic, and social importance.

In recent years, increasing attention has been given to the role of native desert plant species in environmental conservation and sustainable development. Among these species, *Prosopis cineraria* occupies a unique position due to its multifunctional nature and wide distribution. Its abundance in Dudhwakhara and the surrounding region makes it an important species for understanding the relationship between native vegetation, ecosystem sustainability, and rural livelihoods.

II. STUDY AREA

Dudhwakhara is a large village located in Churu tehsil of Churu district, Rajasthan. The village represents a typical arid ecosystem of the Thar Desert region, where extreme climatic conditions influence the distribution and composition of vegetation. The area supports a variety of drought-resistant plant species, among which *Prosopis cineraria* is one of the most common and dominant trees. Due to its ecological characteristics and the abundance of *Prosopis cineraria*, Dudhwakhara provides an appropriate setting for understanding the role of this species in arid environments.

A. Geographic Location and Landscape

Dudhwakhara is a prominent village situated in Churu tehsil of Churu district, Rajasthan. The village lies in the arid region of north-western India and forms a part of the Thar Desert ecosystem. Geographically, it is located at approximately 28.47° N latitude and 75.08° E longitude, covering an area of about 4295.85 hectares. The landscape is largely characterized by sandy plains, open agricultural fields, grazing lands, and scattered natural vegetation. The physical environment of the area reflects typical desert conditions and supports plant species adapted to water scarcity and high temperatures.

B. Climate and Soil Features

Dudhwakhara experiences a semi-arid climate marked by extreme seasonal variations. Summer temperatures often rise above 48°C, while winter temperatures may fall close to 1–2°C. The region receives low and irregular rainfall, with an average annual precipitation of approximately 300–350 mm, most of which occurs during the monsoon season. Relative humidity generally ranges between 40% and 60% and remains lowest during the peak summer months.

The soil of the area is predominantly coarse and sandy in nature. It possesses low moisture-holding capacity and limited nutrient content, making plant growth challenging. Despite these conditions, several drought-tolerant plant species thrive in the region due to their specialized adaptations.

C. Vegetation and Ecological Characteristics

The vegetation of the study area is characterized by the presence of several drought-resistant tree species that are well adapted to arid environmental conditions. The dominant tree species include *Prosopis cineraria*, *Acacia nilotica*, *Tecomella undulata*, *Dalbergia sissoo*, *Senegalia catechu*, and *Salvadora persica*. These species form an important part of the natural vegetation and contribute significantly to the ecological stability of the region.

Among them, *Prosopis cineraria* is one of the most abundant and widely distributed tree species. Due to its remarkable adaptability to water-deficient conditions and its ability to thrive in sandy soils, it occupies a prominent position in the vegetation of the area. The species is commonly found in agricultural fields, grazing lands, and open landscapes, making it an important component of the local ecosystem. The combined presence of these tree species enhances biodiversity and reflects the characteristic vegetation pattern of the arid regions of Rajasthan.

III. REVIEW OF LITERATURE

Prosopis cineraria is one of the most important tree species of the arid and semi-arid regions of India, particularly Rajasthan. Several researchers have highlighted its ecological, economic, and medicinal importance. Previous studies have reported that the species plays a significant role in maintaining ecosystem stability and supporting vegetation in desert environments.

Various authors have emphasized the adaptability of *Prosopis cineraria* to harsh climatic conditions such as high temperature, low rainfall, and sandy soils. Due to its drought tolerance and deep root system, the species is considered an important component of desert ecosystems. Studies have also indicated its contribution to soil improvement and environmental sustainability in arid regions.

The medicinal value of *Prosopis cineraria* has been documented by several researchers. Different parts of the plant have been reported to possess therapeutic properties and have been traditionally used in rural communities for the management of various ailments. Ethnobotanical studies have highlighted its importance in traditional healthcare systems.

Researchers have also reported the significance of *Prosopis cineraria* in livestock-based rural economies. The species is widely recognized as a valuable source of fodder, particularly during periods of drought when the availability of other forage resources becomes limited. Its role in supporting livestock production has been discussed in several studies conducted in desert areas.

In addition to its ecological and economic importance, *Prosopis cineraria* has been recognized for its contribution to biodiversity conservation and sustainable land management. The species provides habitat and resources for various organisms and contributes to the resilience of arid ecosystems. Previous studies have therefore identified *Prosopis cineraria* as a multifunctional tree species with considerable ecological and socio-economic value.

IV. OBJECTIVES OF THE STUDY

- 1.To study the ecological importance of *Prosopis cineraria* in the study area.
- 2.To understand the medicinal uses of *Prosopis cineraria*.
- 3.To know the role of *Prosopis cineraria* in livestock nutrition.
- 4.To study the contribution of *Prosopis cineraria* to biodiversity conservation.
- 5.To understand the importance of *Prosopis cineraria* in sustainable land management.

V. METHODOLOGY

The present study was carried out to gather information on the ecological, ethnomedicinal, and socio-economic importance of *Prosopis cineraria*. Data were collected through field observations, interactions with local people, and available scientific literature. The methodology adopted for the study is described below.

A. Field Observation

Field observations were carried out during visits to different locations within the study area. These visits helped in understanding the occurrence, abundance, and distribution pattern of *Prosopis cineraria* under natural conditions. Observations were made on the presence of the species in agricultural fields, grazing lands, village surroundings, and other habitats. Attention was also given to its association with other plant species growing in the area. General observations regarding the condition of the trees, their adaptation to the local environment, and their contribution to the surrounding vegetation were recorded. Photographic documentation and field notes were maintained wherever necessary to support the observations.

- Photographs recorded during the survey are presented below-



Fig 1- *Prosopis cineraria* growing in the study area

B. Interaction with Local Residents

Information regarding the traditional importance and local uses of *Prosopis cineraria* was obtained through informal discussions with local residents. Elderly people, farmers, livestock owners, and other knowledgeable individuals were approached to understand their experiences and observations related to the species. These interactions provided useful insights into the relationship between local communities and *Prosopis cineraria*. Traditional knowledge associated with the species was also documented during the study.

C. Literature Survey

A detailed review of available literature was conducted to collect scientific information related to *Prosopis cineraria*. Various sources, including research papers, scientific journals, books, review articles, and published reports, were consulted. Information concerning the ecological importance, ethnomedicinal value, livestock utility, biodiversity significance, and environmental contributions of the species was gathered from these sources. The literature survey helped in understanding previous research findings and provided a scientific basis for the present study.

D. Data Compilation and Analysis

The information collected through field observations, literature review, and local interactions was compiled and organized in a systematic manner. Similar information obtained from different sources was compared and verified to ensure accuracy and consistency. The collected data were then analyzed using a descriptive approach. The findings were categorized according to the objectives of the study and presented under different thematic sections. This method helped in evaluating the ecological, ethnomedicinal, and socio-economic significance of *Prosopis cineraria*.

VI. RESULT

The findings of the present study revealed that *Prosopis cineraria* is one of the most important tree species of the region. The species plays a significant role in maintaining ecological balance and supporting the livelihood of local communities. Its wide distribution and adaptability to arid conditions make it an important component of the local vegetation. The major findings of the study are discussed below.

A. Ecological Importance of *Prosopis cineraria*

Prosopis cineraria is an important component of the natural vegetation of arid and semi-arid regions. The species is well adapted to extreme environmental conditions and remains green even during prolonged dry periods. Its presence contributes to the stability of the ecosystem and supports the survival of many living organisms. The tree helps maintain a suitable environment in areas where climatic conditions are often unfavorable for plant growth. Because of its resilience and ecological value, *Prosopis cineraria* occupies a significant position among the native tree species of Rajasthan.

Table 1- Ecological Importance of *Prosopis cineraria*

Ecological aspects	Importance
Soil Conservation	Helps protect soil from erosion
Soil Fertility	Contributes to improvement of soil conditions
Shade Provision	Creates a favorable microenvironment
Drought Tolerance	Survives under harsh climatic conditions
Biodiversity Support	Supports different forms of life
Ecosystem Stability	Helps maintain ecological balance

B. Ethnomedicinal Applications of *Prosopis cineraria*

Prosopis cineraria is widely used in traditional healthcare systems of arid regions. Local people have long relied on this tree for basic health needs because it is easily available and considered useful in many common conditions. Different parts of the plant are used in different ways depending on the requirement. The knowledge of its use is based on traditional experience and is still followed in rural areas.

Table 2- Ethnomedicinal Applications of *Prosopis cineraria*

Plant parts	Traditional Importance
Stem and bark	Used in traditional remedies for stomach-related problems, skin irritation, and general weakness. It is also considered helpful in wound healing practices.
Root	Used in limited traditional practices, mainly for general wellness and in some local healing methods.
Leaves	Used in folk medicine for digestive issues and general body discomfort. In some areas, leaf preparations are also used during fever and minor infections.
Flowers	Used in traditional preparations believed to support general health and relieve mild health conditions.
Pods	Commonly used as a nutritious and health-supporting food, especially helpful in improving energy levels and during seasonal weakness.
Gum	Used in local remedies for soothing throat irritation and for general body strength in traditional systems.

Photographic documentation was carried out during the field survey to record important plant structures of *Prosopis cineraria*. The photographs presented below illustrate some of the prominent parts of the species that are commonly recognized and utilized by local communities.



Stem (Bark)



Leaves



Green pods (Sangri)



Mature dry pods

Fig 2- Different morphological parts of *Prosopis cineraria*.**C. Role in Livestock Nutrition**

Prosopis cineraria plays an important role in supporting livestock in arid and semi-arid regions, especially during dry seasons when green fodder becomes scarce. In rural areas, this tree is considered a reliable natural source of feed for animals. Its leaves and pods are commonly used as fodder because they are available for a long period of the year and provide essential nutrients. The tree helps rural households maintain their livestock even under harsh climatic conditions. Because of its availability and nutritional value, it is an important part of traditional animal feeding practices.

Table 3- Role in Livestock Nutrition

Plant parts	Importance for livestock
Leaves	Widely used as green fodder; help maintain animal health during dry periods and reduce feed shortage problems.
Pods	Nutritious and commonly consumed by cattle, goats, and sheep; help in maintaining energy and body condition.
Young Twigs	Sometimes browsed by animals when other fodder is not available.

D. Contribution to Biodiversity Conservation

Prosopis cineraria plays an important role in maintaining biodiversity in arid and semi-arid ecosystems. Its presence supports a wide range of living organisms by providing food, shelter, and suitable habitat conditions. The tree helps in sustaining ecological interactions among plants, animals, and microorganisms. In dry regions where resources are limited, such native trees become important for maintaining life forms and ecological balance. Because of its wide adaptability, it also supports the survival of several associated species.

Table 4- Contribution to Biodiversity Conservation

Biodiversity Component	Contribution
Birds	Provides nesting sites, shelter, and food resources such as flowers and pods.
Insects	Supports pollinators and other beneficial insects through flowers and foliage.
Small Animals	Offers protection and habitat in dry and open landscapes.
Associated Plants	Improves surrounding micro-environment, helping the growth of nearby vegetation.

E. Importance in Sustainable Land Management

Prosopis cineraria is considered an important species for maintaining and improving land conditions in arid regions. It helps in reducing the impact of harsh environmental factors and supports the long-term productivity of soil and vegetation. The presence of this tree contributes to better land stability and helps in managing degraded or dry lands. In rural areas, it is also associated with traditional land-use practices that support both agriculture and livestock systems. Because of its adaptability and multiple benefits, it is widely regarded as a useful species for sustainable land use in desert environments.

Table 5- Importance in Sustainable Land Management

Aspects	Contribution
Agroforestry Practice	Commonly retained in fields as part of traditional farming systems
Sustainable Farming	Supports tree–crop coexistence in dry regions

Resource Support	Provides fodder, fuelwood, and other local needs
Land Use Balance	Maintains balance between agriculture and natural vegetation
Rural Livelihood	Supports farming and livestock-based economy

VII. CONCLUSION

The present study highlights that *Prosopis cineraria* is one of the most important and useful tree species of arid and semi-arid regions. It plays a significant role in supporting the natural environment as well as rural life. The species is well adapted to harsh climatic conditions and continues to survive in areas where other vegetation cannot grow easily.

It provides multiple benefits such as support to livestock through fodder, traditional medicinal uses, and contribution to maintaining ecological balance. The tree is also helpful in sustaining rural livelihoods by fulfilling various daily needs like fuelwood and other local resources.

Overall, *Prosopis cineraria* can be considered a key species for sustainable development in dry regions. Its conservation and proper management are important for maintaining environmental stability and supporting future generations in arid landscapes.

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