Anusandhanvallari
Vol 2024, No.1
December 2024
ISSN 2229-3388

Declining biodiversity of plants in Jhalana forest area of Rajasthan.

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Abstract

The current survey-based study identified a total of 79 plants in Jhalana forestry area facing the danger of extinction owing to several natural and anthropogenic factors. The plants belong to 43 distinct plant families. The distribution of species across families revealed that the most prominent families were Fabaceae (7), Euphorbiaceae (6), Asteraceae (5), Malvaceae (4), Mimosaceae (4), Moraceae (4), Solanaceae (3), Asclepiadaceae, Caesalpiniaceae, Convolvulaceae, Lamiaceae. Meliaceae, Poaceae, Rhamnaceae, Sterculiaceae, Tiliaceae and Verbenaceae (2 each). Apart from these families, other families included in this survey based study were, Achyranthaceae, Amaranthaceae, Anacardiaceae, Annonaceae, Apiaceae, Apocynaceae, Arecaceae, Balanitaceae, Bombacaceae, Burceraceae, Cappariadaceae, Cleomaceae, Combretaceae, Crassulaceae, Cucurbitaceae, Ehretiaceae, Liliaceae, Lythraceae, Nyctaginaceae, Nyctanthaceae, Papaveraceae, Pteridaceae, Rutaceae, Vitaceae and Zygophyllaceae (1 plant each). All these plants were found in various habitats, including trees, shrubs, herbs, and climbers, the most prominent habits were Herbs (27), Tree (18), Small tree (12), Shrub (11) and Climber shrub (2). Apart from these, the study also included several other habits, including, Erect herb, Evergreen tree, Grass, Large tree, Prostrate herb, Shrub like grass and Twining shrub (1). The study showed gradual decline in plant biodiversity in this area owing to several factors such as overharvesting of the plant species, habitat destruction due to deforestation, habitat destruction, Illegal logging for its valuable heartwood, overgrazing, illegal trade, agricultural expansion, pollution as well as and climate change.

Keywords: Jhalana area; loss of plant bidioversity; conservation etc.

Introduction

Plants have been a vital part of our existence throughout history since they not only provide us with oxygen but also support our well-being by offering medicinal benefits that have been passed down through generations. Unfortunately, the balance of nature is being disrupted at an alarming rate, and the pace at which plant species are disappearing is accelerating. Increasing urbanization and industrialization are the primary drivers of this loss, with the natural habitats of many plants being destroyed in the process (Ellis *et al.,* 2012; Vellend *et al.,* 2017; Cappelli *et al.,* 2022; Shin *et al.,* 2022).

The situation is even more critical in arid parts of Rajasthan, such as Jaipur, which is seeing increasing pressure on plant life due to rapid urban growth, agricultural expansion, and the introduction of invasive species. The Jhalana Forest is a prime example of how these factors are taking a toll on biodiversity. This ecosystem which was once renowned for its variety of medicinal plants, is now facing habitat destruction and other human-driven activities, such as mining, overgrazing by livestock, and pollution. These pressures are not only harming the plants

themselves but also the communities that rely on them for traditional remedies and other uses (Kumar *et al.,* 2024; Jain *et al.,* 2020; Nathawat *et al.,* 2025; Kumar *et al.,* 2024; Yadav *et al.,* 2024).

With increasing expansion of the city and multiplication of industries, plant species that once flourished in these areas are being pushed to the brink of extinction. This has led to some plants disappearing or becoming increasingly rare. Not only are we losing valuable resources that could help treat ailments and improve lives, but we are also undermining the delicate balance of the local ecosystem. Considering this, the current study aims to shed light on the ongoing loss of plant biodiversity in Jhalana Forest. Also, the study aims to explore the causes behind this loss and the role these plants play in both the local environment and human health.

Study Area

Jhalana forest area lies in the heart of Jaipur city of Rajasthan in the north-western part of the country. Jhalana forest area lies between latitudes 26.54'02N to 26.50'09N and longitudes 75.49'25E to 75.52'01E while covering a total area of about 20 SqKms. Jhalana forest area is demarcated by Aravali ranges running from top to bottom in the forest area. The climate in Jhalana Forest Area is characterized by presence of semi-arid conditions, with summer months (March to June) with temperature exceeding 40°C, Winters (November to February) with temperatures ranging from around 5°C (41°F) to 25°C (77°F), monsoon season (July to September) with rainfall between 500-600 nm and low humidity.

Materials And Methods

Jahlana, a vibrant area in Jaipur, Rajasthan, is known for its rich cultural heritage and scenic landscapes. Nestled close to the Aravalli hills, it offers a unique blend of urban and natural environments. The region is characterized by its lush greenery, wildlife sanctuary, and historical sites, making it a popular destination for both locals and tourists. Jahlana is particularly famous for the Jhalana Leopard Safari, where visitors can experience the thrill of spotting leopards in their natural habitat. The area is also dotted with traditional Rajasthani architecture, colorful markets, and warm hospitality, reflecting the essence of Jaipur's royal past.

The methodology for conducting a survey of plants in the Jahlana area of Jaipur involved several systematic steps. First, specific sites were selected to represent various habitats, such as forests, grasslands, and rocky outcrops. Preparations include gathering essential tools like plant identification guides, GPS devices, and field notebooks, alongside developing a detailed survey plan outlining objectives and team roles. Data collection was performed using techniques like quadrat sampling and transect lines to systematically document plant species, noting their abundance and characteristics. Environmental assessments were conducted to gather information on soil type, moisture levels, and light availability. Findings were meticulously recorded in field notebooks, incorporating GPS coordinates and photographs. After data collection, analysis focuses on species diversity and distribution patterns, using statistical tools to explore relationships with environmental factors. Finally, results were compiled into a comprehensive report that includes maps and charts, discussing implications for conservation in the Jhalana area, with considerations for long-term monitoring to track changes in plant populations over time.

Results

Family Wise classification of plants

The present study identified a total of 79 plant species from Jaipur, which belong to 43 distinct plant families. These plants were found in various habitats, including trees, shrubs, herbs, and climbers. The distribution of species across families revealed that the most prominent families were Fabaceae (7), Euphorbiaceae (6), Asteraceae (5), Malvaceae (4), Mimosaceae (4), Moraceae (4), Solanaceae (3) Asclepiadaceae, Caesalpiniaceae, Convolvulaceae, Lamiaceae. Meliaceae, Poaceae, Rhamnaceae, Sterculiaceae, Tiliaceae and Verbenaceae (2 each). Apart from these families, other families included in this survey based study were, Achyranthaceae, Amaranthaceae, Anacardiaceae, Annonaceae, Apiaceae, Apocynaceae, Arecaceae, Balanitaceae, Bombacaceae, Burceraceae, Cappariadaceae, Cleomaceae, Combretaceae, Crassulaceae, Cucurbitaceae, Ehretiaceae, Liliaceae, Lythraceae, Nyctaginaceae, Nyctanthaceae, Papaveraceae, Pteridaceae, Rutaceae, Vitaceae and Zygophyllaceae (1 plant each).

Habit-wise classification of plants

These plants were found in various habitats, including trees, shrubs, herbs, and climbers. The distribution of species across habits revealed that the most prominent habits were Herbs (27), Tree (18), Small tree (12), Shrub (11) and Climber shrub (2). Apart from these, the study also included several other habits, including, Erect herb, Evergreen tree, Grass, Large tree, Prostrate herb, Shrub like grass and Twining shrub (1).

The herb plants included in the study are *Abelmoschus manihot*, *Abutilon indicum*, *Acanthospermum hispidum*, *Achyranthes aspera*, *Argemone mexicana*, *Blumea lacera*, *Boerhavia diffusa*, *Cassia tora*, *Celosia argentea*, *Centella asiatica*, *Cleome viscosa*, *Corchorus olitorius*, *Eclipta alba*, *Euphorbia hirta*, *Ipomoea nil*, *Ipomoea pestigridis*, *Kydia calycina*, *Lantana camara*, *Mallotus philippensis*, *Momordica balsamina*, *Nicotiana tabacum*, *Ocimum bacillacum*, *Ocimum sanctum*, *Phyllanthus niruri*, *Actiniopteris dichotoma*, *Ricinus communis* and *Sida acuta*

The trees included in the study are *Acacia nilotica*, *Acacia senegal*, *Aegle marmelos*, *Anogeissus pendula*, *Azadirachta indica*, *Balanites aegyptiaca*, *Bombax ceiba*, *Boswellia serrata*, *Bauhinia racemosa*, *Bridelia retusa*, *Calotropis gangetica*, *Capparis decidua*, *Cordia dichotoma*, *Dalbergia latifolia*, *Emblica officinalis*, *Ficus benghalensis*, *Ficus religiosa* and *Mangifera indica*. The study also included several small tree, which were, *Acacia catechu*, *Bauhinia racemosa*, *Bridelia retusa*, *Butea monosperma*, *Capparis decidua*, *Cassia tora*, *Mallotus philippensis*, *Miliusa tomentosa*, *Morus alba*, *Nyctanthes arbor-tristis*, *Phoenix sylvestris* and *Terminalia arjuna.* Apart from this, the study included shrubs, which were, *Calotropis gangetica*, *Calotropis procera*, *Cleome viscosa*, *Grewia flavescens*, *Helicteres isora*, *Lantana camara*, *Nyctanthes arbor-tristis*, *Ocimum bacillacum*, *Sida acuta*, *Solanum xanthocarpum* and *Withania somnifera.* The climber shrubs included in the study were *Cissus quadrangulari* and *Mucuna pruriens.*

Anusandhanvallari
Vol 2024, No.1
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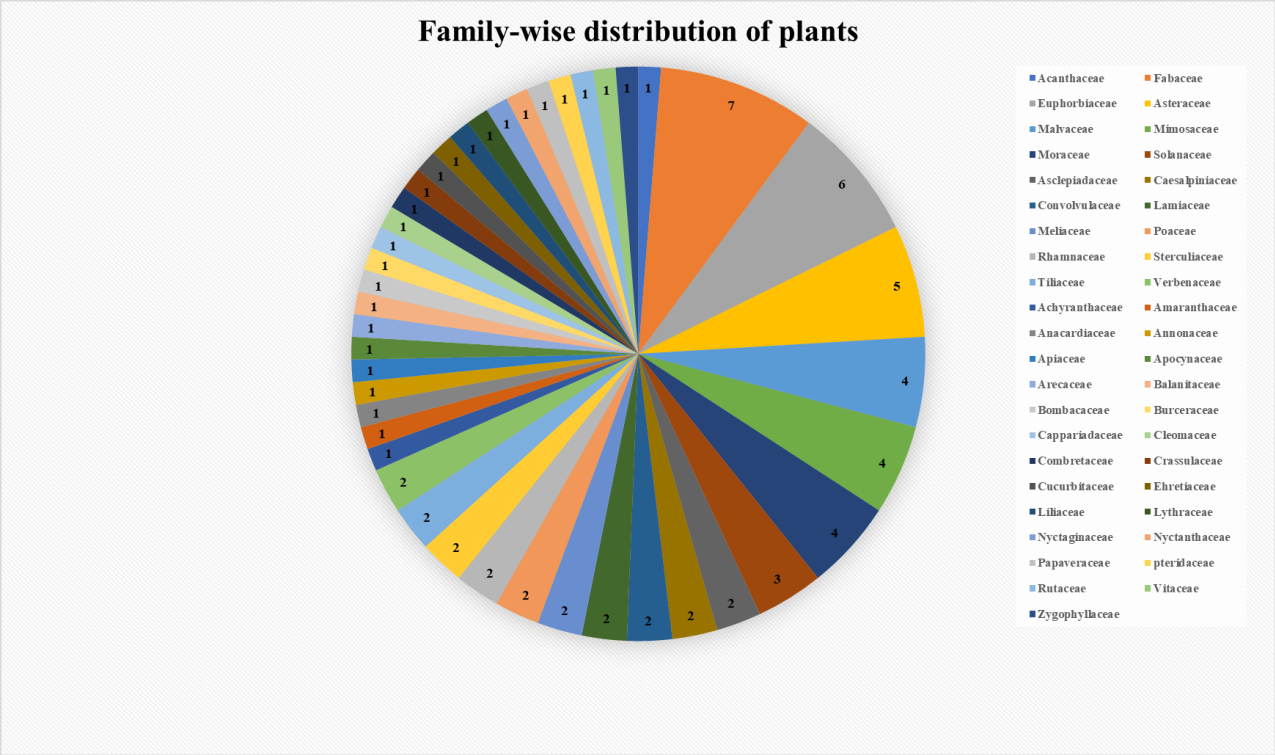

Figure 1: Family wise distribution of medicinal plants of Jhalana area

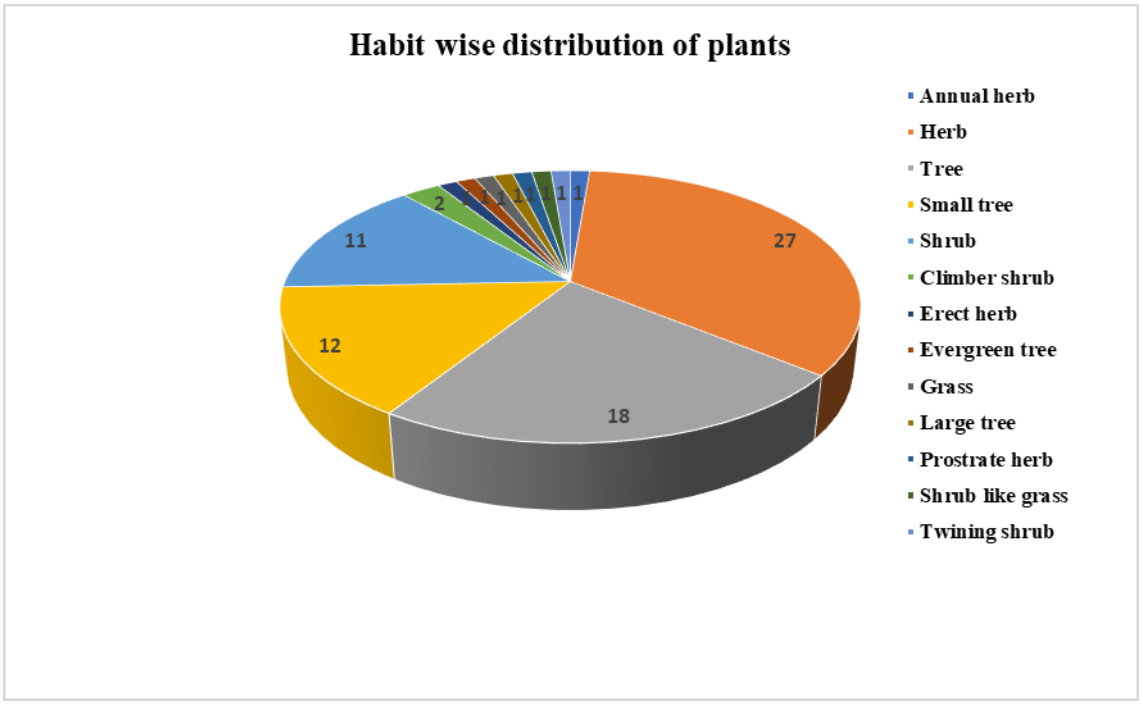

Figure 2: Habit wise distribution of medicinal plants of Jhalana area

Details of plants included in the study

The details of the plants included in the study are as follows:

- *Abrus precatorius* (Fabaceae), locally known as Gunja, is a twining shrub species found in Jaipur.
- *Abelmoschus manihot* (Malvaceae), known as Jangli Bhindi, is a herb species commonly found in the region.
- *Abutilon indicum* (Malvaceae) is a herb species found in Jaipur.
- *Acacia catechu* (Mimosaceae), locally called Kala Khair, is a small tree species found in the area.
- *Acacia nilotica* (Mimosaceae), known as Babul, is a tree species found in Jaipur.
- *Acacia senegal* (Mimosaceae), called Safed Khair, is a tree species commonly found in the region.
- *Acanthospermum hispidum* (Asteraceae), known as Gokhru or Gondhichedi, is a herb species found in the area.
- *Achyranthes aspera* (Achyranthaceae), locally called Unga or Chipchipi, is an erect herb species found in Jaipur.
- *Aegle marmelos* (Rutaceae), known as Bel, is a tree species found in the region.
- *Anogeissus pendula* (Crassulaceae), called Safed Dhok, is a tree species commonly found in Jaipur.
- *Argemone mexicana* (Papaveraceae), known as Kateli, is an erect herb species found in the area.
- *Azadirachta indica* (Meliaceae), locally called Neem, is an evergreen tree species found in Jaipur.
- *Balanites aegyptiaca* (Balanitaceae), called Hingot, is a tree species commonly found in the region.
- *Barleria prionites* (Acanthaceae), known as Vajradanti, is a herb species found in Jaipur.
- *Blumea lacera* (Asteraceae), called Kakranda, is a herb species found in the region.
- *Boerhavia diffusa* (Nyctaginaceae), locally known as Punernava, is a herb species found in Jaipur.
- *Bombax ceiba* (Bombacaceae), called Rogal, is a tree species found in the region.
- *Boswellia serrata* (Burceraceae), known as Salar, is a tree species commonly found in Jaipur.
- *Bauhinia racemosa* (Caesalpiniaceae), called Kachnar, is a small tree species found in the area.
- *Bridelia retusa* (Euphorbiaceae), locally known as Ungna, is a small tree species found in Jaipur.
- *Butea monosperma* (Fabaceae), known as Chhila, is a small tree species found in the region.
- *Calotropis gangetica* (Asclepiadaceae), called Aakda, is a shrub species found in Jaipur.
- *Calotropis procera* (Asclepiadaceae), locally known as Aakda, is a shrub species found in the region.
- *Capparis decidua* (Cappariadaceae), called Keri or Teti, is a small tree species found in Jaipur.
- *Cassia tora* (Caesalpiniaceae), known as Pawar, is a herb species found in the region.
- *Celosia argentea* (Amaranthaceae), called Dhudi, is a herb species found in Jaipur.
- *Centella asiatica* (Apiaceae), known as Brahmi-buti, is a herb species commonly found in the region.
- *Chlorophytum tuberosum* (Liliaceae), called Musli, is an annual herb species found in Jaipur.
- *Cissus quadrangularis* (Vitaceae), locally known as Harjadi, is a climbing shrub species found in the area.
- *Cleome viscosa* (Cleomaceae), known as Jakhya or Hulhul, is a herb species found in Jaipur.
- *Corchorus olitorius* (Tiliaceae), called Kosta, is a herb species found in the region.
- *Cordia dichotoma* (Ehretiaceae), known as Lisoda, is a small tree species found in Jaipur.
- *Cynodon dactylon* (Poaceae), called Dubghas, is a grass species commonly found in the region.
- *Dalbergia latifolia* (Fabaceae), known as Shisam, is a tree species found in Jaipur.
- *Desmodium heterocarpon* (Fabaceae), called Sarivan, is a herb species found in the region.
- *Eclipta alba* (Asteraceae), locally called Bringaraj, is a herb species found in Jaipur.
- *Emblica officinalis* (Euphorbiaceae), known as Amla, is a tree species commonly found in the area.

- *Euphorbia hirta* (Euphorbiaceae), called Dudhiya Rokdi, is a herb species found in Jaipur.
- *Ficus benghalensis* (Moraceae), known as Bargad, is a tree species commonly found in the region.
- *Ficus racemosa* (Moraceae), called Gular, is a tree species found in Jaipur.
- *Ficus religiosa* (Moraceae), locally known as Pipal, is a tree species found in the region.
- *Grewia flavescens* (Tiliaceae), called Chapun, is a shrub species commonly found in Jaipur.
- *Helicteres isora* (Sterculiaceae), known as Maror, is a shrub species found in the area.
- *Ipomoea nil* (Convolvulaceae), called Kaladana, is a herb species found in Jaipur.
- *Ipomoea pestigridis* (Convolvulaceae), locally known as Kaladana, is a herb species found in the region.
- *Kydia calycina* (Malvaceae), called Phuilau or Pulao, is a tree species found in Jaipur.
- *Lantana camara* (Verbenaceae), known as Lalten, is a shrub species found in the area.
- *Mallotus philippensis* (Euphorbiaceae), locally called Rohni or Roli, is a small tree species found in Jaipur.
- *Mangifera indica* (Anacardiaceae), called Aam, is a tree species commonly found in the region.
- *Miliusa tomentosa* (Annonaceae), known as Bakayan, is a small tree species found in Jaipur.
- *Momordica balsamina* (Cucurbitaceae), called Karela, is a herb species found in the area.
- *Morus alba* (Moraceae), locally known as Sahtut, is a small tree species found in Jaipur.
- *Mucuna pruriens* (Fabaceae), known as Kounch, is a climber shrub species found in the region.
- *Nicotiana tabacum* (Solanaceae), called Tambaku, is a herb species found in Jaipur.
- *Nyctanthes arbor-tristis* (Nyctanthaceae), known as Har singar, is a small tree species found in the area.
- *Ocimum bacillacum* (Lamiaceae), called Manbawchi, is a herb species found in Jaipur.
- *Ocimum sanctum* (Lamiaceae), locally known as Tulsi, is a herb species found in the region.
- *Phoenix sylvestris* (Arecaceae), called Khajur, is a small tree species found in Jaipur.
- *Phyllanthus niruri* (Euphorbiaceae), known as Hajardane, is a herb species found in the area.
- *Actiniopteris dichotoma* (Pteridaceae), called Mayura shikki, is a herb species found in Jaipur.
- *Pongamia pinnata* (Fabaceae), known as Karanj, is a tree species found in the region.
- *Prosopis juliflora* (Mimosaceae), called Vilayati babul, is a small tree species found in Jaipur.
- *Ricinus communis* (Euphorbiaceae), locally known as Arandi, is a shrub species found in the area.
- *Sida acuta* (Malvaceae), known as Kristi, is a herb species found in Jaipur.
- *Solanum xanthocarpum* (Solanaceae), called Kateri or Ringni, is a herb species found in the region.
- *Soymida febrifuga* (Meliaceae), known as Rohan, is a shrub species found in Jaipur.
- *Sterculia urens* (Sterculiaceae), called Katira or Kadaya, is a large tree species found in the area.
- *Tephrosia pumila* (Fabaceae), known as Chhota Pawar, is a herb species found in Jaipur.
- *Terminalia arjuna* (Combretaceae), called Tal, is a tree species commonly found in the region.
- *Tribulus terrestris* (Zygophyllaceae), known as Gokhru, is a prostrate herb species found in Jaipur.
- *Tridax procumbens* (Asteraceae), called Ghavpala, is a herb species found in the region.
- *Vernonia cinera* (Asteraceae), known as Nili rokdi, is a herb species found in Jaipur.
- *Vetiveria zizaniodes* (Poaceae), called Khas, is a shrub-like grass species commonly found in the area.
- *Vitex negundo* (Verbenaceae), known as Nigad Large, is a shrub species found in Jaipur.
- *Withania somnifera* (Solanaceae), called Asawagandha, is a shrub species found in the region.
- *Woodfordia fruticosa* (Lythraceae), known as Ladokadi, is a shrub species found in Jaipur.
- *Wrightia tinctoria* (Apocynaceae), called Dudhi or Khirni, is a tree species found in the area.
- *Ziziphus mauritiana* (Rhamnaceae), known as Beri, is a tree species found in Jaipur.
- *Ziziphus nummalaria* (Rhamnaceae), locally called Jhad, is a shrub species commonly found in the region.

Discussion

Plants have been a fundamental part of human existence since times immemorial owing to their ability to not only help sustain life on Earth by providing oxygen, but also offer us the nutrients and resources needed to survive. However, beyond their importance in our diet, plants have a deeper, often overlooked significance in amelioration of human health. In fact, plants have been at the heart of human healing for thousands of years due to their usage in herbal remedies to modern-day treatments, leading to treatment of a wide variety of ailments. Plants serve as natural pharmacy, full of powerful compounds that aid us to fight infections and illnesses. These benefits stem from plant-derived compounds, such as alkaloids, flavonoids, terpenoids, and saponins, can act as antibiotics, antioxidants, and anti-inflammatories. In today's times, where antimicrobial resistance is becoming a serious global concern, nature's pharmacy might just hold the key to fighting back. Apart from these benefits, plants also help to maintain the water cycle, provide food for animals, stabilize soil, and even aid in the pollination process that is crucial for the growth of crops. Without plants, our ecosystem would collapse.

However, increasing globalization and industrialization over the last few years has led to decline in plant biodiversity. In recent years, the beautiful Jhalana area in Jaipur has seen a steady decline in its plant diversity, which is a worrying trend. The region, once rich in plant life, now faces the threat of losing several plant species, many of which have been used for centuries for their medicinal value. Several factors have contributed to this decline, which include:

- Overexploitation and Overharvesting: One of the biggest reasons for the decline in plant biodiversity is the overexploitation of plant species. Many plants, especially those with valuable medicinal properties, are being harvested faster than they can regenerate. People often take more than what's sustainable, leaving behind a barren landscape where these plants once thrived. Without proper care and sustainable harvesting practices, these plants simply can't keep up with demand, and they face the risk of extinction.
- Deforestation and Habitat Destruction: Another significant factor contributing to the loss of biodiversity is deforestation. The forests of the Jhalana area are being cleared for industrialization, and agriculture. This not only affects the plant species themselves but also disrupts the local wildlife that depends on them for food and shelter.
- Climate Change and Invasive Species: Globally rising temperatures and changing rainfall patterns have made it difficult for some plant species to thrive in their natural habitats. In addition, the introduction of invasive plant species—plants that aren't native to the area—has further complicated matters. These non-native species can outcompete local plants for resources like water and nutrients, sometimes pushing native plants to the brink of extinction.
- Pollution: Pollution is another critical factor harming plant diversity in the Jhalana area. Dumping of industrial waste, sewage, and the dumping of solid waste into water sources have led to deteriorating soil and water quality (Singh *et al.,* 2021; Körner 2024; Cui *et al.,* 2022l Prakash *et al.,* 2022; Zhang *et al.,* 2023; He *et al.,* 2022).

With declining plant biodiversity in Jhalana, it's crucial to take action to preserve the valuable species that remain and ensure a healthy environment for future generations. One of the most important things we can do is adoption of sustainable harvesting practices, which allows plants to regenerate and thrive. This can involve educating local communities on the importance of conservation and encouraging them to harvest plants in a way that doesn't harm their long-term viability. Also, replanting and restoration of degraded habitats can create a safe space for native plants to grow. It is important to protect plants as well as other wildlife from industrial waste, sewage, and trash need to be properly managed and disposed of to prevent contamination of water and soil. Initiatives aimed at cleaning up polluted areas, such as water bodies like Amanishah Nala, would go a long way in restoring the health of the ecosystem. Another step that can aid in addressal of this issue is managing and controlling the spread of

invasive species For instance, Invasive species, like *Prosopis juliflora,* can threaten native plants by outcompeting them for resources. It is importany to ecxecute programs aimed at controlling the spread of invasive species and promoting the growth of native plants can help restore balance in the ecosystem. Engaging people who live in and around Jhalana in conservation efforts is crucial. This will aid us in creating a network of conservation advocates who will help preserve plant biodiversity for generations to come (Villar *et al.,* 2021; Caffaro *et al.,* 2022; Panwar *et al.,* 2023; Zhang *et al.,* 2022; Cui *et al.,* 2022).

In conclusion, the loss of plant biodiversity in the Jhalana area is a complex issue, driven by various factors such as overharvesting, habitat destruction, pollution, and the spread of invasive species. However, through concerted efforts to promote sustainable practices, restore natural habitats, combat pollution, and engage local communities in conservation, we can help protect and preserve the unique plant life of this area.

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