

## Setting Prioritisation for Medicinal Plant Conservation in Saudi Arabia

Ibrahim Jamaan Alzahrani<sup>1,2\*</sup>, Joana Magos Brehm<sup>1</sup> and Nigel Maxted<sup>1</sup>

<sup>1</sup>School of Biosciences, University of Birmingham, Birmingham, B15 2TT, United Kingdom

<sup>2</sup>Department of Biology, Arts and Sciences in Almahwah, Al-Baha University, 65553, Saudi Arabia

\***Corresponding Author:** Ibrahim Jamaan Alzahrani, School of Biosciences, University of Birmingham, Birmingham, B15 2TT, United Kingdom, ORCID: <https://orcid.org/0009-0002-9186-5722>, E-mail: [ijalzahrani@bu.edu.sa](mailto:ijalzahrani@bu.edu.sa)

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### Abstract

Traditional medicine is an important part of cultural heritage and was widely used in Saudi Arabia before the introduction of biomedicine, and it is still much used in the present. This study was conducted to create a medicinal plant checklist and a priority list for active conservation in Saudi Arabia. The checklist includes 1174 MP taxa of medicinal plants, consisting of 1100 species and 74 subspecific taxa within 122 families and 607 genera, including 1045 native (89.01%) and 129 introduced taxa (10.99%). An inventory was compiled using a variety of published resources. This inventory was prioritised using a serial method and four criteria: traditional use, native status, threat status, and legal use. The prioritised inventory for Saudi Arabia includes 74 species of medicinal plants from 35 families and 69 genera. These priority medicinal plant species necessitate additional research on *in situ* and *ex situ* conservation measures, as well as public education about the significance of medicinal plant conservation.

**Keywords:** Medicinal Plants; Priority List; *In Situ*; *Ex Situ*; Conservation; Saudi Arabia

## Introduction

There is a long tradition of plants and herbs with medicinal properties being used by humans for healing purposes [1,2]. Plants are the source of a number of ancient medicines and may also be of new remedies [3]. There are 390,900 flowering plants worldwide [4], and over 50,000 of them have medicinal properties [5-8]. According to the World Health Organization (WHO), roughly 80% of the global human population depends upon herbal medicine, which are used in primary healthcare [3,9-13]. Moreover, the demand for herbal medicines is rising in developed countries, where many people think plants are safer and more effective than modern medicine because of their natural source and they are comparatively cheap [1,2,10].

Continued wild medicinal plant (MP) use is predicated on continued MP existence and MP species like any other wild plant species are subject to increased threats from human mismanagement of the environment. One of the most urgent issues facing the global conservation community is how to identify areas rich in biodiversity and allocate the limited resources available among regions to secure biodiversity for the future and initial, first step is species prioritization [14]. The conservation of MPs is gaining increasing attention due to the renewed interest in herbal medicines for healthcare around the world [15]. In the past decade, focus has been on identifying biodiversity hotspots and conservation gaps for endangered and endemic MP species [12]. This is essential to protect these species before their diversity is reduced, or they go extinct. Doing so should increase awareness of the importance of MPs amongst all stakeholders and stimulate the desire to protect this cultural heritage and natural resource, and clarify knowledge about their ecological requirements. Therefore, conservation planning is an important step in protecting the most threatened species and to avoid a major decline in the diversity of MPs [16].

The conservation and sustainable use of medicinal and aromatic plants has been widely researched [17-24], and many suggestions on conservation priorities have been put forward, including the establishment of coordinated systems that hold an inventory of species, monitor species status and record existing *in situ* and *ex situ* conservation prac-

tices [11]. The best way to conserve biodiversity is *in situ* as this protects the original habitat and the genetic diversity of species as well as allowing species to evolve in their natural environment [25]. In order to carry out *in situ* conservation, protected areas exist globally, and these represent a regulatory and management tool for conservation [26]. In addition, it is necessary to apply a number of complementary *ex situ* strategies, such as seed banks, botanical gardens and DNA banks, to ensure species conservation [27].

The Arabian Peninsula is rich in biodiversity and contains different ecosystems with diverse plant species, including a plethora of medicinal herbs, shrubs, and trees [2,27]. Saudi Arabia is about 1,969,000 km<sup>2</sup> and occupies two-thirds of the Arabian Peninsula [28]. It has a hot desert climate and little rainfall [1]. Traditional medicine is an important aspect of Saudi cultural heritage, which was widely used prior to the introduction of biomedicine [2,29] and is still relied upon by many in Saudi Arabia [30].

Out of a total of 2,250 species of Saudi flora [1,31], 300 are known medicinal species (12%), belonging to 72 families, with a further 1,950 species belonging to 142 families which still need to be investigated for their potential medicinal properties [31]. Saudi Arabia's flora faces various and substantial threats, including irregular weather, heavy metals stress, salinity, changed soil pH, drought, extreme temperatures, and increased habitat fragmentation [27], many of which are associated with climate change. The number of endangered species is growing annually due to unfavourable environmental conditions and human mismanagement [32]. In addition, specifically for medicinal plants there is only partial legislative or regulatory control over the use or manufacturing of local herbal medicines in Saudi Arabia [33]. Therefore, there is a great need and urgency for conservation, cultivation, and the sustainable use of important MP species to sustaining future and potential use [34].

In Saudi Arabia, as in other parts of the world, many plants are harvested by local communities without any regard for conservation. However, people collect and sell plants in local markets to make a living in the arid, mountainous environment [28]. The Saudi Food and Drug Authority (SFDA) has published a list of 131 MP species allowed to be sold in Saudi herbal markets, which includes on-

ly 42 native plant species distributed in Saudi Arabia [35]. MPs are a vital, healthy, and economic element of region-specific biodiversity ecosystem services. However, if the resource is to be maintained it is important to conduct a survey MP diversity to aid conservation planning and implementation and sustainable use [2,31]. The conservation of biodiversity became an important part of Saudi government policy as early as the 1970s, and the country became a signatory of the Convention on Biological Diversity (CBD) in 2001 [27]. Determining the priorities and standards for species conservation are the first important, necessary steps in the conservation process [36], MP prioritization may be based on several factors such as species richness, habitat, endemism, probability of species extinction, genetic diversity, economic value, and other indices [14].

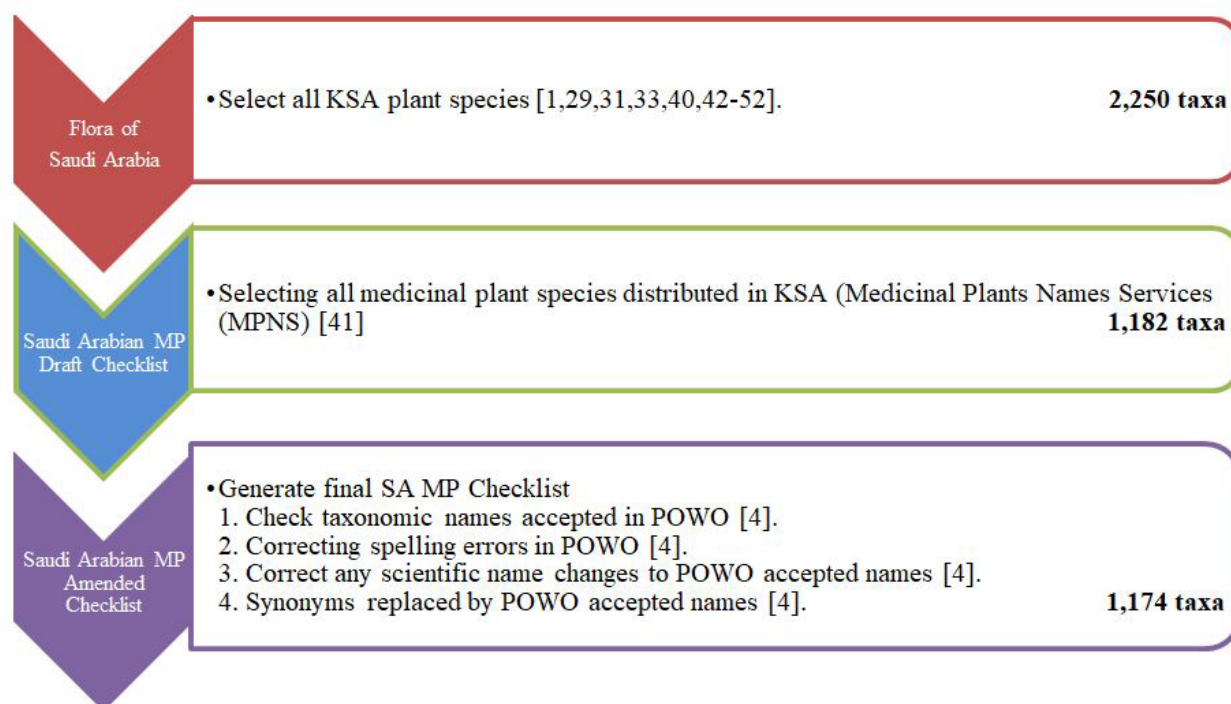
Several authors from diverse countries have prioritised MPs, for example, Kala et al. [37] prioritised MP species in the Indian state of Uttaranchal based on four criteria: endemism, use value, mode of harvesting, and rarity status; Allen et al. [38] prioritised threatened native MP species in Europe; Cahyaningsih et al. [36] prioritised MPs in Indonesia based on threat status, Indonesian legislation, native sta-

tus, part of the plant harvested, and rarity; and Nankaya et al. [39] prioritised MPs in the Maasai Mara region of Kenya based on use value, rarity status, and the part of the plant harvested. However, this had not been previously attempted in Saudi Arabia, so the goal of this paper is to compile and analyse a comprehensive checklist of MPs for Saudi Arabia and then prioritise the most deserving species for active conservation.

## Methods

### MP Checklist Creation

A checklist of MPs in Saudi Arabia was compiled from published works: first *Wildflowers of Saudi Arabia* [40], only taxa that were used as MPs internationally and recorded in the online Medicinal Plants Names Services (MPNS) were selected due to the possibility of their future use in Saudi Arabia [41]; second MPs studied in Saudi Arabia [1,29,31,33,42-52]. Additionally, to ensure that the taxonomic names used remained legitimate, any misspellings were corrected, and synonyms were included under the scientific name accepted in the online database *Plants of the World Online* (POWO) [4] (Figure 1).



**Figure 1:** Method of generating MP checklist for Saudi Arabia

## MP Checklist Prioritisation

The MP checklist for Saudi Arabia contained 1,174 taxa, but this was considered too large a set of taxa for active conservation, so additional information collected from the literature review was used for prioritised. The prioritisation criteria applied were: traditional use, native status, threat status, and legal use (Figure 2) as follows:

**1. Traditional Use:** This criterion relies on existing knowledge of MP usage in Saudi Arabia, gathered through comprehensive literature reviews, including sources such as the *Handbook of Arabian Medicinal Plants* [43]. It has been applied to taxa that are traditionally widely used within the country. Each plant species is identified with details on the parts used (e.g., leaves, roots, bark), the diseases they treat (e.g., cough, fever, rheumatism), and traditional preparation methods (e.g., decoctions, infusions) (Appendix 1).

**2. Native Status:** The native status of a species has been previously used as a prioritisation criteria for MP by Allen et al. [38] and Cahyaningsih et al. [36]. Plants were classified as native, non-native, or invasive based on botanical records and databases (e.g., Flora of Saudi Arabia and regional herbarium collections). Non-native and potentially invasive species they may compete with or excluded native species [53]; therefore, all non-native alien taxa were excluded from the prioritisation list to prevent competition and displacement of native species.

**3. Threat Status:** Relative threat status, defined as the relative risk that a species faces of extinction [54], was used as a prioritisation criterion for MP by Cahyaningsih et al. [36], as taxa with higher threat categories are more likely to be threatened with genetic erosion or extinction [55]. Saudi Arabia does not have a complete floral IUCN-based red list using global or regional assessments (<https://www.iucnredlist.org/>). Collenette [40] did provide a subjective threat assessment in her flora based on her own expert assessment but not using IUCN criteria. Given the scarcity of threat assessments available we prioritised any MP taxa that were assessed as threatened using the IUCN categories Endangered (EN), Vulnerable (VU), and Near Threatened (NT); note there are no Critically Endangered (CR) taxa in Saudi Ara-

bia as well as those assessed by Collenette [40] as threatened (Appendix 1).

**4. Legal Use:** Official sanction collection and use is a MP prioritisation criteria used previously by de Oliveira et al. [56] and is also used here. In Saudi Arabia, the Food and Drug Authority (SFDA) authorises the wild collection and commercial sale / use of a specific subset of MP taxa (listed in Appendix 1) [35]. However, this sanction has resulted in widespread over collection many of these taxa are highly threatened in their natural habitats. Furthermore, there is no monitoring of these taxa. Therefore, this criterion was applied through the information gathered from (SFDA) to protect taxa and ensure their persistence in the wild.

These criteria were then applied to the checklist serially, i.e. first applying the traditional use criterion, then native status and finally, threat status and the legal use criterion. An inventory was then prepared for priority MPs, including the following information: scientific names, authors, vernacular names, plant habits, threat status, plant parts used, uses, and the method of preparation used.

## Results

### Checklist of MPs in Saudi Arabia

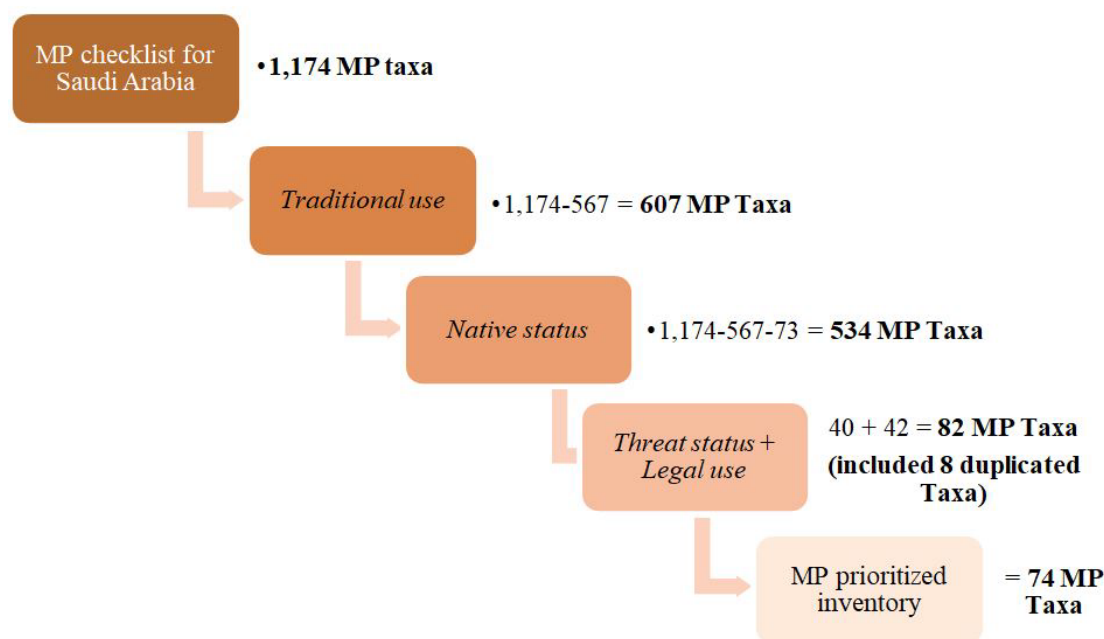
The checklist of Saudi Arabia contains 1,174 MP taxa, consisting of 1,100 species and 74 subspecific taxa within 122 families and 607 genera (Table S1). There are 1,045 native (89.01%) and 129 introduced (10.99%) taxa. The families with the highest number of MP are the Asteraceae and Fabaceae, with 106 species each (9.03%), followed by the Poaceae, which contains 103 species (8.78%), the Amaranthaceae, with 59 species (5.03%), and the Lamiaceae, with 45 species (3.83%). The Brassicaceae and Euphorbiaceae families contain 39 species each (3.32%), followed by the Apocynaceae, which contains 37 species (3.15%). The remaining 114 families contain fewer than 37 species each, constituting less than 3% of the total number of species. Among the genera of MPs, *Euphorbia* is the genus with the highest number of species (23 species), followed by *Cyperus* (13) and *Solanum*, with (12). *Cleome*, *Heliotropium* and *Vachellia* include (11 species each), followed by *Amaranthus*, *Indigofera*, *Plantago*, and *Rumex*, containing (10 species each). The remaining genera contain fewer

than ten species.

### Identifying Priority MPs in Saudi Arabia

According to the criteria discussed above, conservation priority was given to 74 MP species in Saudi Arabia (Figure 2), which fall under 35 families and 69 genera (Appendix 1). The plant families most represented are the Fabaceae (10 species/ 13.51%), followed by the Asteraceae and Lamiaceae (8 species each/ 10.81%). Apiaceae include (5 species/ 6.76%). Among the genera of priority MPs,

*Senna* is the dominant genus (3 species/ 4.05%), followed by *Dracaena*, *Salvia* and *Plantago* (2 species each/ 2.70%). Of the 74 priority species, 70 are acknowledged worldwide as MP (MPNS) [41], but the remaining four *Lavandula atriplicifolia* Benth. (noted in Alqethami et al., 2020), *Pyrostria phyllanthoidea* (Baill.) Bridson (in Remesh et al. [51]), *Vachellia origena* (Hunde) Kyal. & Boatwr. (in Abulafatih [42] and Ghazanfar [43]), and *Prunus arabica* (Olivier) Meikle (in Al-Shanawani [45] and Shabana et al. [52]) are used in Saudi folk medicine (Appendix 1).



**Figure 2:** Schematic prioritisation of MPs of Saudi Arabia

According to the chosen criteria, a total of 607 MP taxa are identified as traditionally used in Saudi Arabia, containing 534 native species (Table S2). Based on the IUCN assessments at the global level and Collenette's observations [40], 40 out of the 74 priority MPs are considered threatened. Based on the SFDA list, 42 native species out of 74 are permitted for collection, sale and use. Eight species are threatened and permitted for sale and use by SFDA (Appendix 1).

For the priority MPs the most frequently used parts of priority MPs are leaves, seeds, or the whole plant (Appendix 1). Most priority medicinal species consist of herbs (39 species/ 52.70%), shrubs (22 species/ 29.73%), and trees (13 species/ 17.57%). Species are prepared for treatment in several ways: as a decoction, infusion, powder,

paste, raw, as a drink, oil, dried, drops, through smoke, and by burning or eating. The most observed preparation mode is a decoction, followed by infusion, powder and paste (Appendix 1).

Most MP treat several ailments: *Apium graveolens* L. (19 ailments); *Anethum graveolens* L. and *Myrtus communis* L. (18 ailments each); *Lawsonia inermis* L. (13 ailments); *Matricaria aurea* (Loefl.) Sch.Bip., *Olea europaea* L., and *Senegalia senegal* (L.) Britton (12 ailments each); *Cymbopogon schoenanthus* (L.) Spreng. and *Origanum syriacum* L. (11 ailments each); and *Commiphora myrrha* (Nees) Engl. (10 ailments). Based on the results, most diseases treated with medicinal plants are digestive system disorders, followed by urinary ailments, dermatological disorders, respiratory system disorders, and cardiovascular disorders.

## Discussion

### Checklist of Saudi Arabian MPs

Creating a checklist and prioritized inventory of plants is an essential first step in effective conservation [57]. Creating a national checklist of Saudi MP species and adding additional data to allow for priority setting is crucial for conservation. Previously, there were no comprehensive or updated checklist of the MPs of Saudi Arabia. This may be due to a scarcity of qualified taxonomists and conservationists, limited data availability, and significant risks associated with fieldwork in the desert and mountainous regions [48]. Additionally, the information concerning medicinal plants is scattered through numerous sources and is arguably incomplete, so it is necessary to collect and review a wide literature [36], updating and correcting the nomenclature of scientific name, verifying the validity of scientific names through previous studies, and comparing them to relevant websites such as Plants of the World Online (POWO) [4] and the Catalogue of Life (COL) [58]. Moreover, the checklist of MPs should be reviewed by taxonomists so it can be a primary source for future studies and for determining conservation priorities. Here a first iteration of the checklist and prioritized inventory of MPs in Saudi Arabia was presented as a basis for further research into the medicinal properties of plants.

### Priority of conservation of MPs in Saudi Arabia

Setting conservation priorities for MPs is essential in conservation planning at national, regional and global levels. This study determined the priority for conservation of native MPs in Saudi Arabia. There are some previous studies that discussed the importance of preserving medicinal plants in the Kingdom of Saudi Arabia and recommended developing a plan to prioritise their conservation. Rahman et al. [31] listed 86 species under seven families as the most used in Saudi Arabia, which are: Amaranthaceae, Apocynaceae, Capparaceae, Euphorbiaceae, Lamiaceae, Polygonaceae, and Solanaceae. Seven species of priority MPs in the current study are consistent with their results: *Celosia trigyna* L., *Nerium oleander* L., *Teucrium capitatum* L., *Calligonum comosum* L'Hér., *Mentha longifolia* (L.) L., *Salvia lanigera* Poir., and *Thymus decussatus* Benth. Yusuf et al.

[48] listed 61 species under 15 families as the most widely used in Saudi Arabia, which are Boraginaceae, Convolvulaceae, Cucurbitaceae, Fabaceae, Malvaceae, Molluginaceae, Papaveraceae, Portulacaceae, Ranunculaceae, Rhamnaceae, Rutaceae, Tamaricaceae, Urticaceae, Verbenaceae and Vitaceae. Three priority MPs in the current study are also included in their results: *Alhagi graecorum* Boiss., *Clitoria ternatea* L., and *Senna alexandrina* Mill. Regarding the priority families of MPs, this study indicates that Fabaceae is the most represented family, which follows the findings of Yusuf et al. [48].

According to legal use, the SFDA has published a list of 131 MP species that are allowed to be sold in Saudi herbal markets, which includes 42 native plant species (Appendix 1). The priority list of MPs contains 40 threatened species based on IUCN [54] and Collenette [40]. Only three species, *Celosia trigyna* L., *Nerium oleander* L., and *Thymus decussatus* Benth., are consistent with the results of Rahman et al. [31]. This may be due to their reliance on only seven families.

In Saudi Arabia many people still prefer to use wild collected MPs for effective treatment of many diseases. The increasing demand for them has led to over-collection and a decline in their numbers, threatening them with extinction [59,60]. Other threats include overgrazing, overharvesting, climate change, and urbanisation [60], which also increase the risk of extinction, so there is an urgent need to preserve these species. This study indicates that eight out of 74 species are most vulnerable to extinction due to their popular demand and traded in the markets. They were also assessed as threatened with extinction by Collenette [40], they are *Anethum graveolens* L., *Apium graveolens* L., *Glebionis coronaria* (L.) Cass. ex Spach, *Brassica rapa* L., *Glycyrrhiza glabra* L., *Thymus decussatus* Benth., *Lavandula atriplicifolia* Benth., and *Myrtus communis* L.

Most MP species are herbs, followed by shrubs and trees. Similar observations were made by Al-Sodany et al. [47] and Ullah et al. [49]. Leaves are the most frequently used part of MPs, which aligns with results reported in previous studies [49,51,61]. According to Remesh et al. [51], leaves are easy to obtain as they contain many phytochemicals such as alkaloids, tannic acid, glycosides, saponins, es-

sential oils and numerous therapeutically active secondary metabolites [62]. This could explain why leaves are the most used part of the plant in folk medicine. Regarding decoction being the most observed mode of preparation, a similar observation was made by Youssef [33]. This study also revealed that most MPs are used to treat ailments of the digestive system, which corresponds to the results in previous literature [33,62,63]. This may be due to the large number of digestive system problems around the world, which motivated the pursuit of MPs that could treat them [64].

## Conclusion

This study highlights the critical role of MP in Saudi Arabia's healthcare system. From an initial checklist of 1,174 MP taxa, a prioritised inventory of 74 species belonging to 35 families and 69 genera was identified. All these prioritised species are currently used in traditional medicine to treat various diseases. However, it is crucial to study and examine these priority plants under laboratory conditions to identify any potential side effects. This study can significantly contribute to raising public awareness within Saudi Arabia about the importance of MP conservation. It serves as a valuable tool for researchers and conservation scientists by:

- **Informing conservation strategies:** The identified priority inventory can guide the development of suitable conservation techniques, both in natural habitats (*in situ*) and in controlled environments (*ex situ*).
- **Identifying Conservation Gaps:** Gap analyses can be conducted using this data to identify areas where additional conservation efforts are most needed, for both *in situ* and *ex situ* approaches.
- **Establishing a Red List:** The IUCN Red Listing Criteria can be applied to prioritise species based on their threat level, creating a Red List of vul-

nerable MPs in Saudi Arabia.

- **Climate change impact assessment:** Climate change modelling can be used to identify taxa requiring active conservation measures and to predict how climate change might affect the overall diversity of medicinal plants in Saudi Arabia.
- **Evaluating current conservation measures:** The study can help assess the effectiveness of existing conservation strategies and suggest improvements where necessary.
- **Studying the properties of lesser-known Plants:** Research can focus on the medicinal properties of lesser-known plants in the priority inventory.
- **Exploring sustainable harvesting Practices:** This study can promote the development and implementation of sustainable harvesting practices to ensure the long-term availability of medicinal plants for future generations.

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## Conflict of Interest

The authors declare that they have no conflict of interest.

## Author Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by I.J.A. The first draft of the manuscript was written by I.J.A and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Appendix 1: Priority list of medicinal plants of Saudi Arabia

No.	Family	Botanical name	Local name	Plant habit	Part used	Uses	Mode of preparation	Legal Use	IUCN Threat status	Ref.
1	Aizoaceae	<i>Trianthema portulacastrum</i> L.	Laani	Herb	Leaves, roots	Used for the treatment of asthma.	Powder		EN	[40,50]
2	Amaranthaceae	<i>Celosia trigyna</i> L.	Trgana	Herb	Leaves, flowers	It is used to treat menstruation bleeding, diarrhea, boils, skin and heart diseases.	Decoction, raw, paste		EN	[1,31,40,45]
3	Apiaceae	<i>Ammi majus</i> L.	Khelah Shytani	Herb	Whole plant	It is used to treat toothache, asthma, carminative, angina pectoris, different skin diseases, skin cancer, the urinary system as a diuretic, contraception and general tonic.	Decoction, powder, infusion	Yes	NE	[33,45]
4	Apiaceae	<i>Anethum graveolens</i> L.	Shabat	Herb	Whole plant	Use for respiratory diseases, colic, appetiser, mouthwash, carminative, backache, the urinary system as a diuretic, aphrodisiac, abortifacient, astringent, cordial, laxative for the digestive system, tonic, antiseptic, anthelmintic, in liver and spleen problems and antispasmodic.	Powder or raw	Yes	EN	[1,33,40,42,43,50]
5	Apiaceae	<i>Apium graveolens</i> L.	Karafs	Herb	Leaves, roots, seeds	Use for liver and spleen disorder, urinary tract infections and pains, incontinence, kidney problems, appetiser, tonic, high blood pressure, purgative, vermifugal, antiasthmatic, anti-rheumatoid, antispasmodic, colic, sedative, anticonvulsant, calming	Raw, drink	Yes	EN	[29,33,40,44,45]
6	Apiaceae	<i>Deverra tortuosa</i> (Desf.) DC.	Hazza	Herb	Stems and flowers	Used for urinary system problems	Decoction, infusion		EN	[40,44]
7	Apiaceae	<i>Foeniculum vulgare</i> Mill.	Shamr, Snot	Herb	Seeds, leaves, stem	Use for abdominal colic, cough and as a toothbrush	Decoction, raw	Yes	NE	[29,42,43,45]



8	Apocynaceae	<i>Cynanchum acutum</i> L.	Al-Modeed	Herb	Leaves and stems	Used to treat diabetes, bacterial infections, and skin diseases	Decoction, infusion		EN	[1,40,65]
9	Apocynaceae	<i>Nerium oleander</i> L.	Haban, Dafla	Shrub	Leaves, roots	Used for coughs and bronchitis, as well as for skin diseases.	Smoke, drink, paste		EN	[31,40,43,45]
10	Apocynaceae	<i>Solenostemma argel</i> (Delile) Hayne	Al-Argal	Shrub	Leaves	Use for cough and rheumatic	Decoction, powder	Yes	NE	[1]
11	Arecaceae	<i>Phoenix dactylifera</i> L.	Nakhl, Tammar	Tree	Fruit, seeds	Use for digestive, skin, as a general tonic, cardiovascular, and aphrodisiac	Raw, infusion, paste	Yes	NE	[29,43,45]
12	Arecaceae	<i>Hyphaene thebaica</i> (L.) Mart.	Doom	Tree	Seeds	Use for cardiac stimulation, antimicrobial, skin, respiratory, urologic, and reproductive tract	Infusion, drink, powder	Yes	NE	[1,29]
13	Asparagaceae	<i>Dracaena ombet</i> Heuglin ex Kotschy & Peyr.	Azef	Tree	Resin	Used for treating haemorrhage and skin infections	Paste		EN	[1,54,66]
14	Asparagaceae	<i>Dracaena serrulata</i> Baker	Ariyeb	Tree	Resin from trunks and branches	Used as a pain reliever, treat haemorrhage and skin infections	Paste		EN	[43,54]
15	Asteraceae	<i>Achillea fragrantissima</i> (Forssk.) Sch.Bip.	Qaissom	Shrub	Whole plant	Use for fever, antimicrobial, nervous system, skeletal system, and digestive system disorders	Decoction	Yes	NE	[1,33,45]
16	Asteraceae	<i>Artemisia judaica</i> L.	Beithran	Shrub	Leaves, flowers	Use to cure cough, cold, fever, carminative, emmenagogue, menstruation, regulator, and nervous system	Decoction	Yes	NE	[33,45,49,50]
17	Asteraceae	<i>Matricaria aurea</i> (Loefl.) Sch.Bip.	Babunag	Herb	Flowers, whole plant	Use for digestive, neurologic, respiratory, muscular, skeletal, reproductive, urologic, ear and throat, cardiovascular, skin, endocrine	Infusion, drink	Yes	NE	[1,43,45]
18	Asteraceae	<i>Glebionis coronaria</i> (L.) Cass. ex Spach	Aqhuan Al Ha	Herb	Whole plant	Use for gonorrhoea, strong laxative, relieve the inflamed parts	Raw, powder	Yes	EN	[40,45]
19	Asteraceae	<i>Crepis ruppellii</i> Sch. Bip.	Labnh	Herb	Leaves	Used for jaundice and liver pains.	Decoction, raw		EN	[40,43,45]
20	Asteraceae	<i>Dicoma tomentosa</i> Cass.	Marar	Herb	Whole plant	Used to postpartum fever and wounds	Decoction		EN	[40,45]

21	Asteraceae	<i>Launaea intybacea</i> (Jacq.) Beauverd	Dahana	Herb	Whole plant	It is used for the treatment of dry cough.	Decoction, infusion		EN	[40,50]
22	Asteraceae	<i>Sonchus asper</i> (L.) Hill	Almoqbabah alkaberah - Eiltifaf	Herb	Leaves	Used for body pain	Drink		EN	[40,51]
23	Boraginaceae	<i>Ehretia obtusifolia</i> Hochst. ex A.DC.	Lakhf, Al-sab, Masuk	Shrub	Stem, Branches	Used to relieve body pain	Decoction		EN	[40,47,67]
24	Brassicaceae	<i>Anastatica hierochuntica</i> L.	Kaff Maryam	Herb	Whole plant	It is used to treat respiratory diseases and during childbirth.	Infusion	Yes	NE	[33, 43,45,46,50]
25	Brassicaceae	<i>Brassica rapa</i> L.	Khardal	Herb	Roots, leaves, seeds, whole plant	Use for wounds, diuretic, cough, antipruritic, leukoderma, tooth pain, increased bile secretion, as aphrodisiac	Decoction, paste	Yes	EN	[1,33,40,45,47]
26	Brassicaceae	<i>Eruca sativa</i> Mill.	Rocka	Herb	Seeds, leaves	Use for sexual weakness, antimicrobial, antiscorbutic, stimulant, diuretic, stomachic, hair tonic	Raw, oil	Yes	NE	[33,45,46]
27	Brassicaceae	<i>Lepidium sativum</i> L.	Rashad	Herb	Leaves, seeds	Use for aches and pains, as an emollient and for measles, treat stomach troubles	Decoction, powder, raw, paste	Yes	NE	[29,42,43,45]
28	Burseraceae	<i>Commiphora myrrha</i> (T.Nees) Engl.	Myrrh	Tree	Resin	Use for treating colds, fever, to help digestion and treat haemorrhoids, antimicrobial, expectorant, carminative, antiseptic, astringent, and toothache	Smoke, burned, infusion, drops, Paste	Yes	NE	[1,29,43]
29	Caryophyllaceae	<i>Dianthus deserti</i> Kotschy	Ud al-lhilba	Herb	Roots	Used for sprains.	Powder, paste		EN	[40,43]
30	Caryophyllaceae	<i>Gypsophila vaccaria</i> (L.) Sm.	Vaccaria	Herb	Seed, roots	Used as anti-flatulence, appetite enhancer and aids digestion	Decoction, infusion		EN	[40,45,68]
31	Cleomaceae	<i>Cleome droserifolia</i> (Forssk.) Delile	Zaaf	Shrub	The air-dried herb	Used for sore eyes	Powder, paste		EN	[40,43,69]
32	Convolvulaceae	<i>Convolvulus arvensis</i> L.	Olaique	Herb	Roots, leaves, fruits	Use for foot cracking and anti-haemorrhagic	Powder	Yes	NE	[43,45,46]
33	Crassulaceae	<i>Umbilicus rupestris</i> (Salisb.) Dandy	Sarat Al-Sakhr	Herb	Leaves	Used for skin inflammation, wounds, burns disinfectant, parasiticidal, and as an eye disinfectant	Decoction, infusion		EN	[40,47,70]

34	Euphorbiaceae	<i>Euphorbia ammak</i> Schweinf.	Amk sabur	Tree	The latex	Used on painful joints.	Paste		VU	[43,54]
35	Fabaceae	<i>Alhagi graecorum</i> Boiss.	Aaqool	Herb	Whole herb	Use for rheumatism, anti-tussive, anti-haemorrhoids, laxative, diuretic, expectorant, aphrodisiac, analgesic, and for opacity of the cornea	Drink, oil, decoction	Yes	NE	[1,48,49]
36	Fabaceae	<i>Clitoria ternatea</i> L.	Hareejah	Shrub	Leaves, roots, seeds	It is used to treat gonorrhoea, irritation of the urinary bladder, diuretic respiratory diseases, ulcers, indigestion, flatulence and vermifuge.	Decoction		EN	[40,45,48]
37	Fabaceae	<i>Glycyrrhiza glabra</i> L.	Eirqsos	Herb	Leaves, roots	Use for treating muscle pain, indigestion, cough, as an expectorant, pain reliever and a purgative	Powder	Yes	EN	[29,40,43]
38	Fabaceae	<i>Melilotus albus</i> Medik.	Otrah	Herb	Whole plant	Used as an astringent and as a narcotic, also as to treat rheumatic pain	Decoction		EN	[40,43,45]
39	Fabaceae	<i>Scorpiurus muricatus</i> L.	Dhanab Al-Aqrab Al-Shaek	Herb	Leaves, stems	Used to urinary tract infections	Infusion		EN	[40,44]
40	Fabaceae	<i>Senegalia senegal</i> (L.) Britton	Samg Arabic	Tree	Bark, resin	Use for respiratory, digestive, muscular, neurologic, reproductive, urologic, endocrine, cardiovascular, skin, setting bones, general tonic and antiseptic	Powder, paste	Yes	NE	[29,43]
41	Fabaceae	<i>Senna alexandrina</i> Mill.	Sana makki	Herb	Leaves, fruit	Use for stomach cramps and constipation	Decoction	Yes	NE	[42,43,45,48]
42	Fabaceae	<i>Senna holosericea</i> (Fresen.) Greuter	Ashraq	Herb	Leaves, seeds, fruits	Use for treating nervous diseases, laxative, tonic for the digestive system, flatulence, purgative	Decoction	Yes	NE	[33,43,45]
43	Fabaceae	<i>Senna italica</i> Mill.	Ashrq	Herb	Leaves, seeds, fruits	Use for inflammations, treat constipation, stomach cramps, purgative, alexipyretic, urinary tract purifier, expectorant	Decoction	Yes	NE	[29,33,42,43]

44	Fabaceae	<i>Vachellia origena</i> (Hunde) Kyal. & Boatwr.	Salam	Tree	Leaves	Used for sore eyes	Decoction		NT	[42,43,54]
45	Lamiaceae	<i>Teucrium capitatum</i> L.	Jaada	Shrub	Leaves	Use for diabetes, fever, liver problems, anti-cancer, endocrinal disorders	Decoction	Yes	NE	[1,31,43]
46	Lamiaceae	<i>Mentha longifolia</i> (L.) L.	Naana	Herb	Leaves	Use for treating coughs, difficulty breathing, fevers, headache, stomach problems, chills, menstrual cramps, renal and urinary bladder stones.	Decoction, drying	Yes	NE	[31,42,43,50]
47	Lamiaceae	<i>Salvia dianthera</i> Roth	Dharah	Shrub	Leaves	Used to relieve headaches, joint- and muscle pain, also to skin problems	Infusion		EN	[40,42]
48	Lamiaceae	<i>Salvia lanigera</i> Poir.	Maryamia	Herb	Aerial parts	Use for indigestion and as carminative	Drink	Yes	NE	[1,31]
49	Lamiaceae	<i>Thymus decussatus</i> Benth.	Za'atar	Shrub	Whole herb	Use for nausea	Decoction	Yes	EN	[1,31,40]
50	Lamiaceae	<i>Ocimum americanum</i> L.	Habaq	Herb	Leaves	Use for parasitic skin diseases, ear and throat, respiratory, reproductive, digestive	Infusion, decoction	Yes	NE	[1,29]
51	Lamiaceae	<i>syriacum</i> <i>Origanum</i> L.	Bardaqush	Shrub	Leaves	Use for antitussive, anti-inflammatory, skin, ear, throat, digestive, respiratory, muscular, reproductive, neurologic, cardiovascular	Infusion, decoction, powder	Yes	NE	[1,29]
52	Lamiaceae	<i>Lavandula atriplicifolia</i> Benth.	Lavender	Shrub	Flowers	Use for digestive	Infusion	Yes	EN	[29,40]
53	Lythraceae	<i>Lawsonia inermis</i> L.	Henna	Shrub	Leaves, branches, flowers, young buds	Use for fever, anti-inflammatory, local anaesthetic, treating mouth ulcers, soften the skin of hands and feet, hair tonic, hair colour, as a cosmetic, skin diseases, headache, allays swelling and muscle pain, spleen tumour	Powder, raw	Yes	NE	[33,42,43,45]

54	Menispermaceae	<i>Cocculus hirsutus</i> (L.) W.Theob.	Hamr al majnun	Shrub	Leaves and roots	Used for fever, emetic, demulcent, for digestive problems, as a purgative and for treating venereal diseases, skin rash and as a pain reliever.	Decoction, powder		EN	[40,43]
55	Moraceae	<i>Ficus palmata</i> Forssk.	Hamat	Shrub	Latex, fruits	Used as an analgesic, soothing and laxative and in diseases of the lungs and bladder	Drops		EN	[40,42,45]
56	Moringaceae	<i>Moringa peregrina</i> (Forssk.) Fiori	Moringa	Tree	Seeds, leaves	Use for back and muscle pains, burns, fever, headache, abdominal pain and constipation, and during labour in childbirth	Infusion, powder, oil	Yes	NE	[1,43,45]
57	Myrtaceae	<i>Myrtus communis</i> L.	Ace Marouf	Shrub	Leaves, oil, fruit	Use for skin, stomach, and liver diseases, bladder, in the treatment of indigestion, epilepsy, and mouth ulcers, relieve scorpion stings, helps in hair growth, diuretic, bleeding, as a germicide, disinfectant, for rheumatism, strong laxative, internal ulcers, respiratory problems, and tonic for brain and heart	Decoction, oil, paste	Yes	EN	[29,40,45]
58	Oleaceae	<i>Olea europaea</i> L.	Zeetoun	Tree	Resin, fruit, leaves and bark	Use for neurologic, respiratory, digestive, muscular, reproductive, ear and throat, cardiovascular, skin rashes, constipation, cataracts, bone fractures, blisters and ulcers	Raw	Yes	NE	[29,42,43,45]
59	Orobanchaceae	<i>Cistanche tubulosa</i> (Schenk) Wight ex Hook.f.	Dhanun, Zanoon	Herb	Stem, leaves and flowers	Used for treating diarrhoea	Decoction		EN	[33,40,43,45]
60	Plantaginaceae	<i>Plantago ovata</i> Forssk.	Rebla, Qurayta	Herb	Seeds	Use for chronic colitis, an emollient, demulcent and astringent, a diuretic and for treating venereal diseases	Infusion, decoction, powder	Yes	NE	[1,43,45]

61	Plantaginaceae	<i>Plantago afra</i> L.	Kzaam, Gteena	Herb	Seeds	It is used to treat gastrointestinal disorders, ulcers, strong laxative, colon disorders and dysentery ulcerative.	Powder	Yes	NE	[45,52]
62	Plumbaginaceae	<i>Plumbago zeylanica</i> L.	Ensain	Shrub	Roots and stems	Used for treating skin problems, also for leprosy	Powder		EN	[1,40,43]
63	Poaceae	<i>Cymbopogon schoenanthus</i> (L.) Spreng.	Azkar	Herb	Whole plant	Use for anorexia, polyarthritits, hysteritis, analgesic, sedative, expectorant, prevent skin problems, antispasmodic, hypotension, carminative, colic gripes, flatulence	Decoction, infusion	Yes	NE	[1,33,45]
64	Poaceae	<i>Hordeum vulgare</i> L.	Shaeir	Herb	Seeds	Use for cardiovascular, neurologic, urinary tract infections and retention	Decoction, infusion, drink	Yes	NE	[29,44]
65	Polygonaceae	<i>Calligonum comosum</i> L'Hér.	Arta'a	Shrub	Stems, leaves, whole plant	Use as an antimicrobial, and toothache	Drying	Yes	NE	[31,43]
66	Polygonaceae	<i>Rumex cyprius</i> Murb.	Hamsis	Herb	Leaves	Used for retentions of blood in the urine and urinary tract infections	Eat		EN	[40,44,71]
67	Portulacaceae	<i>Portulaca oleracea</i> L.	Regla	Herb	Whole plant	Use as an anti-inflammation, constipation, and as a diuretic	Raw, paste	Yes	NE	[43,45,46]
68	Rhamnaceae	<i>Ziziphus spina-christi</i> (L.) Desf.	Sedr	Tree	Leaves, fruit, seeds, bark	Use for duodenum and stomach ache, headache, blisters, bruises, chest pains, fractures, mouth and gum problems	Decoction, powder, raw, infusion, paste	Yes	NE	[42,43,45,46]
69	Rosaceae	<i>Crataegus × sinaica</i> Boiss.	Alzaroor	Shrub	Leaves, fruits	Used for sexual weakness, cancer, cardiovascular diseases, as well as diabetes	Decoction		EN	[40,47,72]
70	Rosaceae	<i>Prunus arabica</i> (Olivier) Meikle	Louisa	Shrub	Whole plant	Used for indigestion and as an appetizer	Infusion		NT	[45,52,54]
71	Rubiaceae	<i>Pyrostria phyllanthoidea</i> (Baill.) Bridson	Samah	Shrub	Leaves	Used to treat burns	Paste		VU	[51,54]
72	Sapindaceae	<i>Allophylus rubifolius</i> (Hochst. ex A.Rich.) Engl.	Zerkim	Shrub	Leaves	Used for treating skin ulcers and boils	Powder		EN	[40,43]

73	Tamaricaceae	<i>Tamarix aphylla</i> (L.) H.Karst.	Athal	Tree	Leaves	Use for sores, wounds, wound infection stomach ache, headache, fever, bitter, astringent, tonic, eczema capitis, and during childbirth	Paste	Yes	NE	[42,43,45,46]
74	Zygophyllaceae	<i>Balanites aegyptiaca</i> (L.) Delile	Heglig	Tree	Stem bark, fruits	Used to treat yellow fever, syphilis, jaundice, epilepsy, liver and spleen problems	Decoction		EN	[1,40,45]

EN: Endangered, VU: Vulnerable, NT: Near Threatened, NE: Not Evaluated

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