# Floristic Composition, Vegetation Structure, and Regeneration Dynamics of Aleppo Pine Forest in Dibeen Forest Reserve, Jordan

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**Abstract**

Dibeen Forest Reserve in northern Jordan represents one of the last remaining natural forests of *Pinus halepensis*, playing a vital role in conserving Mediterranean forest biodiversity in the country. This study provides an assessment of the reserve's floristic composition, vegetation structure, and regeneration dynamics, based on fieldwork conducted across 30 systematically selected plots and 11 random route transects. A total of 513 vascular plant species were recorded, representing 50 families and 254 genera. Conservation assessments revealed the presence of 74 nationally threatened species and 7 globally threatened taxa, including orchids listed under CITES. The tree layer was dominated by *P. halepensis* and *Quercus coccifera*, which exhibited the highest Importance Value Index (IVI) values. The shrub layer was characterized by high abundance of *Cistus creticus*, while the herbaceous layer was dominated by annual grasses such as *Aegilops peregrina, Brachypodium pinnatum,* and *Bromus sterilis.* Regeneration surveys indicated strong recruitment of *P. halepensis*, with an estimated density of 653 seedlings/ha and a seedling-to-mature-tree ratio of 7.1:1. In contrast, other native tree species exhibited limited regeneration, and species such as *Pistacia atlantica* and *Quercus infectoria* were either absent or rare in the regeneration layer. Vegetation mapping delineated three main forest types: Aleppo pine forest, evergreen oak forest, and deciduous oak forest, each distributed along distinct environmental gradients. These findings highlight the ecological importance of Dibeen Forest Reserve as a refuge for threatened and endemic Mediterranean species and underscore the need for habitat specific monitoring and targeted conservation efforts, especially in areas with limited recruitment or high human disturbance.

**Keywords:**

Mediterranean forest, Vegetation structure, Natural regeneration, Threatened species, Habitat mapping.

## Introduction

Jordan's geographical position is located at the intersection of Africa, Asia, and Europe, provides it with diverse climatic, geological, and topographic conditions that contribute to its rich biodiversity (Aburjai *et al.,* 2007; Al-Eisawi, 1996; 1998). Despite its small area (89,287 km²), Jordan encompasses four major biogeographical regions; Mediterranean, Irano-Turanian, Saharo-Arabian, and Sudanian (sub-Tropical), comprising 13 distinct vegetation types (Al-Eisawi, 1996).

Forest ecosystems occupy a very limited area in Jordan, as approximately 80% of the country is classified as arid or semi-arid, receiving less than 150 mm of rainfall annually. However, the Mediterranean region, particularly in the highlands, supports forested areas where annual precipitation ranges from 400 to 900 mm. These regions contain the most fertile soils compared to other parts of the country (Al-Eisawi, 1985; Alrababah and Alhamad, 2006). The forests

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include natural and man-made forests; classified into six different types; Pine Forest, Evergreen Oak Forest, Deciduous Oak Forest, mixed forest, Juniper Forest, and man-made forest (Al-Eisawi, 2012; Al-Eisawi and Oran, 2015), all these forest types are under significant threats, making them highly vulnerable to degradation from logging, overgrazing, fires, habitat fragmentation, and urban expansion (Khresat *et al.,* 2008). To address these threats, the Royal Society for the Conservation of Nature (RSCN) has established a national network of protected areas, including Dibeen Forest Reserve, primarily aimed at conserving the last remaining natural Aleppo pine forest. The Dibeen Forest, dominated by *Pinus halepensis* and associated species such as *Quercus coccifera*, *Arbutus andrachne*, and *Cistus criticus*, constitutes an important habitat for Mediterranean biodiversity in Jordan (Al-Eisawi, 1996; Nawash *et al.,* 2014). Earlier, Al-Shgair (2005) conducted a comprehensive vegetation study in Dibbin National Park, documenting 177 plant species belonging to 38 families. His results highlighted the dominance of *Pinus halepensis* as the primary canopy species, co-dominated by *Quercus coccifera*, and recognized four distinct vegetation strata ranging from tall trees to herbaceous layers. The study emphasized the climax status of the Aleppo pine community, providing one of the earliest detailed ecological baselines for Dibeen forest.

In terms of stand density, Al-Shgair (2005) estimated a total of approximately 1,119 trees/ha, with *P. halepensis* exhibiting the highest density followed by *Q. coccifera*. This quantitative baseline further emphasized the structural dominance of Aleppo pine within the forest.

Beyond its floristic value, Dibeen has recently gained attention as a refuge for rare and threatened species. For instance, Othman *et al.* (2023) evaluated habitat suitability for *Iris bismarckiana*, a rare and vulnerable species, and identified parts of Dibeen Forest Reserve as ecologically suitable for potential reintroduction efforts. Their findings emphasize the microhabitat diversity and relative ecological stability of the reserve, further supporting its conservation importance.

While the study by Othman *et al.* (2023) focused on a single rare and representative species, highlighting Dibeen's ecological potential, the present study builds upon that by examining a broader spectrum of rare and endemic plant species.

In the broader Eastern Mediterranean region, *P. halepensis* has been widely studied for its ability to regenerate naturally under various environmental conditions. Several studies have reported particularly high regeneration following disturbances such as fire. For instance, Pausas *et al.* (2004) observed post-fire seedling densities reaching up to 12,400 individuals per hectare in eastern Spain, while Thanos *et al.* (1996) and Kazanis (2005) reported 50,000–60,000 seedlings/ha in fire-affected areas in central Greece. Similarly, Spanos *et al.* (2010) found that regeneration was significantly higher in unmanaged than in disturbed stands in northern Greece. These findings highlight the species strong capacity to regenerate under favorable ecological conditions, especially when disturbance reduces competition and enhances light availability.

In contrast, the regeneration dynamics of *P. halepensis* in Jordan appear more limited. Triepke *et al.* (2012) conducted a detailed assessment of the species communities in Dibeen Forest Reserve and reported sparse to moderate levels of natural regeneration across most sites. Factors such as dense litter layers, insufficient canopy gaps, and grazing pressure were identified as key ecological barriers. While their study offered valuable insights into forest composition and structure, detailed quantification of regeneration metrics (e.g., seedling densities, number of seedlings, and comparison of the regeneration of associated species) was lacking.

These observations are further supported by forest health evaluations. Alananbeh *et al.* (2023) assessed regeneration status in four Jordanian forest reserves, including Dibeen, and recorded seedling densities ranging

from 25 to over 200 individuals per 1000 m². Regenerating species included *P. halepensis, Q. coccifera,* and *A. andrachne*. However, the study noted that human activity—especially along tourist trails was associated with decreased regeneration, suggesting the need for stricter conservation measures in sensitive zone

This contrast between the high regeneration reported in other Mediterranean countries and the more limited patterns observed in Jordan underscores the importance of site-specific ecological assessments. It also highlights important questions about the local factors affecting regeneration in Dibeen, particularly under continued anthropogenic pressures. Therefore, the present study aims to provide a comprehensive analysis of floristic composition, vegetation structure, and regeneration status across different habitat types within Dibeen Forest Reserve, filling a critical gap in current ecological knowledge and supporting future conservation strategies

## Materials and Methods

### Study Area

Dibeen Forest Reserve (Figure1), located in northern Jordan, which encompasses a diverse range of Mediterranean habitats. The reserve has a Mediterranean climate with an annual rainfall ranging from 400 to 900 mm, particularly concentrated during the winter months. Its elevation ranges between 500 and 900 meters above sea level. The reserve has varied topography includes hills, slopes, and wadies, and its diverse soil types; calcareous, Terra Rosa, and limestone support multiple distinct plant communities (Al-Eisawi, 1996; Al Omary, 2011).

### Sampling Design and Data Collection

A systematic sampling design was employed to ensure representative coverage of the habitat types within the reserve. The methodology consisted of two integrated approaches: random route surveys and systematic plot-based sampling (Figure1).

### Random Route Surveys

Eleven random routes were selected to cover the major habitat types within the reserve, with priority given to areas containing key vegetation features such as water springs and wadi systems (Figure 1). The distance and path of each transect varied depending on the density of the vegetation cover. In some cases, the end of the transect was determined by the physical boundaries of the reserve. Along these routes, all vascular plant species were recorded, and voucher specimens were collected for the herbarium. Transitions between vegetation types, particularly changes in dominant tree species, were georeferenced using handheld GPS units to facilitate later spatial analysis and mapping of vegetation distribution.

### Systematic Plot Sampling

A grid system was applied across the entire reserve, dividing it into 500 × 500 m grid cells, resulting in 44 potential sampling units (Figure1). From these, 30 plots were randomly selected, covering approximately 75% of the total number of grid cells, to ensure representative sampling of the reserve's various habitat types. Within each selected grid cell, a 20 × 20 m plot was established for the assessment of floristic composition, trees, and shrubs. All individual trees and shrubs within each plot were identified to species level, and their counts were recorded to calculate abundance, density, and regeneration status. Regeneration was assessed by recording seedlings and saplings within the plots as indicators of natural recruitment and forest sustainability. Additionally, for herbaceous vegetation (annuals and perennials), a 50 m line transect was established from the center of each plot. Along these transects, all herbaceous species intersecting the line were identified and recorded.

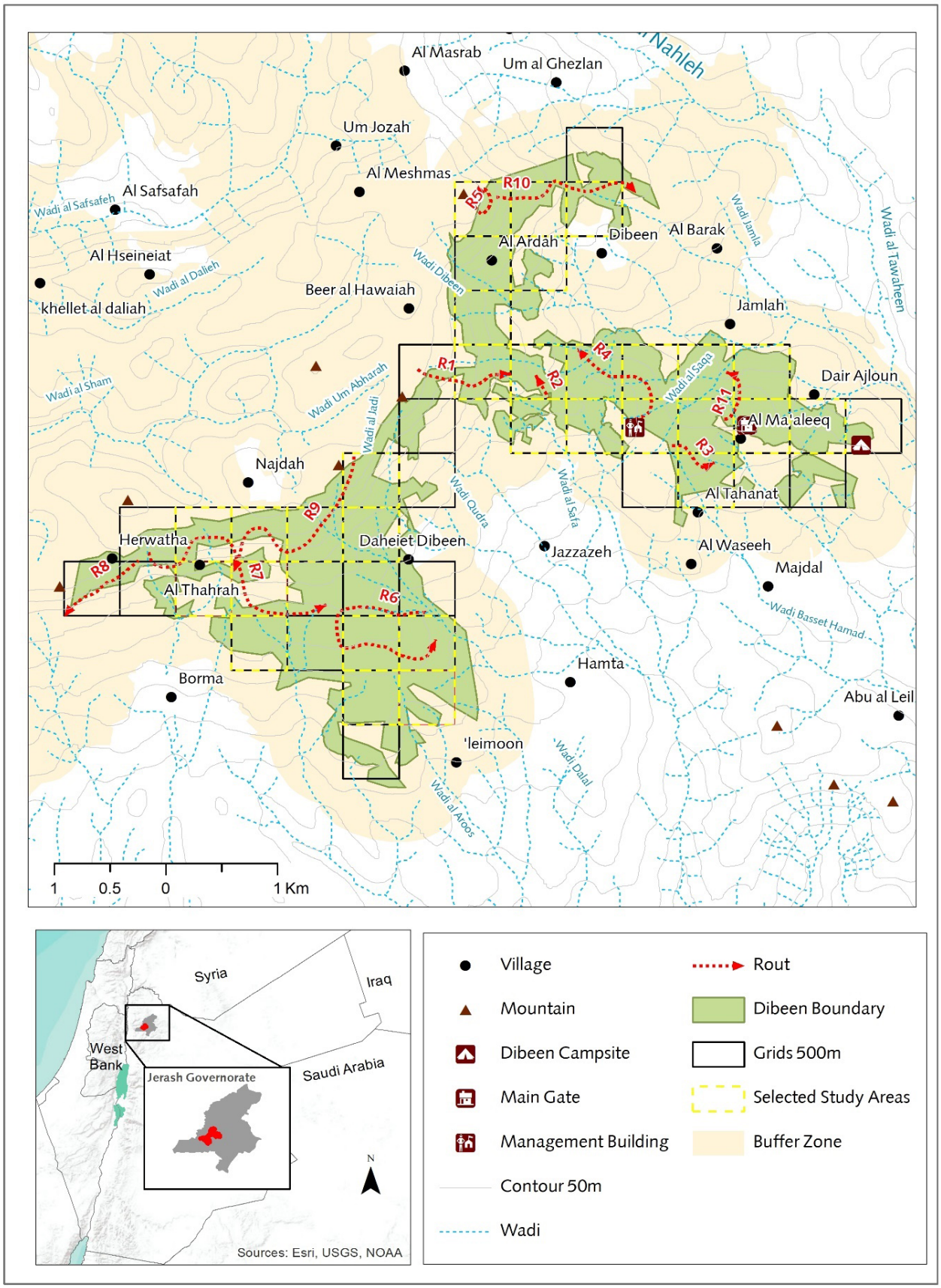


**Figure 1.** Location of Dibeen Forest Reserve in Jordan Showing Random Transects and Selected Plots

**Vegetation Analysis Parameters**

The results of the systematic sampling (Quadrats) were used following Ludwig and Reynolds (1988) to analyze the vegetation data. The following quantitative parameters were calculated:

**Abundance:** Refers to number of individuals of each species recorded across all plots or line transects. The total count of individuals for each species was summed across all sampling units**.**

**Density and Relative Density:** Density indicates the numerical strength of a species, calculated by dividing the total number of individuals of a species by the number of quadrats studied. Relative density represents the proportion of individuals of a given species relative to the total number of individuals of all species combined.

**Frequency and Relative Frequency:** Frequency refers to the number of sampling units (plots or transects) in which a species occurs, expressed as a percentage of the total number of units. In this measure, only the presence or absence of a species is recorded—not the number of individuals—giving insight into species distribution across the study area. Relative frequency represents the frequency of a species relative to the cumulative frequency of all recorded species.

**Relative Dominance:** Refers to the coverage (or basal area) of a species in relation to the total coverage of all species in the area. It provides a measure of the spatial influence of a species within the community.

**Importance Value Index (IVI):** Assesses the overall ecological significance of a species by integrating its relative frequency, relative dominance, and relative density. It provides a comprehensive view of a species' role in the plant community.

To calculate IVI = Relative Frequency + Relative Density + Relative Dominance

**Herbarium specimens' collection**

All collected specimens were pressed and dried and then were poisoned chemically using a mixture of 150 g mercuric chloride (HgCl) and 350 g ammonium chloride ($NH_4Cl$) dissolved in a minimal volume of distilled water sufficient to dissolve the salts, combined with 10 L of 96% ethanol. After processing, the specimens were identified, labeled, and mounted. Voucher specimen of each species was deposited at the herbarium of the Royal Society for the Conservation of Nature (RSCN).

**Results**

**Floristic Composition**

A total of 512 plant species were identified within Dibeen Forest Reserve, representing 50 families and 254 genera (Table 1). The most dominant families in terms of species richness were Fabaceae, Poaceae, Asteraceae, and Brassicaceae.

**Table 1**. List of vascular plant species recorded in Dibeen Forest Reserve during this study.

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| **AMARANTHACEAE** | | | |
| *Atriplex* | *halimus* L. | Common | Least Concern |
| **ANACARDIACEAE** | | | |
| *Pistacia* | *atlantica* Desf. | Near Threatened | Near Threatened |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Pistacia* | *palaestina* Boiss. | Least Concern | Not Evaluated |
| *Rhus* | *coriaria* L. | Not Evaluated | Least Concern |
| **APIACEAE** | | | |
| *Ainsworthia* | *carmelii* Boiss. | Not Evaluated | Not Evaluated |
| *Ainsworthia* | *trachycarpa* Boiss. | Not Evaluated | Not Evaluated |
| *Artedia* | *squamata* L. | Not Evaluated | Not Evaluated |
| *Astomaea* | *seselifolia* (A.DC.) Rauschert | Least Concern | Not Evaluated |
| *Chaetosciadium* | *trichospermum* (L.) Boiss. | Least Concern | Not Evaluated |
| *Daucus* | *carota* L. | Least Concern | Least Concern |
| *Daucus* | *jordanicus* Post | Least Concern | Least Concern |
| *Daucus* | *subsessilis* Boiss. | Not Evaluated | Least Concern |
| *Eryngium* | *creticum* Lam. | Least Concern | Not Evaluated |
| *Eryngium* | *glomeratum* Lam. | Least Concern | Not Evaluated |
| *Foeniculum* | *vulgare* Mill. | Not Evaluated | Least Concern |
| *Heptaptera* | *anisoptera* (DC.) Tutin | Vulnerable | Not Evaluated |
| *Lagoecia* | *cuminoides* L. | Least Concern | Not Evaluated |
| *Lecokia* | *cretica* (Lam.) DC. | Least Concern | Not Evaluated |
| *Orlaya* | *grandiflora* (L.) Hoffm. | Least Concern | Not Evaluated |
| *Pimpinella* | *cretica* Poir. | Least Concern | Not Evaluated |
| *Scandix* | *iberica* M.Bieb. | Not Evaluated | Not Evaluated |
| *Scandix* | *stellata* Banks & Sol. | Least Concern | Not Evaluated |
| *Tordylium* | *carmeli (Labill.) Al-Eisawi* | Not Evaluated | Not Evaluated |
| *Tordylium* | *trachycarpum* (Boiss.) Al-Eisawi | Least Concern | Not Evaluated |
| *Torilis* | *arvensis* (Huds.) Link | Least Concern | Not Evaluated |
| *Torilis* | *japonica* (Houtt.) DC. | Least Concern | Not Evaluated |
| *Torilis* | *leptophylla* (L.) Rchb.f. | Least Concern | Not Evaluated |
| *Torilis* | *nodosa* (L.) Gaertn. | Least Concern | Not Evaluated |
| *Torilis* | *tenella* (Delile) Rchb.f. | Least Concern | Not Evaluated |
| *Turgenia* | *latifolia* (L.) Hoffm. | Least Concern | Not Evaluated |
| **ARACEAE** | | | |
| *Arum* | *dioscoridis* Sm. | Endangered | Not Evaluated |
| *Arum* | *hygrophilum* Boiss. | Endangered | Near Threatened |
| *Arum* | *palaestinum* Boiss. | Endangered | Least Concern |
| *Bupleurum* | *nodiflorum* Sibth. & Sm. | Least Concern | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| **ASPARAGACEAE** | | | |
| *Muscari* | *commutatum* Guss. | Least Concern | Not Evaluated |
| *Ornithogalum* | *arabicum* L. | Not Evaluated | Not Evaluated |
| *Ornithogalum* | *montanum* Cirillo | Least Concern | Not Evaluated |
| *Ornithogalum* | *narbonense* L. | Least Concern | Not Evaluated |
| *Ornithogalum* | *neurostegium* Boiss. & Blanche | Least Concern | Not Evaluated |
| *Ornithogalum* | *neurostegium* subsp. *eigii* (Feinbrun) Feinbrun | Least Concern | Not Evaluated |
| *Ornithogalum* | *trichophyllum* Boiss. | Least Concern | Not Evaluated |
| **ASPLENIACEAE** | | | |
| *Asplenium* | *ceterach L.* | Not Evaluated | Not Evaluated |
| **ASTERACEAE** | | | |
| *Achillea* | *aleppica* DC. | Not Evaluated | Not Evaluated |
| *Achillea* | *arabica* Kotschy | Least Concern | Not Evaluated |
| *Anthemis* | *bornmuelleri* Stoj. & Acht. | Not Evaluated | Not Evaluated |
| *Anthemis* | *brachycarpa* Eig | Critically Endangered | Not Evaluated |
| *Anthemis* | *maris-mortui* Eig | Endangered | Not Evaluated |
| *Anthemis* | *nabataea* Eig | Vulnerable | Not Evaluated |
| *Anthemis* | *pseudocotula* Boiss. | Least Concern | Not Evaluated |
| *Anthemis* | sp | Not Evaluated | Not Evaluated |
| *Symphyotrichum* | *subulatum* (Michx.) G.L.Nesom | Introduced | Least Concern |
| *Asteriscus* | *graveolens* (Forssk.) Less. | Least Concern | Not Evaluated |
| *Atractylis* | *cancellata* L. | Least Concern | Not Evaluated |
| *Calendula* | *arvensis* M.Bieb. | Least Concern | Not Evaluated |
| *Carduus* | *argentatus* L. | Least Concern | Not Evaluated |
| *Carduus* | *getulus* Pomel | (LC)Least Concern | Not Evaluated |
| *Carduus* | *nigrescens* subsp. *australis* (Nyman) Greuter | Endangered | Not Evaluated |
| *Carlina* | *hispanica* Lam. | Least Concern | Not Evaluated |
| *Carthamus* | *nitidus* Boiss. | Least Concern | Not Evaluated |
| *Carthamus* | *tenuis* (Boiss. & Blanche) Bornm. | Least Concern | Not Evaluated |
| *Catananche* | *lutea* L. | Least Concern | Not Evaluated |
| *Centaurea* | *hyalolepis* Boiss. | Least Concern | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Centaurea* | *iberica* Trevir. ex Spreng. | Least Concern | Not Evaluated |
| *Centaurea* | *rigida* Banks & Sol. | Least Concern | Not Evaluated |
| *Centaurea* | sp | Not Evaluated | Not Evaluated |
| *Chiliadenus* | *iphionoides* (Boiss. & Blanche) Brullo | Least Concern | Not Evaluated |
| *Cichorium* | *pumilum* Jacq. | Least Concern | Least Concern |
| *Cota* | *palaestina* Reut. ex Unger & Kotschy | Least Concern | Not Evaluated |
| *Crepis* | *aspera* L. | Least Concern | Not Evaluated |
| *Crepis* | *hierosolymitana* Boiss. | Least Concern | Not Evaluated |
| *Crepis* | *kotschyana* (Boiss.) Boiss. | Not Evaluated | Not Evaluated |
| *Crepis* | *micrantha* Czerep. | Least Concern | Not Evaluated |
| *Crepis* | *palaestina* (Boiss.) Bornm. | Least Concern | Not Evaluated |
| *Crepis* | *sancta* (L.) Bornm. | Least Concern | Not Evaluated |
| *Crepis* | *syriaca* (Bornm.) Babc. & Navashin | Least Concern | Not Evaluated |
| *Crupina* | *crupinastrum* (Moris) Vis. | Least Concern | Not Evaluated |
| *Dittrichia* | *viscosa* (L.) Greuter | Least Concern | Not Evaluated |
| *Echinops* | *pungens* Trautv. | Least Concern | Not Evaluated |
| *Filago* | *contracta* (Boiss.) Chrtek & Holub | Least Concern | Not Evaluated |
| *Filago* | *eriocephala* Guss. | Least Concern | Not Evaluated |
| *Filago* | *gallica* (L.) L. | Endangered | Not Evaluated |
| *Filago* | *inexpectata* Wagenitz | Least Concern | Not Evaluated |
| *Filago* | *pyramidata* L. | Least Concern | Not Evaluated |
| *Geropogon* | *hybridus* (L.) Sch.Bip. | Least Concern | Not Evaluated |
| *Hedypnois* | *rhagadioloides* (L.) F.W.Schmidt | Least Concern | Not Evaluated |
| *Helichrysum* | *sanguineum* (L.) Kostel. | Least Concern | Not Evaluated |
| *Hyoseris* | *scabra* L. | Not Evaluated | Not Evaluated |
| *Hypochaeris* | *achyrophorus* L. | Not Evaluated | Not Evaluated |
| *Klasea* | *pusilla* (Labill.) Greuter & Wagenitz | Least Concern | Not Evaluated |
| *Lactuca* | *tuberosa* Jacq. | Least Concern | Least Concern |
| *Lactuca* | *viminea* (L.) J.Presl & C.Presl | Not Evaluated | Least Concern |
| *Leontodon* | *tuberosus* L. | Least Concern | Not Evaluated |
| *Micropus* | *supinus* L. | Endangered | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Notobasis* | *syriaca* (L.) Cass. | Least Concern | Not Evaluated |
| *Onopordum* | *carduiforme* Boiss. | Least Concern | Not Evaluated |
| *Onopordum* | *cynarocephalum* Boiss. & Blanche | Least Concern | Not Evaluated |
| *Onopordum* | *jordanicola* Eig | Endangered | Not Evaluated |
| *Phagnalon* | *rupestre* (L.) DC. | Least Concern | Not Evaluated |
| *Picnomon* | *acarna* (L.) Cass. | Least Concern | Not Evaluated |
| *Picris* | *amalecitana* (Boiss.) Eig | Least Concern | Not Evaluated |
| *Picris* | *cyanocarpa* Boiss. | Least Concern | Not Evaluated |
| *Picris* | *galilaea* (Boiss.) Eig | Least Concern | Not Evaluated |
| *Picris* | *longirostris* Sch.Bip. | Least Concern | Not Evaluated |
| *Rhagadiolus* | *edulis* Gaertn. | Not Evaluated | Not Evaluated |
| *Rhagadiolus* | *stellatus* (L.) Gaertn. | Not Evaluated | Not Evaluated |
| *Scolymus* | *maculatus* L. | Least Concern | Not Evaluated |
| *Senecio* | *vernalis* Waldst. & Kit. | Least Concern | Not Evaluated |
| *Silybum* | *marianum* (L.) Gaertn. | Least Concern | Least Concern |
| *Sonchus* | *oleraceus* (L.) L. | Least Concern | Not Evaluated |
| *Tragopogon* | *porrifolius* subsp. *longirostris* (Sch.Bip.) Greuter | Least Concern | Not Evaluated |
| *Urospermum* | *picroides* (L.) Scop. Ex F. W. Schmidt | Least Concern | Not Evaluated |
| **BORAGINACEAE** | | | |
| *Alkanna* | *strigosa* Boiss. & Hohen. | Least Concern | Not Evaluated |
| *Alkanna* | *tinctoria* (L.) Tausch | Least Concern | Least Concern |
| *Anchusa* | *aegyptiaca* (L.) A.DC. | Least Concern | Not Evaluated |
| *Anchusa* | *arvensis* subsp. *orientalis* (L.) Nordh. | Not Evaluated | Not Evaluated |
| *Anchusa* | *strigosa* Banks & Sol. | Least Concern | Not Evaluated |
| *Buglossoides* | *arvensis* (L.) I.M.Johnst. | Least Concern | Not Evaluated |
| *Buglossoides* | *tenuiflora* (L.f.) I.M.Johnst. | Least Concern | Not Evaluated |
| *Echium* | *judaeum* Lacaita | Least Concern | Not Evaluated |
| *Heliotropium* | *hirsutissimum* Grauer | Endangered | Not Evaluated |
| *Myosotis* | *ramosissima* Rochel | Endangered | Not Evaluated |
| *Myosotis* | *uncata* Boiss. & Balansa | Endangered | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Nonea* | *echioides* (L.) Roem. & Schult. | Not Evaluated | Not Evaluated |
| *Nonea* | *melanocarpa* Boiss. | Not Evaluated | Not Evaluated |
| *Nonea* | *obtusifolia* (Willd.) DC. | Not Evaluated | Not Evaluated |
| *Nonea* | *philistaea* Boiss. | Not Evaluated | Not Evaluated |
| *Symphytum* | *prachycalyx* Boiss. | Not Evaluated | Not Evaluated |
| | BRASSICACEAE | | |
| *Alyssum* | *damascenum* Boiss. & Gaill. | Least Concern | Not Evaluated |
| *Arabis* | *aucheri* Boiss. | Least Concern | Not Evaluated |
| *Arabis* | *turrita* L. | Not Evaluated | Not Evaluated |
| *Arabis* | *verna* (L.) R.Br. | Least Concern | Not Evaluated |
| *Bifora* | *testiculata* (L.) Roth | Least Concern | Not Evaluated |
| *Biscutella* | *didyma* L. | Least Concern | Not Evaluated |
| *Brassica* | *aucheri* Boiss. | Not Evaluated | Not Evaluated |
| *Brassica* | *nigra* (L.) K.Koch | Least Concern | Least Concern |
| *Calepina* | *irregularis* (Asso) Thell | Least Concern | Not Evaluated |
| *Capsella* | *bursa-pastoris* (L.) Medik. | Least Concern | Least Concern |
| *Carrichtera* | *annua* (L.) DC. | Least Concern | Least Concern |
| *Clypeola* | *jonthlaspi* L. | Least Concern | Not Evaluated |
| *Crambe* | *hispanica* L. | Least Concern | Least Concern |
| *Crambe* | *orientalis* L. | Least Concern | Not Evaluated |
| *Draba* | *verna* L. | Not Evaluated | Not Evaluated |
| *Eruca* | *vesicaria* (L.) Cav. | Least Concern | Least Concern |
| *Erucaria* | *rostrata* (Boiss.) A.W.Hill ex Greuter & Burdet | Least Concern | Not Evaluated |
| *Fibigia* | *clypeata* (L.) Medik. | Not Evaluated | Not Evaluated |
| *Hirschfeldia* | *incana* (L.) Lagr.-Foss. | Least Concern | Not Evaluated |
| *Lepidium* | *draba* L. | Least Concern | Not Evaluated |
| *Malcolmia* | *chia* (L.) DC. | Least Concern | Not Evaluated |
| *Matthiola* | *arabica* Boiss. | Least Concern | Not Evaluated |
| *Matthiola* | *longipetala* (Vent.) DC. | Least Concern | Not Evaluated |
| *Neslia* | *paniculata* subsp. *thracica* (Velen.) Bornm. | Least Concern | Not Evaluated |
| *Raphanus* | *raphanistrum* L. | Near Threatened | Not Evaluated |
| *Sinapis* | *alba* L. | Least Concern | Least Concern |
| *Sinapis* | *arvensis* L. | Least Concern | Least Concern |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Sisymbrium* | *orientale* L. | Least Concern | Not Evaluated |
| *Thlaspi* | *perfoliatum* L. | Least Concern | Not Evaluated |
| CAMPANULACEAE | | | |
| *Campanula* | *erinus* L. | Least Concern | Not Evaluated |
| *Campanula* | *hierosolymitana* Boiss. | Least Concern | Not Evaluated |
| *Campanula* | *rapunculus* L. | Least Concern | Not Evaluated |
| *Campanula* | *strigosa* Banks & Sol. | Least Concern | Not Evaluated |
| *Legousia* | *falcata* (Ten.) Fritsch ex Janch. | Least Concern | Not Evaluated |
| **CAPPARACEAE** | | | |
| *Capparis* | *spinosa* L. | Least Concern | Least Concern |
| **CAPRIFOLIACEAE** | | | |
| *Cephalaria* | *syriaca* (L.) Schrad. ex Roem. & Schult. | Least Concern | Not Evaluated |
| *Gypsophila* | *pilosa* Huds. | Least Concern | Not Evaluated |
| *Lomelosia* | *palaestina* (L.) Raf. | Not Evaluated | Not Evaluated |
| *Lonicera* | *etrusca* Santi | Vulnerable | Not Evaluated |
| *Pterocephalus* | *brevis* Coult. | Not Applicable | Not Evaluated |
| *Pterocephalus* | *papposus* (L.) Coult. | Not Evaluated | Not Evaluated |
| *Lomelosia* | *prolifera* (L.) Greuter & Burdet | Not Evaluated | Not Evaluated |
| *Valerianella* | *coronata* (L.) DC. | Least Concern | Not Evaluated |
| *Valerianella* | *muricata* (Steven ex M.Bieb.) W.H.Baxter | Least Concern | Not Evaluated |
| *Valerianella* | *sclerocarpa* Fisch. & C.A.Mey. | Least Concern | Not Evaluated |
| *Valerianella* | *vesicaria* (L.) Moench | (LC)Least Concern | Not Evaluated |
| **CARYOPHYLACEAE** | | | |
| *Arenaria* | *serpyllifolia* subsp. *leptoclados* (Rchb.) Nyman | Least Concern | Not Evaluated |
| *Cerastium* | *dichotomum* L. | Least Concern | Not Evaluated |
| *Cerastium* | *glomeratum* Thuill. | Not Evaluated | Not Evaluated |
| *Herniaria* | *hirsuta* L. | Least Concern | Not Evaluated |
| *Minuartia* | *decipiens* Bornm. | Not Applicable | Not Evaluated |
| *Minuartia* | *globulosa* (Labill.) Schinz & Thell. | Critically Endangered | Not Evaluated |
| *Minuartia* | *hybrida* (Vill.) Schischk. | Least Concern | Not Evaluated |
| *Minuartia* | *mediterranea* (Ledeb. ex Link) K.Malý | Least Concern | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Minuartia* | *meyeri* (Boiss.) Bornm. | Least Concern | Not Evaluated |
| *Paronychia* | *argentea* Lam. | Least Concern | Not Evaluated |
| *Silene* | *aegyptiaca* (L.) L.f. | Least Concern | Not Evaluated |
| *Silene* | *apetala* Willd. | Not Evaluated | Not Evaluated |
| *Silene* | *behen* L. | Least Concern | Not Evaluated |
| *Silene* | *colorata* Poir. | Least Concern | Not Evaluated |
| *Silene* | *conoidea* L. | Least Concern | Not Evaluated |
| *Silene* | *italica* (L.) Pers. | Critically Endangered | Not Evaluated |
| *Silene* | *linearis* Decne. | Not Applicable | Not Evaluated |
| *Silene* | *macrodonta* Boiss. | Critically Endangered | Not Evaluated |
| *Silene* | *nocturna* L. | Least Concern | Not Evaluated |
| *Silene* | *palaestina* Boiss. | Not Applicable | Not Evaluated |
| *Silene* | *telavivensis* Zohary & Plitmann | Not Evaluated | Not Evaluated |
| *Silene* | *vivianii* Steud. | Not Evaluated | Not Evaluated |
| *Silene* | *vulgaris* (Moench) Garcke | Least Concern | Least Concern |
| *Spergularia* | *hybrida* Hausskn. | Not Evaluated | Not Evaluated |
| *Stellaria* | *media* (L.) Vill. | Least Concern | Not Evaluated |
| *Velezia* | *rigida* L. | Least Concern | Not Evaluated |
| **CHENOPODIACEAE** | | | |
| *Chenopodium* | *album* L. | Least Concern | Not Evaluated |
| *Chenopodium* | *murale* L. | Least Concern | Least Concern |
| CISTACEAE | | | |
| *Cistus* | *creticus* L. | Least Concern | Not Evaluated |
| *Cistus* | *salviifolius* L. | Least Concern | Not Evaluated |
| *Fumana* | *arabica* (L.) Spach | Vulnerable | Not Evaluated |
| *Fumana* | *thymifolia* (L.) Spach | Least Concern | Not Evaluated |
| *Helianthemum* | *aegyptiacum* (L.) Mill. | Least Concern | Not Evaluated |
| *Helianthemum* | *ledifolium* subsp. *lasiocarpum* (Desf. ex Jacques & Hérincq) Nyman | Least Concern | Not Evaluated |
| *Helianthemum* | *salicifolium* (L.) Mill. | Least Concern | Not Evaluated |
| *Helianthemum* | *syriacum* (Jacq.) Dum. Cours. | Least Concern | Not Evaluated |
| **CONVOLVULACEAE** | | | |
| *Convolvulus* | *pentapetaloides* L. | Not Applicable | Not Evaluated |
| *Convolvulus* | *scammonia* L. | Not Applicable | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Convolvulus* | *siculus* L. | Not Applicable | Not Evaluated |
| **CRASSULACEAE** | | | |
| *Sedum* | *cespitosum* (Cav.) DC. | Least Concern | Not Evaluated |
| *Sedum* | *microcarpum* (Sm.) Schönland | Endangered | Not Evaluated |
| *Sedum* | *pallidum M.Bieb.* | Endangered | Not Evaluated |
| *Sedum* | *rubens* L. | Least Concern | Not Evaluated |
| *Umbilicus* | *intermedius* Boiss. | Least Concern | Not Evaluated |
| **CUCURBITACEAE** | | | |
| *Bryonia* | *cretica* L. | Least Concern | Not Evaluated |
| **EPHEDRACEAE** | | | |
| *Ephedra* | *aphylla* Forssk. | Least Concern | Least Concern |
| *Ephedra* | sp | Not Evaluated | Not Evaluated |
| **ERICACEAE** | | | |
| *Arbutus* | *andrachne* L. | Vulnerable | Not Evaluated |
| **EUPHORBIACEAE** | | | |
| *Euphorbia* | *aleppica* L. | Least Concern | Not Evaluated |
| *Euphorbia* | *aulacosperma* Boiss. | Least Concern | Not Evaluated |
| *Euphorbia* | *densa* Schrenk | Vulnerable | Not Evaluated |
| *Euphorbia* | *helioscopia* L. | Least Concern | Not Evaluated |
| *Euphorbia* | *oxyodonta* Boiss. | Endangered | Not Evaluated |
| *Euphorbia* | *peplus* L. | Least Concern | Not Evaluated |
| *Euphorbia* | *reuteriana* Boiss. | Vulnerable | Not Evaluated |
| *Mercurialis* | *annua* L. | (LC)Least Concern | Not Evaluated |
| **FABACEAE** | | | |
| *Astragalus* | *oleifolius* DC. | Not Evaluated | Not Evaluated |
| *Astragalus* | *corrugatus* Bertol. | Not Evaluated | Not Evaluated |
| *Astragalus* | *epiglottis* L. | Least Concern | Not Evaluated |
| *Astragalus* | *hamosus* L. | Least Concern | Not Evaluated |
| *Astragalus* | *palaestinus* var. *jordanensis* (Eig) Podl. | Not Evaluated | Not Evaluated |
| *Astragalus* | *pelecinus* (L.) Barneby | Not Evaluated | Not Evaluated |
| *Astragalus* | *schimperi* Boiss. | Least Concern | Not Evaluated |
| *Astragalus* | trimestris L. | Least Concern | Not Evaluated |
| *Bituminaria* | *flaccida* (Nábělek) Greuter | Least Concern | Not Evaluated |
| *Calicotome* | *villosa* (Poir.) Link | Least Concern | Not Evaluated |
| *Ceratonia* | *siliqua* L. | Least Concern | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Coronilla* | *scorpiodes* K. Koch | Least Concern | Not Evaluated |
| *Hippocrepis* | *unisiliquosa* L. | Least Concern | Not Evaluated |
| *Hymenocarpos* | *circinnatus* (L.) Savi | Least Concern | Not Evaluated |
| *Lathyrus* | *aphaca* L. | Least Concern | Least Concern |
| *Lathyrus* | *blepharicarpus* Boiss. | Least Concern | Least Concern |
| *Lathyrus* | *cicera* L. | Endangered | Least Concern |
| *Lathyrus* | *gloeosperma* Warb. & Eig | Critically Endangered | Critically Endangered |
| *Lathyrus* | *hierosolymitanus* Boiss. | Least Concern | Least Concern |
| *Lathyrus* | *gorgoni* Parl. | Not Evaluated | Least Concern |
| *Vicia* | *orientalis* (Boiss.) Bég. & Diratz. | Least Concern | Not Evaluated |
| *Vicia* | *lenticula* (Hoppe) Janka | Endangered | Not Evaluated |
| *Vicia* | sp | Not Evaluated | Not Evaluated |
| *Lotus* | *conimbricensis* Brot. | Critically Endangered | Not Evaluated |
| *Lotus* | *edulis* L. | Least Concern | Least Concern |
| *Lotus* | *longesiliquosus* R.Roem. | Not Evaluated | Not Evaluated |
| *Lotus* | *ornithopodioides* L. | Least Concern | Not Evaluated |
| *Lotus* | *peregrinus* L. | Least Concern | Not Evaluated |
| *Lysimachia* | *linum-stellatum* L. | Least Concern | Not Evaluated |
| *Medicago* | *astroites* (Fisch. & C.A.Mey.) Trautv. | Least Concern | Least Concern |
| *Medicago* | *coronata* (L.) Bartal. | Least Concern | Least Concern |
| *Medicago* | *doliata* Carmign. | Not Evaluated | Least Concern |
| *Medicago* | *granadensis* Willd. | Least Concern | Not Applicable |
| *Medicago* | *laciniata* (L.) Mill. | Least Concern | Least Concern |
| *Medicago* | *littoralis* Loisel. | Least Concern | Least Concern |
| *Medicago* | *minima* (L.) L. | Least Concern | Least Concern |
| *Medicago* | *orbicularis* (L.) Bartal. | Least Concern | Least Concern |
| *Medicago* | *polymorpha* L. | Least Concern | Least Concern |
| *Medicago* | *radiata* L. | Least Concern | Not Evaluated |
| *Medicago* | *rotata* Boiss. | Least Concern | Least Concern |
| *Medicago* | *rugosa* Desr. | Least Concern | Least Concern |
| *Medicago* | *truncatula* Gaertn. | Least Concern | Least Concern |
| *Medicago* | *turbinata* (L.) All. | Not Evaluated | Least Concern |
| *Melilotus* | *messanensis* (L.) All. | Least Concern | Not Evaluated |
| *Onobrychis* | *caput-galli* (L.) Lam. | Least Concern | Not Evaluated |
| *Onobrychis* | *crista-galli* (L.) Lam. | Least Concern | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Onobrychis* | *kotschyana* Fenzl | Least Concern | Not Evaluated |
| *Onobrychis* | *squarrosa* Viv. | Not Evaluated | Not Evaluated |
| *Ononis* | *alopecuroides* L. | Critically Endangered | Not Evaluated |
| *Ononis* | *natrix* L. | Least Concern | Least Concern |
| *Ononis* | *ornithopodioides* L. | Least Concern | Not Evaluated |
| *Ononis* | *pubescens* L. | Least Concern | Not Evaluated |
| *Ononis* | *reclinata* L. | Least Concern | Not Evaluated |
| *Ononis* | *spinosa* L. | Least Concern | Least Concern |
| *Ononis* | *spinosa* subsp. *antiquorum* (L.) Briq. | Least Concern | Least Concern |
| *Ononis* | *variegata* L. | Endangered | Not Evaluated |
| *Ononis* | *viscosa* L. | Least Concern | Not Evaluated |
| *Ononis* | *sicula* Guss. | Not Evaluated | Not Evaluated |
| *Ononis* | *ornithopodioides* L. | Least Concern | Not Evaluated |
| *Pisum* | *fulvum* Sibth. & Sm. | Least Concern | Near Threatened |
| *Lathyrus* | *oleraceus* Lam. | Not Evaluated | Least Concern |
| *Pisum* | *syriacum* (A.Berger) C.O.Lehm. | Not Evaluated | Not Evaluated |
| *Scorpiurus* | *muricatus* L. | Least Concern | Not Evaluated |
| *Trifolium* | *campestre* Schreb. | Least Concern | Not Evaluated |
| *Trifolium* | *clusii* Godr. & Gren. | Least Concern | Least Concern |
| *Trifolium* | *clypeatum* L. | Least Concern | Not Evaluated |
| *Trifolium* | *dasyurum* C.Presl | Least Concern | Not Evaluated |
| *Trifolium* | *erubescens* Fenzl | Endangered | Not Evaluated |
| *Trifolium* | *nigrescens* Viv. | (Least Concern | Not Evaluated |
| *Trifolium* | *palaestinum* Boiss. | Not Evaluated | Not Evaluated |
| *Trifolium* | *physodes* M.Bieb. | Least Concern | Not Evaluated |
| *Trifolium* | *pilulare* Boiss. | Least Concern | Not Evaluated |
| *Trifolium* | *purpureum* Loisel. | Least Concern | Not Evaluated |
| *Trifolium* | *repens* L. | Least Concern | Least Concern |
| *Trifolium* | *resupinatum* L. | Least Concern | Least Concern |
| *Trifolium* | *scabrum* L. | Least Concern | Least Concern |
| *Trifolium* | *stellatum* L. | Least Concern | Not Evaluated |
| *Trifolium* | *tomentosum* L. | Least Concern | Not Evaluated |
| *Trigonella* | *filipes* Boiss. | Least Concern | Not Evaluated |
| *Trigonella* | *foenum-graecum* L. | Least Concern | Not Evaluated |
| *Trigonella* | *kotschyi* Benth. | Not Evaluated | Not Evaluated |
| *Tripodion* | *tetraphyllum* (L.) Fourr. | Least Concern | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Vicia* | *galilaea* Plitmann & Zohary | Least Concern | Not Evaluated |
| *Vicia* | *hybrida* L. | Least Concern | Least Concern |
| *Vicia* | *lutea* L. | Least Concern | Least Concern |
| *Vicia* | *narbonensis* L. | Least Concern | Not Evaluated |
| *Vicia* | *palaestina* Boiss. | Least Concern | Not Evaluated |
| *Vicia* | *peregrina* L. | Least Concern | Least Concern |
| *Vicia* | *sativa* L. | Least Concern | Least Concern |
| *Vicia* | *sericocarpa* Fenzl | Least Concern | Least Concern |
| **FAGACEAE** | | | |
| *Quercus* | *coccifera* L. | Vulnerable | Least Concern |
| *Quercus* | *infectoria* G.Olivier | Not Evaluated | Least Concern |
| *Quercus* | *ithaburensis* Decne. | Vulnerable | Least Concern |
| **GERANIACEAE** | | | |
| *Erodium* | *acaule* (L.) Bech. & Thell | Least Concern | Not Evaluated |
| *Erodium* | *alnifolium* Guss. | Not Evaluated | Not Evaluated |
| *Erodium* | *ciconium* (L.) L'Hér. | Least Concern | Not Evaluated |
| *Erodium* | *cicutarium* (L.) L'Hér. | Least Concern | Not Evaluated |
| *Erodium* | *gruinum* (L.) L' Hér. | Least Concern | Not Evaluated |
| *Erodium* | *laciniatum* (Cav.) Willd. | Least Concern | Not Evaluated |
| *Erodium* | *pulverulentum* (Cav.) Willd. | Not Evaluated | Not Evaluated |
| *Erodium* | *malacoides* (L.) L'Hér. | Least Concern | Not Evaluated |
| *Erodium* | *moschatum* (L.) L'Hér. | Least Concern | Not Evaluated |
| *Erodium* | *subintegrifolium* Eig | Endangered (EN) | Not Evaluated |
| *Erodium* | *touchyanum* Delile ex Godr. | Least Concern | Not Evaluated |
| *Erodium* | *trifolium* (Cav.) Guitt. | Not Evaluated | Not Evaluated |
| *Geranium* | *molle* L. | Least Concern | Not Evaluated |
| *Geranium* | *rotundifolium* L. | Least Concern | Not Evaluated |
| **IRIDACEAE** | | | |
| *Gynandriris* | *sisyrinchium* (L.) Parl. | Not Evaluated | Not Evaluated |
| *Iris* | *atrofusca* Baker | Endangered | Vulnerable |
| *Iris* | *bismarckiana* Damman & Sprenger | Critically Endangered | Endangered |
| **LAMIACEAE** | | | |
| *Ajuga* | *chamaepitys* subsp. *chia* (Schreb.) Arcang. | Least Concern | Least Concern |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Ballota* | *saxatilis* Sieber ex C.Presl | Least Concern | Not Evaluated |
| *Ballota* | *undulata* (Sieber ex Fresen.) Benth. | Least Concern | Not Evaluated |
| *Lamium* | *amplexicaule* L. | Least Concern | Not Evaluated |
| *Lamium* | *moschatum* Mill. | Least Concern | Not Evaluated |
| *Micromeria* | *myrtifolia* Boiss. & Hohen. | Least Concern | Not Evaluated |
| *Micromeria* | *nervosa* (Desf.) Benth. | Least Concern | Not Evaluated |
| *Phlomis* | *viscosa* Poir. | Least Concern | Not Evaluated |
| *Prasium* | *majus* L. | Least Concern | Not Evaluated |
| *Salvia* | *dominica* L. | Least Concern | Not Evaluated |
| *Salvia* | *verbenaca L.* | Least Concern | Not Evaluated |
| *Salvia* | *hierosolymitana* Boiss. | Least Concern | Not Evaluated |
| *Salvia* | *indica* L. | Critically Endangered | Not Evaluated |
| *Scutellaria* | *brevibracteata* subsp. *subvelutina* (Rech.f.) Greuter & Burdet | Not Evaluated | Not Evaluated |
| *Sideritis* | *perfoliata* L. | Least Concern | Not Evaluated |
| *Sideritis* | *romana* subsp. *curvidens* (Stapf) Holmboe | Not Evaluated | Not Evaluated |
| *Stachys* | *neurocalycina* Boiss. | Least Concern | Not Evaluated |
| *Teucrium* | *polium* L. | Not Evaluated | Not Evaluated |
| *Thymbra* | *spicata* L. | Not Evaluated | Not Evaluated |
| *Ziziphora* | *capitata* L. | Not Evaluated | Not Evaluated |
| **LILIACEAE** | | | |
| *Allium* | *albotunicatum* O.Schwarz | Not Evaluated | Endangered |
| *Allium* | *decaisnei* C.Presl | Not Evaluated | Not Evaluated |
| *Allium* | *neapolitanum* Cirillo | Least Concern | Not Evaluated |
| *Asparagus* | *aphyllus* L. | Least Concern | Not Evaluated |
| *Asphodeline* | *lutea* (L.) Rchb. | Least Concern | Not Evaluated |
| *Asphodelus* | *aestivus* Brot. | Not Evaluated | Not Evaluated |
| *Bellevalia* | *flexuosa* Boiss. | Least Concern | Not Evaluated |
| *Bellevalia* | *trifoliata* (Ten.) Kunth | Least Concern | Not Evaluated |
| *Drimia* | *maritima* (L.) Stearn | Least Concern | Not Evaluated |
| *Gagea* | *villosa* (M.Bieb.) Sweet | Endangered (EN) | Not Evaluated |
| *Tulipa* | *agenensis* DC. | Least Concern | Least Concern |
| **LINACEAE** | | | |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Linum* | *nodiflorum* L. | Least Concern | Not Evaluated |
| *Linum* | *pubescens* Banks & Sol. | Least Concern | Not Evaluated |
| *Linum* | *strictum* L. | Least Concern | Not Evaluated |
| **MALVACEAE** | | | |
| *Alcea* | *acaulis* (Cav.) Alef. | Least Concern | Not Evaluated |
| *Alcea* | *digitata* Alef. | Least Concern | Not Evaluated |
| *Alcea* | *setosa* (Boiss.) Alef. | Least Concern | Not Evaluated |
| *Althaea* | *ludwigii* L. | Least Concern | Not Evaluated |
| *Malva* | *multiflora* (Cav.) Soldano, Banfi & Galasso | Vulnerable | Not Evaluated |
| *Malva* | *nicaeensis* All. | Least Concern | Not Evaluated |
| *Malva* | *parviflora* L. | Least Concern | Not Evaluated |
| **OLEACEAE** | | | |
| *Olea* | *europaea* L. | Vulnerable | Data Deficient |
| **ORCHIDACEAE** | | | |
| *Anacamptis* | *collina* (Banks & Sol. ex Russell) R.M.Bateman, Pridgeon & M.W.Chase | Endangered | Least Concern |
| *Anacamptis* | *papilionacea* (L.) R.M.Bateman, Pridgeon & M.W.Chase | Endangered (EN) | Least Concern |
| *Anacamptis* | *pyramidalis* (L.) Rich. | Critically Endangered | Least Concern |
| *Cephalanthera* | *longifolia* (L.) Fritsch | Endangered | Least Concern |
| *Limodorum* | *abortivum* (L.) Sw. | Critically Endangered | Least Concern |
| *Ophrys* | *sphegodes* subsp. *taurica* (Aggeenko) Soó ex Niketić & Djordjevic | Critically Endangered | Not Evaluated |
| *Orchis* | *anatolica* Boiss. | Endangered | Least Concern |
| *Orchis* | *galilaea* (Bornm. & M.Schulze) Schltr. | Endangered | Least Concern |
| *Neotinea* | *tridentata* (Scop.) R.M.Bateman, Pridgeon & M.W.Chase | Endangered | Least Concern |
| **OROBANCHACEAE** | | | |
| *Orobanche* | *aegyptiaca* Pers. | Least Concern | Not Evaluated |
| *Orobanche* | sp | Not Evaluated | Not Evaluated |
| *Parentucellia* | *flaviflora* (Boiss.) Nevski | Not Evaluated | Not Evaluated |
| **PAPAVERACEAE** | | | |
| *Ceratocapnos* | *turbinata* (DC.) Lidén | Endangered | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Fumaria* | *densiflora* DC. | Not Evaluated | Not Evaluated |
| *Hypecoum* | *imberbe* Sm. | Not Evaluated | Not Evaluated |
| *Papaver* | *argemone* L. | Least Concern | Not Evaluated |
| *Papaver* | *carmeli* Feinbrun | Least Concern | Not Evaluated |
| PINACEAE | | | |
| *Pinus* | *halepensis* Mill. | Vulnerable | Least Concern |
| **PLANTAGINACEAE** | | | |
| *Kickxia* | *aegyptiaca* (L.) Nábělek | (LC)Least Concern | Not Evaluated |
| *Linaria* | *albifrons* Spreng. | Not Applicable | Not Evaluated |
| *Linaria* | *micrantha* (Cav.) Hoffmanns. & Link | Not Applicable | Not Evaluated |
| *Misopates* | *orontium* (L.) Raf. | Least Concern | Not Evaluated |
| *Plantago* | *bellardii* All. | Not Applicable | Not Evaluated |
| *Plantago* | *cretica* L. | Not Applicable | Not Evaluated |
| *Plantago* | *indica* L. | Not Evaluated | Least Concern |
| *Plantago* | *lagopus* L. | Not Evaluated | Not Evaluated |
| *Veronica* | *cymbalaria* Bodard | Not Applicable | Not Evaluated |
| *Veronica* | *persica* Poir. | Least Concern | Not Evaluated |
| *Veronica* | *polita* Fr. | Least Concern | Not Evaluated |
| *Veronica* | *syriaca* Roem. & Schult. | Not Evaluated | Not Evaluated |
| **POACEAE** | | | |
| *Aegilops* | *geniculata* Roth | Least Concern | Least Concern |
| *Aegilops* | *peregrina* (Hack.) Maire & Weiller | Least Concern | Least Concern |
| *Alopecurus* | *arundinaceus* Poir. | Endangered | Least Concern |
| *Alopecurus* | *myosuroides* Huds. | Endangered | Least Concern |
| *Avena* | *barbata* Pott ex Link | Least Concern | Least Concern |
| *Avena* | *clauda* Durieu | Endangered | Least Concern |
| *Avena* | *eriantha* Durieu | Critically Endangered | Least Concern |
| *Avena* | *longiglumis* Durieu | Least Concern | Data Deficient |
| *Avena* | *sterilis* L. | Least Concern | Least Concern |
| *Avena* | *wiestii* Steudel | Not Evaluated | Least Concern |
| *Brachypodium* | *distachyon* (L.) P.Beauv. | Least Concern | Not Evaluated |
| *Bromus* | *alopecuros* Poir. | Not Evaluated | Not Evaluated |
| *Bromus* | *alopecuros* subsp. *caroli-henrici* (Greuter) P.M.Sm. | Not Evaluated | Not Evaluated |
| *Bromus* | *fasciculatus* C.Presl | Least Concern | Least Concern |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Bromus* | *japonicus* Thunb. | Not Evaluated | Data Deficient |
| *Bromus* | *lanceolatus* Roth | Least Concern | Not Evaluated |
| *Bromus* | *madritensis* L. subsp. *Madritensis* | Least Concern | Least Concern |
| *Bromus* | *rigidus* Roth | Not Evaluated | Not Evaluated |
| *Bromus* | *rubens* L. | Least Concern | Least Concern |
| *Bromus* | *scoparius* L. | Least Concern | Not Evaluated |
| *Bromus* | *sterilis* L. | Least Concern | Not Evaluated |
| *Bromus* | *tectorum* L. | Least Concern | Not Evaluated |
| *Catapodium* | *rigidum* (L.) C.E.Hubb. | Least Concern | Least Concern |
| *Crithopsis* | *delileana* (Schult.) Roshev. | Least Concern | Not Evaluated |
| *Cynosurus* | *echinatus* L. | Least Concern | Not Evaluated |
| *Cynosurus* | *elegans* Desf. | Not Evaluated | Not Evaluated |
| *Dactylis* | *glomerata* L. | Least Concern | Not Evaluated |
| *Gastridium* | *ventricosum* (Gouan) Schinz & Thell. | Critically Endangered | Not Evaluated |
| *Hordeum* | *bulbosum* L. | Least Concern | Least Concern |
| *Hordeum* | *murinum* subsp. *glaucum* (Steud.) Tzvelev | Least Concern | Least Concern |
| *Hordeum* | *spontaneum* K.Koch | Least Concern | Least Concern |
| *Hordeum* | *vulgare* L. | Not Evaluated | Least Concern |
| *Hyparrhenia* | *hirta* (L.) Stapf | Least Concern | Not Evaluated |
| *Lamarckia* | *aurea* (L.) Moench | Least Concern | Not Evaluated |
| *Lolium* | *rigidum* Gaudin | Least Concern | Least Concern |
| *Phalaris* | *brachystachys* Link | Least Concern | Least Concern |
| *Phalaris* | *minor* Retz. | Least Concern | Not Evaluated |
| *Phragmites* | *australis* (Cav.) Trin. ex Steud. | Least Concern | Not Evaluated |
| *Piptatherum* | *blancheanum* Desv. ex Boiss. | Not Evaluated | Not Evaluated |
| *Piptatherum* | *holciforme* (M.Bieb.) Roem. & Schult. | Not Evaluated | Not Evaluated |
| *Piptatherum* | *miliaceum* (L.) Coss. | Not Evaluated | Not Evaluated |
| *Poa* | *bulbosa* L. | Least Concern | Not Evaluated |
| *Poa* | *sinaica* Steud. | Least Concern | Not Evaluated |
| *Psilurus* | *incurvus* (Gouan) Schinz & Thell. | Least Concern | Not Evaluated |
| *Rostraria* | *berythea* (Boiss. & Blanche) Holub | Not Evaluated | Not Evaluated |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Stipa* | *bromoides* (L.) Dörfl. | Least Concern | Least Concern |
| *Stipa* | *capensis* Thunb. | Least Concern | Not Evaluated |
| *Stipa* | *hohenackeriana* Trin. & Rupr. | Least Concern | Not Evaluated |
| *Trisetaria* | *koelerioides* (Bornm. & Hack.) Melderis | Not Evaluated | Not Evaluated |
| *Trisetaria* | *glumacea* (Boiss.) Maire | Least Concern | Not Evaluated |
| *Vulpia* | *ciliata* Dumort. | Least Concern | Not Evaluated |
| *Vulpia* | *fasciculata* (Forssk.) Samp. | Least Concern | Not Evaluated |
| *Vulpia* | *myuros* (L.) C.C.Gmel. | Least Concern | Not Evaluated |
| *Vulpia* | *unilateralis* (L.) Stace | Least Concern | Not Evaluated |
| **POLYGALACEAE** | | | |
| *Polygala* | *monspeliaca* L. | Least Concern | Not Evaluated |
| **POLYGONACEAE** | | | |
| *Polygonum* | *equisetiforme* Sm. | Least Concern | Not Evaluated |
| *Emex* | *spinosa* (L.) Campd. | Least Concern | Not Evaluated |
| *Rumex* | sp | Not Evaluated | Not Evaluated |
| **PRIMULACEAE** | | | |
| *Anagallis* | *arvensis* L. | Least Concern | Not Evaluated |
| *Cyclamen* | *persicum* Mill. | Endangered | Not Evaluated |
| **PTERIDACEAE** | | | |
| *Cheilanthes* | *pteridioides* C. Chr. | Not Evaluated | Least Concern |
| **RANUNCULACEAE** | | | |
| *Adonis* | *aestivalis* L. | Least Concern | Not Evaluated |
| *Adonis* | *dentata* Delile | Least Concern | Not Evaluated |
| *Adonis* | *palaestina* Boiss. | Not Evaluated | Not Evaluated |
| *Anemone* | *coronaria* L. | Least Concern | Not Evaluated |
| *Clematis* | *cirrhosa* L. | Least Concern | Not Evaluated |
| *Delphinium* | *ithaburense* Boiss. | Not Applicable | Not Evaluated |
| *Nigella* | *ciliaris* DC. | Not Applicable | Not Evaluated |
| *Ranunculus* | *asiaticus* L. | Least Concern | Not Evaluated |
| *Ranunculus* | *marginatus* d'Urv. | Not Evaluated | Not Evaluated |
| **RESEDACEAE** | | | |
| *Reseda* | *lutea* L. | Not Evaluated | Not Evaluated |
| **RHAMNACEAE** | | | |
| *Rhamnus* | *palaestina* Boiss. | Not Evaluated | Not Evaluated |
| **ROSACEAE** | | | |

| Genus Name | Species Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|---|
| *Crataegus* | *azarolus* var. *aronia* L. | Least Concern | Least Concern |
| *Prunus* | *dulcis* (Mill.) D.A.Webb | Not Evaluated | Not Evaluated |
| *Pyrus* | *syriaca* Boiss. | Least Concern | Least Concern |
| *Sanguisorba* | *minor* Scop. | Least Concern | Not Evaluated |
| *Sarcopoterium* | *spinosum* (L.) Spach | Not Evaluated | Not Evaluated |
| **RUBIACEAE** | | | |
| *Crucianella* | *macrostachya* Boiss. | Least Concern | Not Evaluated |
| *Crucianella* | *transjordanica* Rech.f. | Endangered | Least Concern |
| *Cruciata* | *articulata* (L.) Ehrend. | Least Concern | Not Evaluated |
| *Galium* | *aparine* L. | Least Concern | Not Evaluated |
| *Galium* | *cassium* Boiss. | Vulnerable (VU) | Not Evaluated |
| *Galium* | *hierochuntinum* Bornm. | Least Concern | Not Evaluated |
| *Galium* | *judaicum* Boiss. | Least Concern | Not Evaluated |
| *Galium* | *murale* (L.) All. | Least Concern | Not Evaluated |
| *Galium* | *setaceum* Lam. | Least Concern | Not Evaluated |
| *Rubia* | *tenuifolia* d'Urv. | Least Concern | Not Evaluated |
| *Theligonum* | *cynocrambe* L. | Not Evaluated | Not Evaluated |
| *Valantia* | *hispida* L. | Least Concern | Not Evaluated |
| **SANTALACEAE** | | | |
| *Osyris* | *alba* L. | Least Concern | Not Evaluated |
| *Thesium* | *bergeri* Zucc. | Least Concern | Not Evaluated |
| *Thesium* | *humile* Vahl | Least Concern | Not Evaluated |
| **SCROPHULARIACEAE** | | | |
| *Scrophularia* | *rubricaulis* Boiss. | Not Evaluated | Not Evaluated |
| *Scrophularia* | *xanthoglossa* Boiss. | Not Evaluated | Not Evaluated |
| *Verbascum* | *sinuatum* L. | Least Concern | Not Evaluated |
| **SOLANACEAE** | | | |
| *Mandragora* | *officinalis* Mill. | Not Evaluated | Not Evaluated |
| **STYRACACEAE** | | | |
| *Styrax* | *officinalis* L. | Vulnerable | Least Concern |
| **URTICACEAE** | | | |
| *Parietaria* | *alsinifolia* Delile | Least Concern | Not Evaluated |
| *Parietaria* | *judaica* subsp. *judaica* | Least Concern | Not Evaluated |
| *Parietaria* | *lusitanica* L. | Least Concern | Not Evaluated |
| *Urtica* | *urens* L. | Least Concern | Least Concern |

Conservation assessments were conducted based on the IUCN Red List (2024) and the Jordan Plant Red List (Volumes 1 and 2) (Taifour and El-Oqlah, 2014; Taifour, 2022). A total of seven species are classified globally as threatened: *Lathyrus gloeosperma* (Critically Endangered), *Iris bismarckiana* and *Allium albotunicatum* (Endangered), *Iris atrofusca* (Vulnerable), and *Pistacia atlantica, Arum hygrophilum,* and *Pisum fulvum* (Near Threatened).

At the national level, 65 species were categorized as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Near Threatened (NT). These include numerous orchid species listed under CITES, such as *Anacamptis pyramidalis, Orchis galilaea, Anacamptis papilionacea,* and *Limodorum abortivum* (Figure 2).


**Figure 2.** Some nationally threatened orchid species from Dibeen Forest Reserve: (A) *Anacamptis pyramidalis,* (B) *Orchis galilaea*, (C)*Anacamptis papilionacea*, and (D) *Limodorum abortivum*), all listed under CITES

Several species were notably frequent among the Critically Endangered group, such as *Anthemis brachycarpa, Silene italica, Avena eriantha,* and *Salvia indica*, indicating local rarity and high conservation priority. Vulnerable taxa included ecologically and structurally significant species such as *Pinus halepensis, Quercus coccifera, Olea europaea,* and *Arbutus andrachne.*

This highlights Dibeen Forest Reserve not only as a biodiversity hotspot but also as a critical refuge for many threatened and endemic species within Jordan, reinforcing the importance of site-specific monitoring and conservation planning. A full list of conservation concern species is presented in (Table 2).

**Table 2.** List of threatened and endemic plant species recorded in Dibeen Forest Reserve, including their national and global conservation status.

| Scientific Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|
| *Allium albotunicatum* | Not Evaluated | Endangered |
| *Alopecurus arundinaceus* | Endangered | Least Concern |
| *Alopecurus myosuroides* | Endangered | Least Concern |
| *Anacamptis collina* | Endangered | Least Concern |
| *Anacamptis papilionacea* | Endangered | Least Concern |
| *Anacamptis pyramidalis* | Critically Endangered | Least Concern |
| *Anthemis brachycarpa* | Critically Endangered | Not Evaluated |
| *Anthemis maris-mortui* | Endangered | Not Evaluated |
| *Anthemis nabataea* | Vulnerable | Not Evaluated |
| *Arbutus andrachne* | Vulnerable | Not Evaluated |
| *Arum dioscoridis* | Endangered | Not Evaluated |
| *Arum hygrophilum* | Endangered | Near Threatened |
| *Arum palaestinum* | Endangered | Least Concern |
| *Avena clauda* | Endangered | Least Concern |
| *Avena eriantha* | Critically Endangered | Least Concern |
| *Carduus nigrescens subsp. australis* | Endangered | Not Evaluated |
| *Cephalanthera longifolia* | Endangered | Least Concern |
| *Ceratocapnos turbinata* | Endangered | Not Evaluated |
| *Crucianella transjordanica* | Endangered | Least Concern |

| Scientific Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|
| *Cyclamen persicum* | Endangered | Not Evaluated |
| *Erodium subintegrifolium* | Endangered | Not Evaluated |
| *Euphorbia densa* | Vulnerable | Not Evaluated |
| *Euphorbia oxyodonta* | Endangered | Not Evaluated |
| *Euphorbia reuteriana* | Vulnerable | Not Evaluated |
| *Filago gallica* | Endangered | Not Evaluated |
| *Fumana arabica* | Vulnerable | Not Evaluated |
| *Gagea villosa* | Endangered | Not Evaluated |
| *Galium cassium* | Vulnerable | Not Evaluated |
| *Gastridium ventricosum* | Critically Endangered | Not Evaluated |
| *Heliotropium hirsutissimum* | Endangered | Not Evaluated |
| *Heptaptera anisoptera* | Vulnerable | Not Evaluated |
| *Iris atrofusca* | Endangered | Vulnerable |
| *Iris bismarckiana* | Critically Endangered | Endangered |
| *Lathyrus cicera* | Endangered | Least Concern |
| *Lathyrus gloeosperma* | Critically Endangered | Critically Endangered |
| *Limodorum abortivum* | Critically Endangered | Least Concern |
| *Limodorum abortivum* | Critically Endangered | Least Concern |
| *Lonicera etrusca* | Vulnerable | Not Evaluated |
| *Lotus conimbricensis* | Critically Endangered | Not Evaluated |
| *Malva multiflora* | Vulnerable | Not Evaluated |
| *Micropus supinus* | Endangered | Not Evaluated |
| *Minuartia globulosa* | Critically Endangered | Not Evaluated |
| *Myosotis ramosissima* | Endangered | Not Evaluated |
| *Myosotis uncata* | Endangered | Not Evaluated |
| *Neotinea tridentata* | Endangered | Least Concern |

| Scientific Name | National Conservation Status (Jordan Red List) | Global Conservation Status (IUCN Red List) |
|---|---|---|
| *Olea europaea* | Vulnerable | Data Deficient |
| *Ononis alopecuroides* | Critically Endangered | Not Evaluated |
| *Ononis variegata* | Endangered | Not Evaluated |
| *Onopordum jordanicola* | Endangered | Not Evaluated |
| *Ophrys sphegodes subsp. taurica* | Critically Endangered | Not Evaluated |
| *Orchis anatolica* | Endangered | Least Concern |
| *Orchis galilaea* | Endangered | Least Concern |
| *Pinus halepensis* | Vulnerable | Least Concern |
| *Pistacia atlantica* | Near Threatened | Near Threatened |
| *Pisum fulvum* | Least Concern | Near Threatened |
| *Quercus coccifera* | Vulnerable | Least Concern |
| *Quercus ithaburensis* | Vulnerable | Least Concern |
| *Raphanus raphanistrum* | Near Threatened | Not Evaluated |
| *Salvia indica* | Critically Endangered | Not Evaluated |
| *Sedum microcarpum* | Endangered | Not Evaluated |
| *Sedum pallidum* | Endangered | Not Evaluated |
| *Silene italica* | Critically Endangered | Not Evaluated |
| *Silene macrodonta* | Critically Endangered | Not Evaluated |
| *Styrax officinalis* | Vulnerable | Least Concern |
| *Trifolium erubescens* | Endangered | Not Evaluated |
| *Vicia lenticula* | Endangered | Not Evaluated |

## Vegetation Structure

– Tree Layer: *Pinus halepensis* was the most dominant tree species, exhibiting the highest Importance Value Index (IVI) of 1.82, followed by *Quercus coccifera* with an IVI of 1.75, indicating a strong co-dominance pattern between these two species across the sampled plots. Additional tree species recorded included *Arbutus andrachne, Pistacia palaestina,* and *Quercus ithaburensis*, though with lower frequencies and densities (Table 3).

*Pistacia atlantica* was not recorded in any of the 30 systematic plots; however, it was documented during the random route surveys. A total of 10 tree species were recorded, with varying dominance and frequencies across the 30 plots. *Arbutus andrachne* appeared in 30% of plots, while other species such as *Pistacia palaestina, Calicotome villosa, Rhamnus palaestina, Quercus ithaburensis, Quercus infectoria,* and *Pyrus syriaca* occurred in fewer than 10% of the plots.

**Table 3.** Total number of each Regeneration species in 30 plots, along with the relative parameters of each tree Regeneration in Dibeen forest reserve.

| Species name | Total number of individuals of each species | Abundance | Frequency % | Relative Frequency | Density | Relative Density | Relative dominance | Importance of Index value |
|---|---|---|---|---|---|---|---|---|
| *Pinus halepensis* | 392 | 17.8 | 73.3 | 0.449 | 13.07 | 0.726 | 0.733 | 1.91 |
| *Quercus coccifera* | 71 | 4.2 | 56.7 | 0.347 | 2.37 | 0.132 | 0.567 | 1.05 |
| *Rhamnus palaestina* | 3 | 1.0 | 10.0 | 0.061 | 0.10 | 0.006 | 0.100 | 0.17 |
| *Calicotome villosa* | 3 | 1.5 | 6.7 | 0.041 | 0.10 | 0.006 | 0.067 | 0.11 |
| *Crataegus azarolus* | 2 | 1.0 | 6.7 | 0.041 | 0.07 | 0.004 | 0.067 | 0.11 |
| *Arbutus andrachne* | 1 | 1.0 | 3.3 | 0.020 | 0.03 | 0.002 | 0.033 | 0.06 |
| *Pistacia palaestina* | 1 | 1.0 | 3.3 | 0.020 | 0.03 | 0.002 | 0.033 | 0.06 |
| *Quercus ithaburensis* | 1 | 1.0 | 3.3 | 0.020 | 0.03 | 0.002 | 0.033 | 0.06 |
| *Quercus infectoria* | 0 | 0.0 | 0.0 | 0.000 | 0.00 | 0.000 | 0.000 | 0.00 |
| *Pistacia atlantica* | 0 | 0.0 | 0.0 | 0.000 | 0.00 | 0.000 | 0.000 | 0.00 |

## Regeneration

A total of 392 *Pinus halepensis* seedlings were recorded across the 30 sampled plots (20 × 20 m each), that is equivalent to an estimated density of 653 seedlings per hectare. *Quercus coccifera* followed with 71 seedlings, corresponding to around 118 seedlings per hectare. Other species such as *Rhamnus palaestina, Calicotome villosa,* and *Arbutus andrachne* were represented by very few regenerating individuals, while species like *Pistacia atlantica* and *Quercus infectoria* showed no seedlings in the systematic plots (Table 4).

The seedling-to-mature-tree ratio for *P. halepensis* was approximately 7.1:1. For *Q. coccifera*, the ratio was approximately 1.07:1.

In terms of regeneration percentage, *P. halepensis* seedlings represented approximately 87.7% of the total regeneration recorded, while *Q. coccifera* contributed around 15.9%. These results highlight the ecological dominance of *P. halepensis* in the regeneration layer of the forest, whereas other native tree species exhibited minimal or no recruitment within the systematic plots.

**Table 4.** Total number of each Regeneration species in 30 plots, along with the relative parameters of each tree Regeneration in Dibeen forest reserve.

| Species name | Total number of individuals of each species | Abundance | Frequency % | Relative Frequency | Density | Relative Density | Relative dominance | Importance of Index value |
|---|---|---|---|---|---|---|---|---|
| *Pinus halepensis* | 55 | 2.62 | 70 | 0.333 | 1.8 | 0.385 | 1.1 | 1.819 |
| *Quercus coccifera* | 66 | 2.54 | 86.67 | 0.413 | 2.2 | 0.471 | 0.9 | 1.750 |
| *Arbutus andrachne* | 9 | 1 | 30 | 0.143 | 0.3 | 0.064 | 0.3 | 0.507 |
| *Pistacia palaestina* | 3 | 1.5 | 6.67 | 0.032 | 0.1 | 0.021 | 0.1 | 0.120 |
| *Calicotome villosa* | 2 | 2 | 3.33 | 0.016 | 0.07 | 0.015 | 0.0 | 0.064 |
| *Rhamnus palaestina* | 2 | 2 | 3.33 | 0.016 | 0.07 | 0.015 | 0.0 | 0.064 |
| *Quercus ithaburensis* | 2 | 2 | 3.33 | 0.499 | 0.07 | 0.015 | 0.0 | 0.064 |
| *Quercus infectoria* | 1 | 1 | 3.33 | 0.016 | 0.03 | 0.006 | 0.0 | 0.056 |
| *Quercus infectoria* | 0 | 0.0 | 0.0 | 0.000 | 0.00 | 0.000 | 0.000 | 0.00 |
| *Pistacia atlantica* | 0 | 0.0 | 0.0 | 0.000 | 0.00 | 0.000 | 0.000 | 0.00 |

-Shrub Layer: The shrub layer was dominated by *Cistus creticus*, which exhibited the highest values in terms of frequency, density, and Importance Value Index (IVI = 1.91). *Cistus salviifolius* and *Sarcopoterium spinosum* were also recorded as prominent shrubs within the sampled plots, but with lower relative densities and frequencies (Table 5). These species together form the core structure of the shrub layer in Dibeen Forest Reserve.

**Table 5.** Total number of each species in 30 plots, along with the relative parameters of each shrub species in Dibeen forest reserve.

| Species name | Total number of individuals of each species | Abundance | Frequency % | Relative Frequency | Density | Relative Density | Relative dominance | Importance of Index value |
|---|---|---|---|---|---|---|---|---|
| *Cistus creticus* | 367 | 19.1 | 63.3 | 0.576 | 12.23 | 0.706 | 0.633 | 1.91 |
| *Cistus salviifolius* | 134 | 12.2 | 36.7 | 0.333 | 4.47 | 0.258 | 0.367 | 0.96 |
| *Sarcopoterium spinosum* | 18 | 9.0 | 6.7 | 0.061 | 0.60 | 0.035 | 0.067 | 0.16 |

-Herbaceous Layer: The herbaceous layer was dominated by species belonging to the Poaceae family, particularly *Aegilops peregrina, Brachypodium pinnatum, Bromus sterilis,* and *Hordeum murinum* subsp. *glaucum* (Table 6). *Aegilops peregrina* was the most abundant annual species, with a total of 2,312 individuals recorded across the line transects and an Importance Value Index (IVI) of 0.83. *Brachypodium pinnatum* and *Bromus sterilis* also showed high abundance and frequency values, indicating their wide distribution within the reserve. Notably, *Urospermum picroides* exhibited a high relative dominance despite its moderate abundance, reflecting its strong local competitiveness. These results highlight the ecological significance of annual grasses and forbs in the herbaceous layer of Dibeen Forest Reserve.

**Table 6.** Total number of each species in 30 line transects, along with the relative parameters (abundance, density, relative density, frequency, relative frequency, relative dominance, and the importance value index) of each annual or perennial species in Dibeen Forest Reserve.

| Plant name | Total number of individuals of each species | Abundance | Frequency % | Relative Frequency | Density | Relative Density | Relative dominance | Importance of Index value |
|---|---|---|---|---|---|---|---|---|
| *Aegilops peregrina* | 2312 | 136 | 56.67 | 0.023 | 77.07 | 0.241 | 0.567 | 0.830 |
| *Brachypodium pinnatum* | 1758 | 117.2 | 50 | 0.02 | 58.60 | 0.183 | 0.500 | 0.703 |
| *Hordeum murinum subsp. glaucum* | 598 | 199.33 | 10 | 0.004 | 19.93 | 0.062 | 0.100 | 0.166 |
| *Bromus sterilis* | 572 | 31.78 | 60 | 0.024 | 19.07 | 0.06 | 0.600 | 0.684 |
| *Catapodium pinnatum* | 420 | 420 | 3.33 | 0.001 | 14.00 | 0.044 | 0.033 | 0.078 |
| *Trifolium stellatum* | 327 | 23.36 | 46.67 | 0.019 | 10.90 | 0.034 | 0.467 | 0.520 |
| *Avena longiglumis* | 227 | 20.64 | 36.67 | 0.015 | 7.57 | 0.024 | 0.367 | 0.405 |
| *Lolium rigidum* | 226 | 25.11 | 30 | 0.012 | 7.53 | 0.024 | 0.300 | 0.336 |
| *Crithopsis delileana* | 219 | 43.8 | 16.67 | 0.007 | 7.30 | 0.023 | 0.167 | 0.196 |
| *Trifolium resupinatum* | 195 | 39 | 16.67 | 0.007 | 6.50 | 0.02 | 0.167 | 0.194 |
| *Bromus scoparius* | 175 | 35 | 16.67 | 0.007 | 5.83 | 0.018 | 0.167 | 0.192 |
| *Urospermum picroides* | 175 | 7 | 38.33 | 0.015 | 5.83 | 0.018 | 0.833 | 0.867 |
| *Lagoecia cuminoides* | 147 | 14.7 | 33.33 | 0.013 | 4.90 | 0.015 | 0.333 | 0.362 |

## Vegetation Types

Based on species composition, dominance, and spatial distribution, three primary vegetation types were delineated within Dibeen Forest Reserve (Figure 3):

**Aleppo Pine Forest**: Typical naturally pine forest forms the best representation of Aleppo Pine in Jordan, with the dominant tree of *Pinus halepensis* can reach 20 meters in height and grows in the reserve at altitudes ranges from 500m to 700m above sea level. As well as association with low trees are

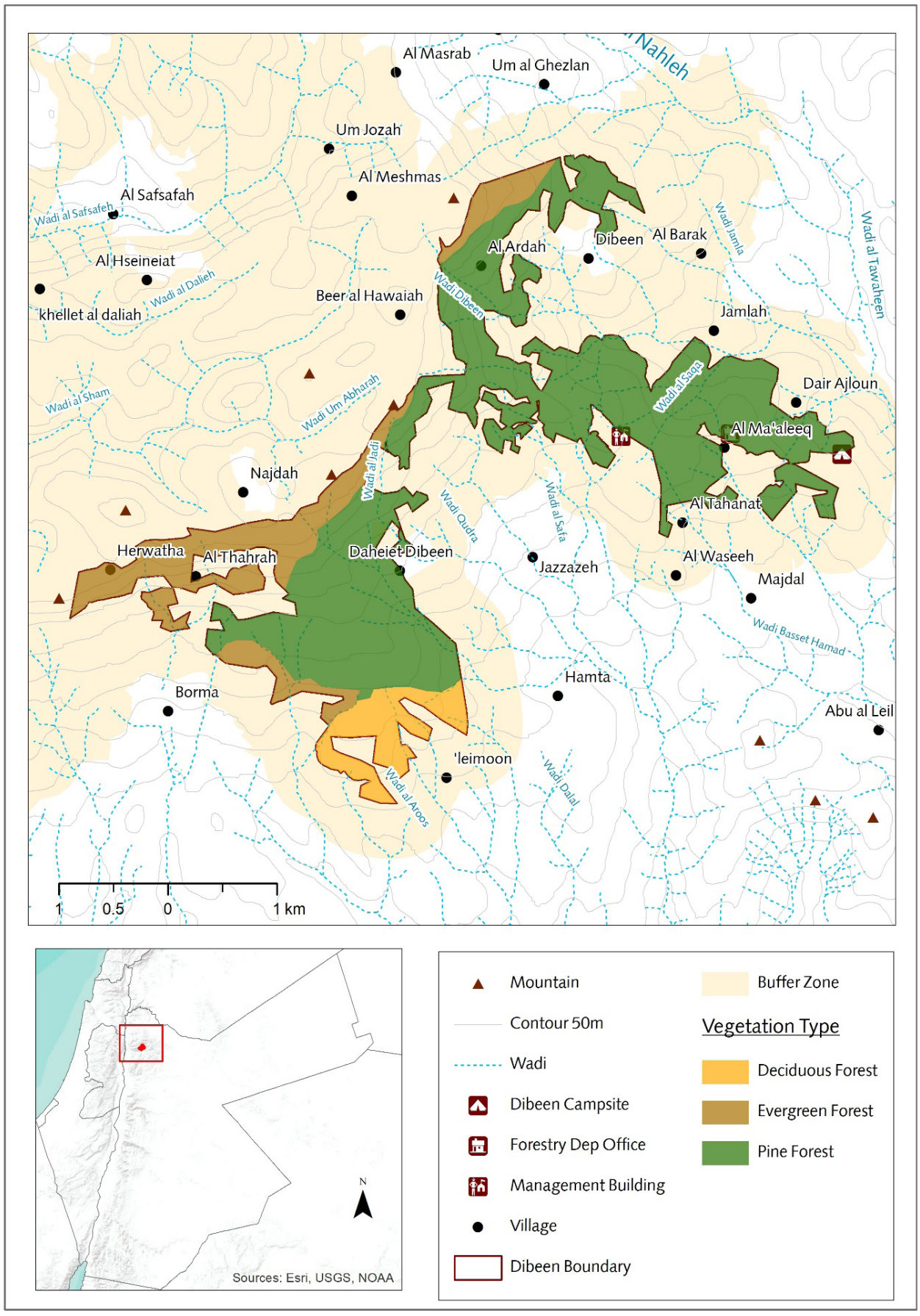


**Figure 3.** Vegetation Communities in Dibeen Forest Reserve.

*Quercus coccifera, Arbutus andrachne* and *Pistacia palaestina* and low shrubs are such as *Cistus creticus* and *Cistus salvifolius*. This vegetation covers the most area of the reserve in the east-west part, where calcareous soil is more dominant in this area.

**Evergreen Oak Forest:** This vegetation is mostly restricted to the western part of reserve at altitudes usually more than 700m, where red soil (Terra rosa) is more dominant in this area. The Major vegetation components are evergreen oak (*Quercus coccifera*) in association with *Quercus ithaburensis*, *Ceratonia siliqua* and *Crataegus aronea*.

**Deciduous Oak Forest:** This type of forest association is smallest area of the reserve, where occur at lower altitude than all other vegetation usually less than 500m and grow on brown soil of hard limestone parental rock. The dominance tree species is *Quercus ithaburensis* and associated with *Pistacia atlantica* and *Ceratonia siliqua*.

**Discussion**

The establishment of Dibeen Forest Reserve by the Royal Society for the Conservation of Nature (RSCN) represents effort to conserve the last remaining natural Aleppo pine (*Pinus halepensis*) forests in Jordan. The present study provides analysis of floristic composition, vegetation structure, and regeneration patterns, contributing insights into the current ecological condition of this unique Mediterranean ecosystem.

The results confirmed the ecological dominance of *P. halepensis* alongside *Quercus coccifera* in the arboreal layer, supported by their high Importance Value Index (IVI) values. This pattern is consistent with the findings of Triepke *et al.* (2012), who also reported the prevalence of these species in Dibeen. The ecological interaction between them is shaped in part by disturbance regimes, particularly fire. *Q. coccifera* exhibits strong vegetative regeneration and thick bark that confer fire resistance, whereas *P. halepensis* relies entirely on post-fire seed germination, triggered by the serotinous nature of its cones (Daskalakou and Thanos, 2004; Pascual *et al.,* 2002; Baker, 2020).

The regeneration survey documented a seedling density of approximately 653 seedlings/ha for *P. halepensis*, representing 87.7% of all seedlings recorded, and a seedling-to-mature-tree ratio of 7.1:1. Although lower than post-fire regeneration figures in the Mediterranean Basin (e.g., 12,400–60,000 seedlings/ha in Greece and Spain; Thanos *et al.,* 1996; Pausas *et al.,* 2004), the observed density indicates relatively healthy recruitment, especially in areas less affected by grazing pressure, where increased light availability, favorable soil alkalinity, and reduced human disturbance support regeneration. Compared to earlier assessments reporting sparse to moderate regeneration (Triepke *et al.,* 2012), these results suggest improvement, likely driven by increased light availability in canopy gaps, favorable soil alkalinity, and reduced human disturbance in select areas (Moya *et al.,* 2008; Al Omary, 2011).

The results also align with the findings of Alananbeh *et al.* (2023), who evaluated regeneration across four Jordanian forest reserves, including Dibeen. Their study recorded seedling densities ranging between 25 and 200 individuals per 1000 m² and identified *P. halepensis, Q. coccifera,* and *Arbutus andrachne* among the regenerating taxa. However, they reported regeneration declines near heavily disturbed areas, especially tourist trails. The current study, which recorded higher regeneration densities, reinforces the role of microhabitat variation and human impact gradients in shaping regeneration success. These observations underscore the importance of site-specific conservation interventions, particularly in high-pressure zones.

The findings of this study also expand upon the earlier assessment by Al-Shgair (2005), who reported *P. halepensis* as the dominant canopy species with *Q. coccifera* as co-dominant, supported by high importance

values. Al-Shgair further noted stable regeneration patterns and interpreted the forest as a climax *P. halepensis* community. While our results similarly confirm the dominance of *P. halepensis* and the co-dominance of *Q. coccifera*, they also indicate spatial variability in regeneration success, particularly under grazing and tourism pressures, which were not explicitly addressed in the 2005 study. This contrast underscores the dynamic nature of regeneration processes in Dibeen and highlights the importance of long-term monitoring to detect shifts in forest stability over time.

Despite the strong regeneration of *P. halepensis*, recruitment of other native tree species remains limited. *Q. coccifera* exhibited moderate regeneration, while *A. andrachne, Pistacia palaestina,* and *Quercus ithaburensis* showed low seedling numbers. Notably, *Pistacia atlantica*, although classified as Near Threatened, was absent from the systematic plots and recorded only during random route surveys. This pattern may reflect species-specific ecological traits rather than regeneration failure, as many Mediterranean broadleaved species are slow-growing, long-lived, and often rely on vegetative resprouting or require specialised microhabitats for successful recruitment (Pausas and Keeley, 2014). Their seedlings may therefore be underrepresented in short-term surveys. Additionally, the absence of *P. atlantica* in systematic plots, in systematic plots, despite its presence along random routes, may be attributed to sampling limitations. These findings highlight the need for long-term, species specific monitoring and habitat-based assessments to better understand the regeneration dynamics and conservation requirements of less dominant native tree species.

The shrub layer was dominated by *Cistus creticus*, which is characteristic of early post-disturbance succession in Mediterranean pine ecosystems. This species tends to dominate recently disturbed habitats but gradually declines as canopy cover increases (Tavşanoğlu and Gürkan, 2005; Spanos *et al.,* 2000). Its high IVI values and widespread presence in the reserve support the interpretation of recent disturbances or early successional phases in many plots. The presence of *Cistus salviifolius* and *Sarcopoterium spinosum* adds structural and compositional diversity, reflecting a typical Mediterranean shrubland assemblage.

The herbaceous layer was primarily composed of annual grasses and forbs, with species such as *Aegilops peregrina, Brachypodium pinnatum,* and *Bromus sterilis* dominating across the transects. These species contribute significantly to ground cover, prevent soil erosion, and provide forage resources (Aboulaich *et al*., 2009). The high IVI of *A. peregrina* indicates its adaptation to semi-open habitats and its competitiveness in early successional stages. Moreover, the documentation of nine orchid taxa, including *Ophrys sphegodes* subsp. *taurica* and *Orchis galilaea*, highlights the floristic significance of the reserve. These orchids are indicators of habitat quality and are commonly associated with calcareous soils beneath Aleppo pine canopies, where decomposing pine litter interacts with alkaline substrates to create favorable microhabitats (Al-Eisawi, 1996; Triepke *et al.,* 2012).

Vegetation mapping revealed three distinct forest types within the reserve: Aleppo pine, evergreen oak, and deciduous oak forests. These types are distributed along gradients of elevation, soil type, and moisture availability. Aleppo pine forests are widespread in mid-elevation zones on calcareous soils; evergreen oak forests dominate higher elevations on Terra Rosa soils, while the fragmented deciduous oak communities occur at lower elevations on hard limestone substrates.

In contrast to Triepke *et al.* (2012), who categorized some stands in Dibeen as mixed pine-oak forests, the current study classified these areas as Aleppo pine communities, based on the clear dominance of *P. halepensis*

which consistently exceeded 60% of the canopy composition. This classification follows the vegetation typology proposed by Al-Eisawi (1996), who described natural Aleppo pine forests as frequently containing evergreen oak components yet maintaining pine as the dominant canopy species. This refinement in classification provides a more consistent interpretation of the forest structure and emphasizes the importance of dominance thresholds in defining vegetation types. The diversity of vegetation types reflects Dibeen's role in preserving multiple successional stages and edaphic niches, consistent with earlier classifications of Jordan's Mediterranean forests (Amer *et al.,* 2004).

In summary, the results of this study reaffirm the ecological importance of Dibeen Forest Reserve as a critical refuge for Mediterranean flora in Jordan. The forest supports active regeneration of key tree species, harbors numerous threatened and endemic taxa, and sustains diverse vegetation types. Nevertheless, the observed spatial variability in regeneration and species distribution indicates that ongoing management efforts should prioritize habitat-specific monitoring, restoration of poorly regenerating species, and stricter regulation of anthropogenic activities in ecologically sensitive areas.

## Conclusion

Dibeen Forest Reserve plays a vital role in conserving one of Jordan's last natural stands of *Pinus halepensis*, which remains ecologically dominant and demonstrates strong natural regeneration across the reserve. While species such as *Quercus coccifera* and *Cistus creticus* increase following disturbance events, particularly fire or canopy openings, they are eventually outcompeted by regenerating pines, indicating their role as early successional, disturbance-favoured species. The limited persistence of mature *C. creticus* in established stands further supports this dynamic. These findings highlight the need to integrate fire ecology into management practices to maintain pine dominance, regulate shrub encroachment, and support natural succession. Ongoing monitoring and targeted interventions in areas with weak regeneration will be critical for sustaining the ecological integrity and biodiversity of the Dibeen Forest ecosystem.

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