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The Goods and Services Offered by Native Plants from Wadi Degla Protected Area, Northeastern Desert, Egypt, A Conservation Perspective

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ABSTRACT

Wadi Degla Protected Area (WDPA) winds through the Eastern Desert's limestone rocks, some of which rise to a height of 50 meters. The goods and services provided by Wadi Degla's natural ecosystem are the main subject of this study. In Wadi Degla, field visits were made to 185 locations. Plant and seed specimens were gathered from every site. The goods, services, and threats of the recorded species were evaluated using data from field observations and interviews with locals and herbalists. A total of 150 species were identified, along with their functions in products and services. The identified threats that cover the gradual change in the study area were recorded. Identified species offered many goods such as medicinal (111species), grazing (89) and human food (42). Also, they provide environmental benefits such as sand accumulation and windbreaks which were the most common, followed by segetal weed (27 species) and esthetic concerns (24). During the field work, we recorded pressures and threats facing the natural vegetation along WDPA. Solid wastes were the most common threat (100 %), then habitat loss (98.2%), Over-collecting and over-cutting (87.6%) Urbanization and tourism (81.4%), Climatic changes and environmental conditions (80.2%), Mining and quarrying (51.6%), Disturbance by cars or trampling (49.7%), Browsing and overgrazing (31.1%) and Clearance for agriculture (13.1%). The authors suggested that Wadi Degla's natural flora be continuously monitored and conserved because the area is losing plant habitat and may see the extinction of these species, which provide various of benefits to the environment and humanity.

Keywords: Ecological goods and services, Wadi Degla Protected Area, Conservation recommendation.

1. Introduction

Egypt has been using therapeutic plants since the Pharaonic era. This was an essential component of the medicine practiced at the time. Currently, 23% of Egyptians utilize medical plants as a solution; 52% live in urban regions, while 48% live in rural areas; this indicates that Egyptians still rely on medicinal plants for therapy (Abouzid and Mohamed, 2011).

Natural ecosystems offer numerous commodities and services necessary for human existence and well-being (Bidak et al., 2015). Numerous advantages that deserts offer can satisfy the needs of the local population as well as those of other nearby settlements. These advantages include raw materials, food, medicine, and water. Nevertheless, there is a lack of comprehensive information about the products and services offered by this biome. As a result, most of studies on ecosystem valuation have ignored deserts. (De Groot *et al*., 2012). Vegetation is

an integral component of arid habitats. How ecosystem services are delivered is determined by its structure and operation (Peters *et al*., 2006 and Havstad *et al*., 2007).

One of Egypt's most essential valleys, the Wadi Degla Protected Area, dates back to the Eocene Epoch and is situated in the Eastern Desert created sixty years ago. The length of the Wadi Degla protectorate is 30 km. It encompasses 60 square kilometers of land. It has fossils and limestone rocks. (Rashwan, 2019). The protected region is home to a wide variety of creatures, including insects, reptiles, and mammals, making it rich in flora and wildlife. There are about 64 distinct kinds of plants in the Wadi Degla Protectorate. It is also regarded as a valley by locals and migratory birds. Wadi Degla is located in Maadi and it is regarded as a haven from the busy pace of everyday life. The protectorate has pure air, and the temperature is lower than in Cairo. (Rashwan, 2019). In 1999, the Egyptian Environmental Affairs Agency classified the Wadi Degla area in the Cairo governorate as a protectorate. It was designated as a protected area for desert lands. This desert region is about 10 kilometers from Cairo and easily accessible. (EEAA, 2006 and Abdou *et al*., 2022).

One of the most significant valleys that runs from east to west and rises in the eastern desert's mountains is WDPA. The Wadi flows over a limestone landscape before cutting into a narrow, steep canyon. Floodwater can be observed in certain spots, sculpting the rocks into unique formations (El Khateeb, 2006 and Abdou *et al*., 2022). The petrified wood patches are sporadic and the rock formations are full of fossils. After the wet season, the Wadi is dominated by ephemeral plants. Birdwatchers, tourists, and those looking for peace and relaxation all enjoy the protectorate greatly. It is also a well-liked resort for individuals who want to escape the daily grind. (Dabes, 2006 and Abdou *et al*., 2022). The reserve is home to several creatures rich in fossils, fossilized wood, and various flora and animals that dwell in caves in the valleys. (Wagdy *et al*., 2008).

Wadi Degla's soil typically comprises rock wastes with various textures, including silt, gravel, and boulders. The Wadi bed's layers of fine materials alternate with layers of coarse gravel, as are frequently observed. The water that plants could use was significantly impacted by the shifting of layers with varying textures. (EL-Gamal *et al*., 2008). The current study set out to:

I. Identify the goods and services offered by desert ecosystems, with a focus on those made available by wadi native plants;
II. Illustrate the relationship between the ecosystems' products and services and the socioeconomic advantages for the surrounding communities and

III. Identify the primary stresses and threats to the ecosystems that could prevent the ecosystems from continuing to provide goods and services.

2. Material and methods

Study area

WDPA is situated in Egypt's northern Eastern Desert. It covers 30 km^2 and lies between latitude 29° 53' and 57' and longitude 31° 19' to 37' in the southeast to northwest direction. Wadi Degla empties its water into the Nile River on the west side, with an outlet at 31 16 12E, 29 56 32.6N (EL-Gamal *et al*., 2008 and Abdou *et al*., 2022). The Wadi is regarded as a component of Egypt's northern plateau and is recognized as a significant and unique geographical region. Wadi Degla begins as tiny tributaries formed by rainfall cascading down the hillsides encircling the Wadi. Wadi Degla is renowned for its breathtaking landscapes and abundant wildlife. The Wadi's overall environment, abundant in plant and animal life, is one of its most notable resources. Over sixty-four plant species make up the permanent plantation layer that protects the Wadi (EL-Gamal *et al*., 2008 and Abdou *et al*., 2022). The Wadi can be divided into: Upstream, Midstream and Downstream (Alhobishi *et al.,* 2023).

Data collection

Field trips were conducted to 185 locations in the WDPA to collect wild plants (Plate1) and took place between January and April of 2021. Plant and seed specimens were gathered from every site. Table 1 lists the websites utilized to find out more details about the recorded plants. The families were listed in alphabetically using the Angiosperm Phylogeny Group's (APG IV) approach (Group *et al.,* 2016). In order to identify plant specimens, the following sources were checked Zohary (1966 and 1972); Täckholm (1974); Feinbrun- Dothan (1978 and 1986); Boulos and El-Hadidi (1986); Turki (1993); Boulos (1999, 2005 and 2009); Ahmed (2009); Heneidy, (2010); Shaltout *et al.* (2010) and Bedair *et al*. (2020). The plant samples were pressed and kept as herbarium specimens. All the collected herbarium sheets were kept in the Herbaria of the Faculty of

Science at Menoufia University, the Faculty of Science at Tanta University, and the Faculty of Science at Ibb University (Yemen). The Raunkiaer (1937) approach was used to evaluate the life forms of the recorded species. The Good (1974) approach, which split the world into six kingdoms, three subkingdoms, and thirty-nine floristic regions, was used to evaluate the global distribution, or floristic regions.

Goods and Services

Things that grow naturally and are directly used for human benefit are considered goods, as are their parts and byproducts (Daily *et al*., 1997). Three criteria were used to evaluate the prospective and actual benefits of the documented species: field observations, data gathered from residents and herbalists, and a survey of the literature as stated by: Ayyad (1998); Batanouny (1999); Shaltout and Al-Sodany (2002); Heneidy and Bidak (2004); Ahmed (2009); Heneidy (2010); Shaltout *et al*., (2010); Bidak *et al*., (2015); Afefe (2020); Bedair *et al*., (2020); Shaltout and Badair (2022); Alhobishi *et al*., (2023) and Arief and Ahmed (2023). The goods fell into eleven main categories: fuel, timber, tanning, medicinal, grazing, human food, ornamental, aromatic source, utilized in handicrafts, detergent, and other purposes (such as catching, creating rope, and building materials).

Ecosystem services are the priceless, continuous advantages healthy ecosystems offer (Turner and Daily, 2008). The services provided by the documented species were assessed using field observations and by using the following references Täckholm (1974); Ayyad (1998); Heneidy and Bidak (2004); Seif El-Nasr and Bidak (2005); Ahmed (2009); Shaltout *et al*., (2010); Shaltout and Ahmed (2012); Bidak *et al*. (2015); Afefe (2020); Bedair *et al*., (2020); Shaltout and Bedair (2022); Alhobishi *et al*., (2023) and Arief and Ahmed (2023). There were twelve service-related aspects described: Segetal weeds, windbreaks, and sand accumulation aesthetic issues (tableau, dried flowers, vases, etc.), shady storage of water, rude weeds, refuges (plants that conceal themselves or act as shelters for other organisms), tolerant of salinity, retainers at banks, Additional services fertility of the soil, controllers of sand, toxic plants, Invaders of the water, controller of weeds, Parasites and water purifiers.

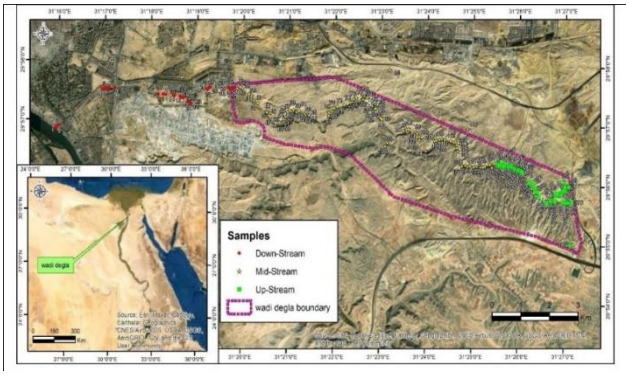

Plate 1. A map of the Wadi Degla Protected Area (Alhobishi et al., 2023).

Table 1. List of websites that were used to collect more information about the recorded plants

Database	Link
The Plant List	http://www.theplantlist.org
Global Plant Science	http://plants.jstore.org
International Plant Name Index (IPNI)	http://plants.jstore.org
Plant Use	http://www.ipni.org
IUCN	http://www.iucnredlist.org/details/

Threats

Threats are the primary and secondary causes of species extinction and environmental deterioration. Nine different categories of dangers were found during field trips in the current study and according to Seif El-Nasr and Bidak (2005); Ahmed (2009); Ahmed *et al*., (2014); Bedair *et al*., (2020); Hussein *et al*., (2021); Shaltout and Bedair (2022); Alhobishi *et al*., (2023) and Arief and Ahmed (2023): (1) solid wastes (SW), (2) habitat loss (HL) (industrial & urban growth and coastal development), (3) over-collecting and over-cutting(OC), (4) urbanization and tourism (UT), (5) climatic changes and environmental conditions (CE), (6) mining and quarrying (MQ), (7) disturbance by cars or trampling (DT), (8) browsing and overgrazing (BO), and (9) clearance for agriculture (CA).

Data Analysis

Microsoft Excel version 2010 (Internet software) was used to express the collected data as tables and graphs using basic descriptive statistics (Microsoft corporation, 2010) available from: https://www.microsoft.com/en-eg/ .

3. Results

Floristic Composition and Geographical Distribution

The current study identified one hundred sixty-one plant taxa—161 species, 27 subspecies, and varieties—belonging to 128 genera and 43 families (Appendix 1, Table 2). The most represented genera were: *Fagonia* (7 taxa), *Zygophyllum* (4 taxa), *Rumex, Atriplex, Chenopodium, Suaeda* and *Solanum* (3 taxa each). Only one genus, two species, and one family (Ephedraceae) comprised the gymnosperm (Appendix 1). There were 38 represented dicot families compared to the 4 monocot families (Poaceae, Alliaceae, Cyperaceae, and Arecaceae), which were represented by 23 genera and 24 species. The families of Asteraceae (22 species) and Poaceae (21 species) were the most well-represented. Chenopodiaceae (20 species), Zygophyllaceae (11 species), while each of Caryophyllaceae and Fabaceae was represented by nine species and Cruciferae by eight species (Fig. 1). The vegetation consists mainly of therophytes (68 species = 42.3 % of the total species) followed by the chemaephytes (44 species = 27.4 %). There were 17 (10.5%) hemicryptophytes. Conversely, the least represented living forms were phanerophytes (12 species = 7.5%), nanophanerophytes (9 species = 5.6%), geophytes—helophytes (9 species = 5.6%), and parasites (2 species = 1.3%) (Fig. 2).

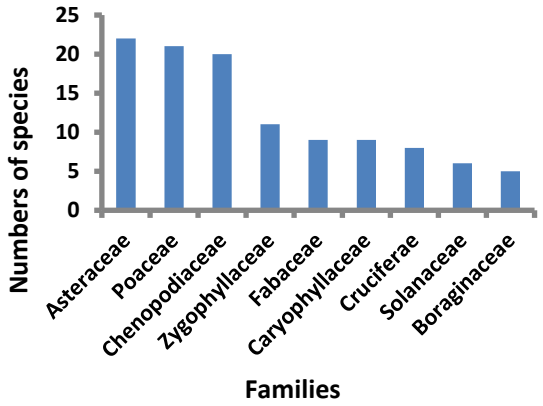

Figure 1. Species-rich families in the Wadi Degla protected area

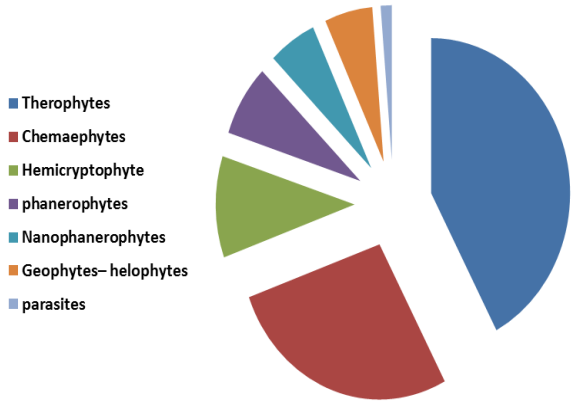

Figure 2. Life form spectrum of the recorded species in Wadi Degla.

The research area's floral analysis showed that 51 species, or approximately 31.7% of the total species, represented the Mediterranean element, whereas 70 species, or roughly 43.5% of the total species, represented the Saharo-Sindian element. Furthermore, 34 species (21.1%) of the total species were identified in the results as either cosmopolitan (15 species), pantropical (3), palaeotropical (10 species), neotropical (2), Australian (1), cultivated and naturalized (2), or near endemic (1). The remaining species were Irano–Turanian, Saharo – Arabian, Euro – Siberian and Sudano–Zambezian. Furthermore, the Irano–Turanian element comprised 41 species. On the other hand, the Saharo–Arabian element was represented by 15species. The Euro–Siberian comprises 15 species and the Sudano–Zambezian element comprised 16 species (Fig. 3).

Goods and services

One hundred and fifty species in Wadi Degla Protected (93.2 % of the total species) had at least one aspect of the potential or actual goods. The goods of the recorded species could be arranged as follows (Appendix 1): medicinal (111species =74 % of the total economic species) > Grazing (89 species =59.3 %) > Human food (42 species = 28%) > Other goods (36 species = 24%) > Fuel (29 species =19.3%) > Ornamenta (9 species =6 %)> Timber (8 species =5.3%)> Tanning, Detergent and used in making handicrafts (1 species = 0.6%) (Fig. 4).

Table 2. Diversity of the major taxonomic groups of the flora of the Wadi Degla Protected Area. Ac: Actua number and Re: Relative number (%).

Taxonomic Group	Family (F)		Genus (G)		Species (S)		Sub-species (Sub)		Sub/S	S/G	G/F
	Ac	Re	Ac	Re	Ac	Re	Ac	Re			
Gymnosprmae	**1**	**2.3**	**1**	**0.8**	**2**	**1.2**	**0**	**0**	**0**	**0**	**1.00**
Dicotyledoneae											
Archichlamydeae	27	62.8	65	50.8	91	56.5	18	66.7	0.19	1.4	2.41
Sympetalae	11	25.6	39	30.5	44	27.3	6	22.2	0.14	1.13	3.55
Monocotyledoneae	4	9.3	23	17.9	24	14.9	3	11.1	0.13	1.04	5.75
Total	43	100	128	100	161	100	27	100	0.17	1.26	2.98

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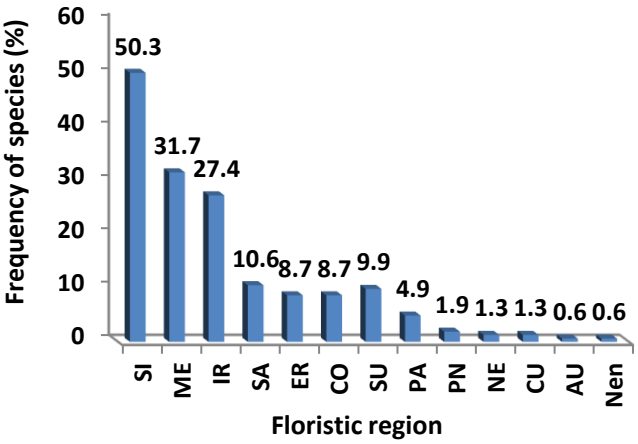

Figure 3. The frequency of the species found in the protected area of Wadi Degla in comparison to their floristic areas : SI; Saharo-Sindian ME: Mediterranean IR: Irano-Turanian, SA: Saharo - Arabian, ER: Euro-Siberian, CO: Cosmopolitan, SU: Sudano-Zambezian, PA: Palaeotropical, PN: Pantropical, NE: Neotropical, CU: Cultivated and Naturalized, Au: Australian and Nen: Near Endemic species.

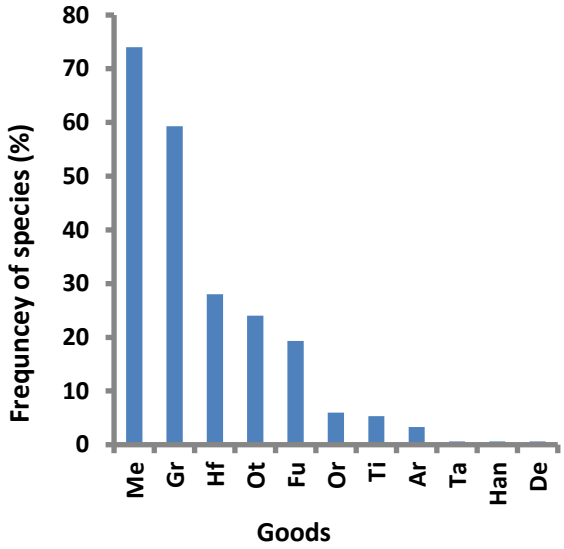

Figure 4. The Wadi Degla Protected Area's items are arranged in descending order by the documented species.. ME: medicinal, GR: grazing, HF: human food, OT: other goods, FU: fuel, Or: Ornamental, TI: timber, Ar: Aromatic source, Ta: Tanning, Han: used in making handicrafts, and De: Detergent.

In addition to their essential economic roles, they play ecologically vital roles (services) provided by the recorded species as flows also, in descending order: sand accumulation (74 species =56.1% of the total environmental servicing species)>Windbreaks (37 species = 28.1%) > Segetal weed (27 species =20.5%) > esthetic concerns (24 species = 18.2%) > Shaders (22 species =16.7%) > water storage (19 species = 14.4%) > Ruderal weed (19 species = 14.4 > refuge (14 species =

10.6%) > Salinity tolerant (12 species =9.1%) > bank retainers (9 species = 6.8%) > Others services (7 species =5.3%) > soil fertility (7 species =5.3%) > Sand controllers (6 species =4.6%) > Poisonous plants (6 species = 4.6%) >Water invaders (4 species =3.1%) > Weed controllers (3 species =2.3%) > Parasites (2 species =1.5%) (Appendix 1, Fig. 5).

In the present study, 12.7% of recorded species (19 species) were of medicinal importance, listed in Table 3, in addition to the recorded ways of use in folk medicine.

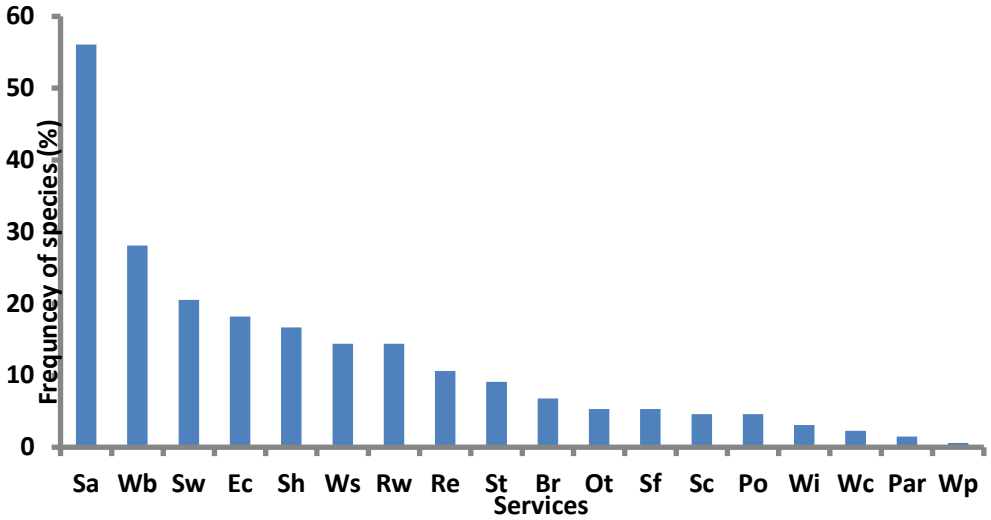

Figure 5: **The Wadi Degla Protected Area has a descending order of species frequency based on the services they provide.. Sa: Sand accumulation, Wb: Windbreaks, Sw: Segetal weeds, Ec: Esthetic concerns, Sh: Shaders, Ws: Water storage, Rw: Ruderal weeds, Re: Refuge, St: Salinity tolerant, Br: Bank retainers, Ot: Others services, Sf: Soil fertility, Sc: Sand controllers, Po: Poisonous plants Wi: Water invaders, Wc: Weed controllers, Par: Parasites and Wp: Water purifiers.**

Threats

During the field work, we recorded pressures and threats facing the natural vegetation along the Wadi Degla Protected Area. Most documented species were subject to at least one type of threats.. The stresses on the recorded species could be arranged in descending order: Solid wastes (161=100 % of the total threatened species) > Habitat loss (158=98.2 % of the total threatened species) > Over-collecting and over-cutting (141=87.6 % of the total threatened species) > Urbanization and tourism species) > Climatic changes and environmental conditions (129=80.2 % of the total threatened species) > Mining and quarrying (83=51.6 % of the total threatened species) > Disturbance by cars or trampling (80=49.7 % of the total threatened species) > Browsing and overgrazing (50=31.1% of the total threatened species) > Clearance for agriculture (21=13.1 % of the total threatened species) (Appendix 1, Fig. 6).

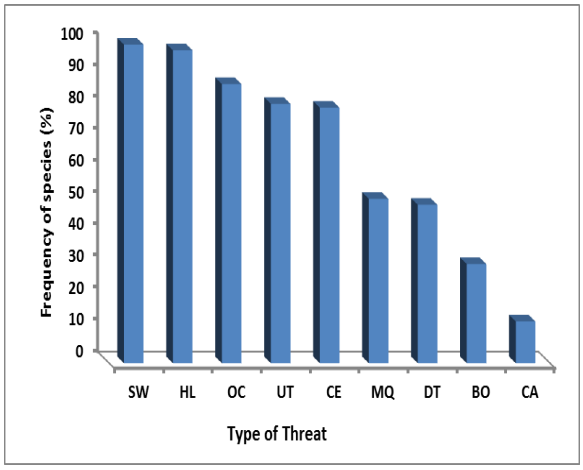

Figure 6. The species frequency is arranged descendingly with respect to the kinds of threats that have been identified for the species in the WDPA.SW: Solid wastes, HL: habitat loss, OC: Over-collecting and over-cutting, UT: Urbanization and tourism, CE: Climatic changes and environmental conditions, MQ: Mining and quarrying, DT: disturbance by cars or trampling, BO: browsing and overgrazing and CA: clearance for agriculture.

Table 3. Therapeutic uses, parts used and treatment method and supporting references for selected medicinal plants recorded in the Wadi Degla protected Area.

Species	Therapeutic uses	Part used and treatment method	Reference
Phoenix dactylifera	Possess expectorant, demulcent, laxative, diuretic, antitussive, and restorative properties. oozing, laxative agent. utilized to treat genitourinary illnesses and diarrhea.	Fruit pulp Sap gum	(Khare, 2007 and Arief and Ahmed, 2023)
Ricinus communis	Used as a musculoskeletal analgesic (toothache); inflammation. Ground seed oil is applied topically as an ointment, applied topically to relieve rheumatism, toothache, and discomfort in the cheeks. It can also be used topically to relieve stomachaches. Fresh leaves can be used to cure stomachaches and are heated and applied to sore knees and joints. Compress leaves are applied topically for sprains, discomfort, headaches, and inflammation. A youngster is wrapped in warm leaves to relieve a stomachache. To treat earaches, oil extracted from the fruits is applied topically.	Leaves, seeds, and fruit	(Aremu and Pendota, 2021 and Arief and Ahmed, 2023)
Sesbania sesban	Due to its capacity to astringent, or contract, bodily tissues, it has traditionally been used as a purgative, demulcent, maturant, anthelmintic, and for all aches and inflammation. utilized as an astringent, emmenagogue, and anti-inflammatory in addition to being used for menorrhagia, spleen enlargement, diarrhea, and anthelmintics.	The leaves and flowers	(Arief and Ahmed, 2023 and Goswami *et al*., 2016)
Tamarix nilotica	It has antibacterial, carminative, astringent, sudorific, ulcer, expectorant, aphrodisiac, and fever-busting properties. It also relieves headaches and reduces inflammation. The leaves and young branches are cooked for spleen edema and coupled with ginger for uterine infections; the bark is used as a lotion to prevent lice. It has also been used in traditional Egyptian medicine as an antiseptic.. This plant has been used since the Pharaonic era and is referenced in medical papyri for its ability to reduce fever, ease headaches, draw out inflammation, and stimulate sexual desire. stem bark applied topically on hemorrhoids The bark, when boiled in water with vinegar, is used as a lotion against lice. The leaves and young branches are cooked for spleen oedema and blended with ginger for uterine infections. Bark is given topically to eyes wounded by blows or scrapes, as well as hemorrhoids.	The leaves and young branches stem bark	(Elhardallou, 2011 andArief and Ahmed, 2023)
Withania somnifera	External use of leaf poultices is used to cure rheumatism. skeletal muscle (inflammation). in order to relieve inflammation. Infusions of leaves are used to treat digestive disorders.	Leaves and roots	(Aremu and Pendota, 2021 and Arief and Ahmed, 2023)
Imperata cylindrica	Diuretic, anti-inflammatory.		(Khare, 2007)
Panicum turgidum	Wound-healing, diabetic, feverish, antipyretic, cough, dysuria, kidney stones, and ocular infection.	powder of whole plants	(Heneidy *et al*., 2017 and Arief and Ahmed, 2023)
Phragmites australis.	Diuretic, respiratory problems, emetic, skin disorders & lesions, food poisoning, cholera, bronchitis, antidote, antiemetic, antipyretic,	leaves decoction of flowers stem	(Heneidy *et al*., 2017 and Arief and Ahmed, 2023)

Species	Therapeutic uses	Part used and treatment method	Reference
	refrigerant, anti-asthmatic, antitussive, depurative, febrifuge, lithotriptic, sedative, sialagogue, diarrhea, stomachaches, lung abscesses, urinary tract infections, foul sores, styptic.	root taken orally leave ashes	
Portulaca oleracea	Refrigerant (lowers body temperature), diuretic, antiscorbutic, and somewhat spasmodic. Used for scurvy, liver, spleen, kidney, and bladder problems; also used for dysuria, stomatitis, and dysentery. is applied on burns, scalds, erysipelas, and swellings. Diuretic and antidysenteric seeds can be externally applied to burns and scalds.	whole plant A paste of leaves	(Khare, 2007 and Arief and Ahmed, 2023)
Rumex dentatus	Used as astringent; used in cutaneous disorders.	Plant	(Khare, 2007 and Arief and Ahmed, 2023)
Urtica urens	Rheumatism, eczema and diuretic	Aerial parts and leaves	(Bidak *et al*., 2015 and Arief and Ahmed , 2023)
Chenopodium ambrosioides	Used for diuretic bladder	Leaf and root	(Ahmed, 2009 and Alhobishi *et al*., 2023)
Capparis spinosa	Used for coughs	Leaves and fruits	(Alhobishi *et al*., 2023)
Hyoscyamus muticus	Utilized to treat fever	Leaves	(Alhobishi *et al*., 2023)
Pluchea dioscoridis	Used to treat rheumatic pain and newborn illnesses	leaf	(Alhobishi *et al*., 2023)
Achillea santolina	Decreased rheumatic and toothaches,	Rubbing young flowering branches	(Alhobishi *et al*., 2023)
Anchusa hispida	Used as diuretic and in the treatment of rheum atism	Leaf	(Alhobishi *et al*., 2023)
Peganum harmala	Used to treat gastrointestinal issues and rheumatism	Leaves and flowers	(Alhobishi *et al*., 2023)
Deverra tortuosa	Has long been utilized in Egypt as a carminative, diuretic, and analgesic for intestinal parasite prevention and stomach discomfort relief. It was employed as an antiasthmatic as a defense against scorpion stings in Tunisia.	Aerial parts	(Slima *et al*., 2021)

4. Discussion

With a wide variety of impacted vegetation species, the transition from nearly unaltered natural areas to significantly altered sites is frequently gradual. Numerous aspects of natural habitat modification have been researched, such as energy flows, nutrient cycles, water and material budgets, urban climatic traits, soil properties, and species acclimated to man-made environments. (Shaltout and El-Sheikh, 2002 and Arief and Ahmed, 2023).

According to Taylor (2012), many plant communities are disturbed by human-induced disturbance brought on by tasks like clearing vegetation and building roads. This type of disturbance has detrimental effects like weed invasion, habitat fragmentation, and damage to and loss of vegetation. The number of species would decline, and the composition and community structure would shift with increased destruction intensity. Additionally, the degree of man-made disturbances affected the amount of disturbed organic matter (carbon and nitrogen). As such, it would be prudent to consider a comprehensive program (Shawky and Mohamed, 2022 and Arief and Ahmed, 2023). There is a significant diversity in the natural vegetation cover of the research area, with 150 plant species reported to be used for products and services. This study agrees with Alhobishi *et al*. (2023). In the present study, therophytes (68 species) were the most frequent life forms, followed by chamaephytes (44 species); this had been confirmed by Hassan (2002); Salama *et al.* (2013); Abd El-Ghani *et al*. (2014); Abd El-Aal *et al*. (2015) and Mashaly *et al*. (2016). Therophytes' superiority over other living species appeared to be a reaction to the hot, dry climate, topographical fluctuation, and biological influence (Heneidy and Bidak, 2001). Therophytes were most likely common during the favorable season due to field weeds' short life cycles, unfavorable weather, a lack of rainfall, and unstable ground (Ayyad, 1983).

Wadi Degla flora goods

Both domestic and wild animals (such as *Melilotus indicus, Trigonella stellata, Fagonia*

arabica, Malva parviflora, Deverra tortuosa, and Sarcocornia fruticosa) can graze and browse on eighty-nine taxa (55.3 % of all species). Various instances of the selective utilization of distinct plant parts during varying seasons were presented. Sheep seem to prefer the blooms of *Tamarix nilotica* over its little branches, presumably beneficial for camels and goats (Shaltout *et al*., 2010). A total of 29 taxa underwent fuel cutting (8.0%) in order to obtain *Lycium.Shawii and Sarcocornia fruticosa, Nitraria retusa and Tamarix nilotica* (Bedair *et al*., 2020). Hassan *et al*. (2015) and Al- Sodany *et al*. (2019) reported that *Calotropis procera* biomass produced biofuel and bioenergy. Only eight species (5.0%) of plants, including *Phoenix dactylifera, Tamarix aphylla, and Tamarix nilotica,* are suitable for timber across Egypt. (Shaltout and Ahmed, 2012). Locals consumed the fruits, flowers, vegetative parts, and ground parts of 42 taxa, or 26.1% of all species. For instance, dates from *Phoenix dactylifera* were consumed, while *Deverra tortuosa* was eaten as a salad. (Shaltout and Ahmed, 2012 and slima *et al*., 2021). Of the total number of species, thirty-six (22.3%) had many traditional uses, such as ornamental value, e.g. *Chrysanthemum coronarium*. Other uses included tanning, detergent, and handicraft production, e.g. *Phoenix dactylifera and Luffa aegyptiaca*. (Shaltout and Al-Sodany, 2002). *Deverra tortuosa* is an excellent natural herbicide combating yeast (Guetat et al., 2019). A tooth brush made of *Phoenix dactylifera* wood was utilized. (Shaltout and Ahmed, 2012). A recent investigation on *Pluchea dioscoridis* demonstrated the antifungal properties of the ethanolic leaf extrac (Metwally *et al*., 2020).

Wadi Degla flora services

The current study found that 132 species (82.0 % of all species) in Wadi Degla possessed at least one characteristic of an environmental service. Windbreaks and sand accumulation are managed by species such as *Panicum turgidum* and *Nitraria retusa*, which have been observed to cope with drift sand. Once established, wind break-producing sand controllers like *Ricinus communis* and *Tamarix* trees spread through seed or their creeping root system. In salt marsh environments, other plants like *Atriplex portulacoides* and *Zygophyllum album* are also beneficial in controlling sand (Ahmed, 2009). Due to the region's predominant sandy soils, sand accumulation significantly impacts Wadi Degla's flora (Zahran and Willis, 2009). *Retusa Nitraria, Ricinus communis, and Tamarix* trees are examples of sand accumulators. Because sandy soils predominate in this location, sand buildup has the most significant impact on the vegetation of Wadi Degla (Seif El-Nasr and Bidak, 2005). Sometimes, like *Ricinus communis* and *Tamarix* trees, they form effective windbreaks spread by seeds or creeping root systems (Shaltout and Ahmed, 2012).

Threats affect plants

In addition to the overuse of the previously listed ecological services without planning, gathering medicinal plants, the destruction of natural habitats by urban growth, and invasive agricultural practices are additional factors that could threaten natural habitats. These explanations are covered in more detail below.

Loss of habitat is one of the greatest threats facing many species of Egyptian flora, particularly in the Mediterranean region. In the research area, 158 species were vulnerable to this because of urbanization, tourism, clearing land for agriculture, and construction activities, this has caused significant habitat deterioration in addition to the total annihilation of the adjacent habitats. Thus, plants in these settings, such as *Lycium shwii*, are threatened (Shaltout and Ahmed, 2012). In the research area, 141 species were subjected to excessive harvesting and over-cutting. Most wild plant species were overharvested by locals, herbalists, and scientists who collected and cut excessively. There were no restrictions on gathering wild, native medicinal herbs for the commercial market. The most concerning part was that it typically targets localized and uncommon flora, further harming them. (Seif El-Nasr and Bidak, 2005); Heneidy (1991); Heneidy and El-Darier (1995); and Ahmed *et al*., (2020) recorded that The anthropogenic activities in the Omayed region, such as the removal and felling of natural vegetation, had a more detrimental effect on the vegetation than animal overgrazing. The populations of Lo Al Bedouin were increasingly needing fuel woods, focusing on larger woody perennials, particularly woody branches and roots. Eliminating large woody perennials decreases the structural complexity of an already highly exposed habitat, as they take many years to attain full sizes, this also speeds up soil movement and erosion, decreases the potential for water retention, and decreases the likelihood that smaller plants and annuals will germinate and become established. The natural landscape underwent a dramatic metamorphosis, with the removal of woody perennials marking the beginning of the process (Seif El-Nasr and Bidak, 2005).

Although still mainly theoretical in 2005, the climate to which 129 species were exposed in the research area is becoming more evident, and minimizing its effects on highly confined species is a significant issue. In the not too distant future, climate change seriously threaten several species' natural populations.

Conservation of the Wadi Degla

Human activity can directly impact vegetation cover in arid regions or indirectly affect other ecosystem components. Desert vegetation is deteriorating as a direct result of human activity's impact on plant cover. The widespread collection of medicinal plants and the removal of plants for the construction of roads and city development are two examples of these operations (Hassan, 2002).

5. Conclusion

The WDPA's natural flora supports a range of ecosystem services and ethnobotanical utilization, including food, fodder, and medicine. In addition to the natural ecosystem benefit, the region could potentially face extinction because of severe environmental or man-made stressors causing habitat loss. A better understanding of these factors promoting soil disturbance in areas of essential habitat susceptible to soil erosion is needed to guide the development of more environmentally friendly measures for developing countries and understand how ecosystems will respond to challenging global issues.

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