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Flora, Vegetation and Human Activities of Wadi Derna-El-Jabal

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Abstract

Wadi Derna one of the most important wadis (Valleys) in El-Jabal El-Akhadar. The Wadi is located within a Mediterranean climate. The analysis of soil samples showed that the soil is mainly composed of clay soil-sandy to clayey alluvial with low-salinity. The vegetation of the area is mainly confined between the two major dams in the study area, where most activities are concentrated. The total number of collected are167, species belonging to 147 general and 57 families. Two families belongs to Pteridophytes, Three families belongs to Gymnosperms and the remaining 52 families to Angiosperms. Monocotyledons are represented by 26 species, 22 genera and, 8 families and Dicotyledons by 135 species, 119 genera and 44 families. The Wadi is characterized by the presence of 6 endemic species belonging to 5 families, while number of medicinal plant species is 34. Life forms spectrum was: 41 % Therophytes, 35 % Chamaephytes, 12 % Phanerophytes, 6 % Hemicryptophytes and 6 % Cryptophytes showing the prevalence of aridity. 30 % of plant diversity is confined within the water fall area between an altitudes of 176-253m above sea level, while the remnant percentage of diversity was recorded at an altitude of 60-70m above sea level, which is estimated 10 %. The vital plant diversity of the area of wadi Derna overall, low and the plant species are threatened with extinction due to extensive anthropogenic pressure.

Keywords: Wadi Derna; El-Jabal El-Akhadar; Mediterranean; Flora; Endemic; Life forms

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First Published: 04 Dec 2017
doi: 10.28915/control.0006.1
Latest Published: 04 Dec 2017
doi: 10.28915/control.0006.1

Citation: Abu-Aziza EB, El-Barasi YM and Rahil RO. Flora, Vegetation and Human Activities of Wadi Derna-El-Jabal [Version 1; awaiting peer review]. ContROL 2017; 1:6 (doi: 10.28915/control.0006.1)

Introduction

El-Jabal El-Akhadar is an upland region which lies at south of the coastal belt in the north-eastern of Libya in Cyrenaica. It extends along the coast to about 300 km and rises to some 881 m above sea level, cut by several wadies and receiving some 250-600 mm of precipitation annually, with red soil or heavy clay *(Al-Zwam 1995).* A network of wadies that are considered a drainage system permeate El-Jabal El-Akhadar, most of these wadi start from the region of Sidi Al-Hamri, 880m above the sea level a key area for the division of water in the peninsula of Cyrenaica, and the origin of many of the wadis descending to the north. Wadi Derna is one the few wadies in El-Jabal El-Akhadar and Libya with perennial water course throughout the year *(Trih 1971).* Wadi Derna has been subjected to intensive anthropogenic pressure mainly in form of agriculture activities and grazing. Two dams in the wadi were built in order to control soil erosion, and to protect the city from flooding. In fact, the city was flooded several times during the years before the construction of the Dam. According to *El-Barasi and Saaed (2013),* the wild life in El-Jabal Al-Akhadar are gradually disappearing as a result of damaging and excessive resource exploitation. The consistency of the irresponsible and inattentive activities such as over grazing, ploughing urbanization, mining, forest fires, over collecting and charcoal production cause damage to several habitats,

and communities disturbance, as a result of that hundreds of species are threatened with disappearance where many are at the brink of extinction, accelerating Aeolian erosion and destroying the seed bank. Accordingly, the survey of the flora of this important zone not only enhances our knowledge and general understanding in terms of their floras but also allow as to provide floristic checklists for specific area, which are important for conservation planning, and also to be used to address aspects such as the presence of threatened species.

The Study Area

The study area is located on the second terrace of El-Jabal El-Akhadar mountain lies of Wadi Derna in Derna region north-east Libya, where the wadi divides the city into two parts, between longitudes (33° 00' - 32° 30' N and 22° 30'-22° 45' E). The elevation of the wadi ranges between 40m up to 300m above sea level **Figure 1**. The climate of the study area is comparable to that of El-Jabal El-Akhadar with mean temperature of about 20 °C. The average rain-fall ranges between 200-300 mm *(El-Barasi and Saaed 2013)*. The rainy season is from October to March with January and December as the wettest months (rainy days are 35 - 50). The rain is of torrential characters, causing a surface run-off, originating alluvial and erosion phenomena. Every 3 or 5 years there are particularly heavy rains causing serious floods.

Materials and Methods

The study area was divided into six deferent stands in accordance with the elevations. The following experiments were conducted.

Soil Analysis

The samples were taken from five sites at depth of (0 - 5cm), put in plastic bags with lables and number then transferred to the Laboratory. The tests included soil texture, electric conductivity (EC), pH, organic matter and calcium carbonate were measured according to *Black CA et al. (1965).*

Flowering Plants Study

The collection of plants started since March 2010, and over the course of the year during the four seasons, so as to get full samples with flowers and fruits. All samples were pressed, dried, then fixed on herbarium sheets and identified using the flora of Libya *(Ali and Jafri 1977; Jafri and El-Gadi 1986; El-Gadi 1989)*. Specimens were deposited in the Cyrenica Herbarium, Botany Department, Faculty of Science, Benghazi University. The biological spectrum was determined according to *Raunkiaer (1934).*

Determining Samples Sites by GPS (Global Positioning System)

The stands of the samples have been recorded by the GPS.

Plant Diversity

Species richness (alpha diversity) was calculated for each vegetation group as the average number of species per stand. Species turnover (beta diversity) was calculated as ratio between the total number of species in certain vegetation group and its alpha diversity *(Al-Sodany et al. 2003).*

Results and Discussion

The results in **Table 1** demonstrate the soil characteristics in Wadi Derna, the soil texture is generally clay soil-sandy to clayey, it also shows that soil is characterized by low salinity, electric conductivity values ranged from 0.37 to 2.37 mS / cm, The pH ranged from 7.96 to 8.34 indicating that the soil is slight alkaline, which is consistent with *Ben-Mahmoud (1995).* Calcium carbonate ranged from 37 to 64 %.values of organic matter ranged from 0.67 to 4.82

The flora of the study area is composed of 167 species, belonging to 147 genera and 57 families as shown in **Table 2.** By a comparison between the previous studies of El-Jabal El-Akhadar like the study *Al-Johari (2002)* on Wadi Zaza which recorded 336 plant species belonging to 61 families, the study of *Asker (1998)* on Wadi Al-Asraa which recorded 244 plant species belonging to 57 families, and the study of *El-Hamadi (1999)* on Wadi Al-Agar which recorded 317 plant species belonging to 66 families. The limitation of the number species recorded in the present study can be attributed to the fact that the Wadi, is subjected to intense human activities when compared with other zones of studies such as agriculture

activities, pollution and overgrazing and other activities. However, the study may show some compatibility in terms of number of species with the study of *Nowras (2007)* on Wadi Estowa which recorded 167 plant species belonging to 57 families. Pteridophytes represented by two species belong to two genera and two families. Gymnosperms are represented by four species belong to four genera and three families. Angiosperms represented by 52 families, Monocotyledons represented by 26 species belong to 22 genera and 8 families, Dicotyledons represented by 135 species belong to 119 genera and 44 families as shown in **Table 3.** When comparing the order of the largest families of the Wadi with the largest families in Libya, where the family Asteraceae occupies the first position in Libya, as well in the study zone the, constituting 16.6 % in the zone of study, followed by Lamiaceae 8.6 % which is ranked seventh in the Libyan Flora, and Poaceae 8.6% ranking second in the Libyan Flora; while, the family Fabaceae 7.4 % occupies the third position, ranking third also in the Libyan Flora as shown in **Table 4.**

The life forms spectrum shows that Therophytes costituted 41 %, this resembles the biological spectrum of some Mediterranean territories and indicating the prevalence of drought in the *Wadi Al-Sodany et al (2003).*These results are in harmony with the previous studies on El-Jabal El-Akhadar regardless of the rates, where it forms 50 % in the Al-Bakur Heights, 57 % in the study of *El-Hamadi (1999)* 57 % in the study of *Al-Johari (2002)* and in the study of *Asker (1998)* it represents less rate, because of the fact that the Wadi does not rely entirely on rain water. The Chameophytes constitute the second highest rate with 35 %, due to the fact that the Wadi is too far from the factors of grazing especially at high elevation; while, Hemicryptophytes and Cryptophytes have constituted 6 %, and Phanerophytes12 % **Figure 2**.

The Wadi is characterized by the presence of six endemic species belonging to six genera and five families, **Table 5.** The previous studies on El-Jabal El-Akhadar areas showed that the number of endemic plants species constituted 8.4 % *(Nowras 2007; Abdul Khaliq 2007)* Whereas, the number of these species in the present study constituted 3.7 % while in El-Jabal El-Akhadar there are 43 endemic species *(El-Barasi and Saaed 2013).*

Table 6 34 medicinal plant species are recorded from the Wadi. Medicinal species are threatened with extinction, due to the intensive of collection; and thus, their existence is mostly confined to rugged places like; *Salvia fruticosa,* and *Rosmarinus officinalis,* and other species. This fits with the findings reached at by *Al-Johari (2002)* that states that many rare medicinal species are present in not accessible. Places. It also noted that species like *Phagnalon rupestre* and *Helichrysum stoechas*, are widely distributed.

Distribution of the Vegetation in Wadi Derna

First Stand: Elevation 40 - 60 m above sea level. The number of collected species in the stand was 26 species. This stand with two location (A, B) the former is located beneath water fall whereas latter is located after the small Dam.

Second Stand: Elevation 60 - 75 m above sea level. The number of collected species in the stand was 17 species.

Third Stand: Elevation 75 - 110 m above sea level. The number of collected species in the stand was 35 species.

Elevation 110 - 176m above sea level. The number of collected species in the stand was 77 species.

Fifth Stand: Elevation 175 - 253 m above sea level. The number of collected species in the stand was 83 species.

Sixth Stand: Elevation 253 - 300 m above sea level. The number of collected species in the stand was 50 species **(Figure 3).**

At an elevation ranging between (110-300 m) the effect of anthropogenic pressure was very low, the area from which 126 plant species were collected. *Sarcopoterium spinosun* was present in 5 stands with constancy 83%. While Artemisia herba-alba present in 4 stands constancy 66 %.

Plant Diversity in Wadi Derna

The results in **Table 7** showing the plant diversity in every stand.

Human Activities

Due to the availability of water in the Wadi the matter which led to intensification of human activities especially in the areas \located between the two big dams. Abu Mansur and Derna dams. In the study zone several earth dikes are implemented and 270 farms are active covering an area of 5 hectares practicing the cultivation of vegetable and fruits and species like, **Punica granatum*, **Vitis vinifera*, **Armeniaca vulgaris* etc. moreover, several earth dike sand many terraces and barriers of stone have been built in various places in order to prevent the erosion of soil and control water floods. Soil fertility, led to the intensification of agricultural activities at the expenses of natural vegetation and increasing the risk of the loss of many important species, which found refuge in the wadi, limiting the vegetation at high altitude in not accessible places and in spaces between farms. The vegetation of the old traditional grazing areas in many places in the wadi was removed and the land cropped. Pollution with solid waste on account of the activities of dwellers and the remains of construction projects in the wadi led to the propagation of several bioindicator species of pollution, like *Nicotiana glauca, Chenopodium murale and Sisymbrium irio*, this corresponds with *(El-Barasi and Saaed 2013; Boulos 2005)* whose stated that *Nicotiana glauca* started intermingling with natural vegetation in / and around solid waste in many areas of El-Jabal El-Akhadar and Marmarica zones. Plant species like *Eucalyptus gomphocephala* and *Nerium oleander* previously planted in the wadi during the Italian occupation of Libya to become included in the natural vegetation. *Artemisia herba-alba* which constituted 66 % of the vegetation (starting from the waterfall area) forming a grazing area in the wadi. *Oxalis pes-caprae* indicates also grazing activities. The poisonous species *Thapsia garganica* is remarkably noticed in the beginning of the area after the waterfall till the Big Dam area.

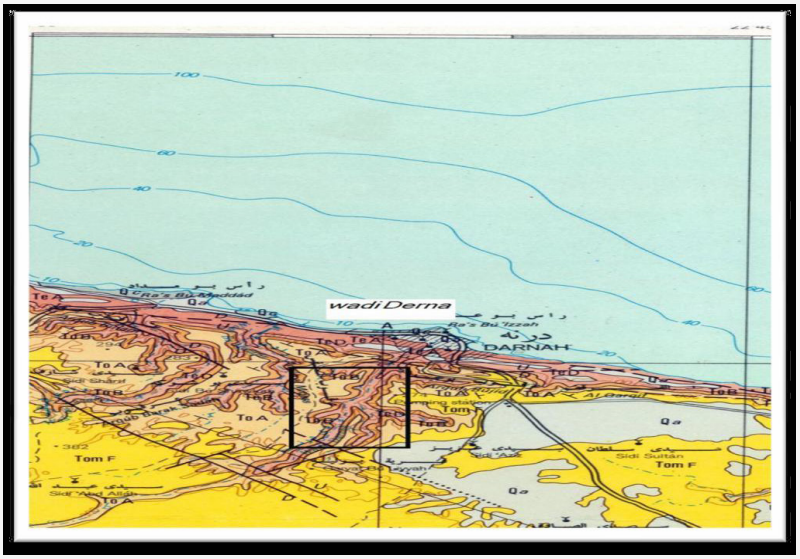

Figure 1: Map of the study area by *(Geological map of Libya, 1974).*

Site No.	Depth	Texture	EC (mS / cm)	pH	$CaCO_3$ (%)	O.M
1	(0 - 5cm)	Loam	2.73	7.96	57	0.67
2		Clay loam	0.37	8.12	37	2.10
3		Sand loam	1.44	8.28	64	4.82
4		Sand loam	0.72	8.11	57	3.82
5		Clay loam	0.43	8.34	53	2.01

Table 1: Values of soil samples analysis in every site in Wadi Derna.

S. No	Species	Family
1	*Adiantum capillus-veneris* L.	Adiantaceae
2	*Allium orientale* Boiss.	Alliaceae
3	*Pistacia lentiscus* L.	Anacardiaceae
4	*Nerium olender* L.	Apocynaceae
5	*Ammi majus* L.	Apiaceae
6	*Ammoides pusilla* (Brot.) Breistr.	Apiaceae
7	*Apium graveolens* L.	Apiaceae
8	*Bupleurum lancifolium* Hornem.	Apiaceae
9	*Erynigum campestre* L.	Apiaceae
10	*Ferula communis* L.	Apiaceae
11	*Ferula marmarica* Aschers.	Apiaceae
12	*Thapsia garganica* L.	Apiaceae
13	*Anthemis secudiramea* Biv.	Asteraceae
14	*Artemisia herba-alba* Asso.	Asteraceae
15	*Atractylis cancellata* L.	Asteraceae
16	*Bellis annua* L.	Asteraceae
17	*Cardus pycnocephalus* L.	Asteraceae
18	*Carthamus lanatus* L.	Asteraceae
19	*Centaurea alexandrina* Delile, Descr.	Asteraceae
20	*Chamomilla aurea* (loefl) Gay.	Asteraceae
21	*Crepis vesicaria* subsp. *vesicaria.*	Asteraceae
22	*Crepis senecioides* subsp. *senecioides*	Asteraceae
23	*Chrysanthemum coronarium* L.	Asteraceae
24	*Cynara cornigera* Lindley.	Asteraceae
25	*Cynara cyrenaica* Maire & Weiller.	Asteraceae
26	*Filago desertorum* Pomel.	Asteraceae
27	*Hedynpois certica* (L.) Dum.	Asteraceae
28	*Helichrysum stoechas* (L.) Cass	Asteraceae
29	*Hypochoeris achyrophorus* (L) Moench.	Asteraceae
30	*Leontodon tuberosus* L.	Asteraceae
31	*Notobasis syriaca* (L.) Cass.	Asteraceae
32	*Onopordum confusum* Pamp.	Asteraceae
33	*Pallenis spinosa* (L.) Cass.	Asteraceae
34	*Phagnalon rupestre* (L.) DC.	Asteraceae
35	*Reichardia picroides* (L.) Roth, Bot.	Asteraceae
36	**Scolymus hispanicus* L.	Asteraceae
37	*Rhagadiolus stellatus* (L.) Gaertner	Asteraceae
38	*Sonchus oleraceus* L.	Asteraceae
39	*Senecio leucanthemifolius* Poirt,Voy.	Asteraceae
40	*Tragopogon porrifolius* L.	Asteraceae
41	*Xanthium strumarium* subsp. *italicum*	Asteraceae
42	*Caralluma europaea* (Guss)N.E	Asclepiadaceae
43	*Phoenix dactylifera* L.	Arecaceae
44	*Arum cyrenaicum* Hruby.	Araceae
45	*Arum* sp.	Aracaceae
46	*Cynoglossum cheirifolium* L.	Boraginaceae
47	*Buglossoides tenuiflora* (L.F) I.M.	Boraginaceae
48	*Echium humile* Desf .	Boraginaceae
49	*Echium angustifolium* Mill.	Boraginaceae
50	*Gastrocotyle hispida* (Forsk.) Bunge	Boraginaceae
51	*Anchusa hybrida* Ten	Boraginaceae
52	*Didesmus aegyptius* (L.) Desv.	Brassicaceae
53	*Matthiola tricuspidata* subsp.*tricuspidata*	Brassicaceae
54	*Sisymbrium irio* L.	Brassicaceae
55	*Sinapis alba* L.	Brassicaceae
56	*Opuntia ficus-indica* (L.) Mill.	Cactaceae
57	*Capparis spinosa* subsp. *orientalis*	Capparaceae
58	*Spergularia bocconii* (Scheele) Asch.	Caryophyllaceae
59	*Minuartia geniculata* (Poiret)Thell.	Caryophyllaceae
60	*Ceratonia siliqua* L.	Caesalpiniaceae
61	*Atriplex halimus* L.	Chenopodiaceae
62	*Chenopodium ambrosioides* L.	Chenopodiaceae
63	*Chenopodium murale* L.	Chenopodiaceae

64	*Beta vulgaris* subsp. *macrocarpa* (Guss.) Thell.	Chenopodiaceae
65	*Suaeda palestina* Eig.	Chenopodiaceae
66	*Helianthemum ciliatum* (Des) Pers.	Cistaceae
67	*Convolvulus althaeoides* L.	Convolvulaceae
68	*Ipomoea hederacea* (L.) Jacq	Convolvulaceae
69	*Citrullus colocynthis* (L.)Schrader	Cucurbitaceae
70	*Scirpus holoshoenus* L.	Cyperaceae
71	*Cupressus sempervirens* Var. *horizontalis* (Mill) Gordon.	Cupressaceae
72	*Juniperus phoenicea* L.	Cupressaceae
73	*Scabiosa arenaria* Forssk.	Dipsacaceae
74	*Ephedra alata* L.	Ephedraceae
75	*Equisetum ramosissimum* (Desf) FI.	Equisetaceae
76	*Euphorbia characias* L.	Euphorbiaceae
77	*Euphorbia dendroides* L.	Euphorbiaceae
78	*Euphorbia falcata* L.	Euphorbiaceae
79	*Ricinus communis* L.	Euphorbiaceae
80	*Calicotome villosa* (poir.) Link	Fabaceae
81	*Lotus ornithopodioides* L.	Fabaceae
82	*Lotus corniculatus* L.	Fabaceae
83	*Lotus edulis* L.	Fabaceae
84	*Lotus cytisodes* L.	Fabaceae
85	*Medicago truncatula* Gaertn.	Fabaceae
86	*Onobrychis crista-galli* (L.) Lam.	Fabaceae
87	*Psoralea bituminosa* L.	Fabaceae
88	*Tetragonolobus purpureus* Moench.	Fabaceae
89	*Trifolium stellatum* L.	Fabaceae
90	*Vicia hybrida* L.	Fabaceae
91	*Fumaria judaica* Boss.	Fumariaceae
92	*Erodium malacoides* L.	Geraniaceae
93	*Erodium hirtum* (Forsk.) Will.	Geraniaceae
94	*Globularia arabica* Jaub & spach.	Globulariaceae
95	*Iris sisyrinchium* L.	Iridaceae
96	*Romulea cyrenaica* Beguinot	Iridaceae
97	*Herniaria hemistemon* J,Gay.	Illecebraceae
98	*Paronychia argeneta* Lam.	Illecebraceae
99	*Ajuga iva* (L.) Schreber .	Lamiaceae
100	*Ballota pseudo-dictamnus* (L.) Benth	Lamiaceae
101	*Mentha pulegium* L.	Lamiaceae
102	*Micromeria nervosa* (Desf) Benth .	Lamiaceae
103	*Marrubium vulgare* L.	Lamiaceae
104	*Nepeta scorodotis* L.	Lamiaceae
105	*Phlomis floccosa* D.	Lamiaceae
106	*Rosmarinus officinalis* L.	Lamiaceae
107	*Salvia fruticosa* Mill	Lamiaceae
108	*Stachys rosea* (Desf) Boiss .	Lamiaceae
109	*Stachys tournefortii* Poiret	Lamiaceae
110	*Thymus algeriensis* Boiss.	Lamiaceae
111	*Teucrium barbeyanum* Aschers.	Lamiaceae
112	*Teucrium apollinis* Maire et Weiller	Lamiaceae
113	*Linum strictum* var. *spicatum*	Linaceae
114	*Asphodelus ramosus* L.	Liliaceae
115	*Asparagus acutifolius* L.	Liliaceae
116	*Bellevalia sessiflora* (Viv.) Kunth, Enum	Liliaceae
117	*Urginea maritima* (L.) Baker .	Liliaceae
118	*Malva sylvestris* L.	Malvaceae
119	*Ficus carica* L.	Moraceae
120	*Eucalyptus gomphocephala* DC.	Myrtaceae
121	*Olea europaea* L.	Oleaceae
122	*Oxalis pes-caprae* L.	Oxalidaceae
123	*Papaver rhoeas* L.	Papaveraceae
124	*Papaver rhoeas* var. *strigosum* Boenin	Papaveraceae

125	*Papaver rhoeas* var. *rhoeas*	Papaveraceae
126	*Anagallis arvensis* L.	Primulaceae
127	*Anagallis arvenis* var. *latifolia*	Primulaceae
128	*Cycalmen rohlfsianum* Aschers.	Primulaceae
129	*Pinus halepnsis* Mill.	Pinaceae
130	*Plantago lanceolata* L.	Plantagoaceae
131	*Polygonum equisetiforme* Sibth & Sm.	Polygonaceae
132	*Aegilops peregrina* (Hack.) Maire et Weill.	Poaceae
133	*Avena barbata* Pott ex Link.	Poaceae
134	*Avena sterilis* L.	Poaceae
135	*Bromus madritensis* L.	Poaceae
136	*Briza maxima* L.	Poaceae
137	*Bromus rubens* L.	Poaceae
138	*Cynodon dactylon* (L.) Pers.	Poaceae
139	*Hordeum murinum* subsp. *glaucum*	Poaceae
140	*Lagurus ovatus* L.	Poaceae
141	*Lolium loliaceum* (Bory et Chaub.) Hand.	Poaceae
142	*Phalaris brachystachys* Link.	Poaceae
143	*Phragmites australis* (Cav.) Trin.	Poaceae
144	*Piptatherum miliaceum* (L.) Cosson.	Poaceae
145	*Stipa capensis* Thurb.	Poaceae
146	*Punica granatum* L.	Punicaceae
147	*Ranunculus asiaticus* L.	Ranunculaceae
148	*Ranunculus macrophyllus* Desf.	Ranunculaceae
149	*Rhamnus lycioides* L.	Rhamnaceae
150	*Ziziphus lotus* (L.) Lam.	Rhamnaceae
151	**Armeniaca vulgaris* Lam.	Rosaceae
152	*Rubus santus* Schreber.	Rosaceae
153	*Sarcopoterium spinosum* (L.) spach.	Rosaceae
154	*Haplophyllum tuberculatum* (Forsk.) Juss	Rutaceae
155	*Saxifrage tridactylites* L.	Saxifragaceae
156	*Misopates orontium* (L.) Raf.	Scrophulariaceae
157	*Scrophularia canina* L.	Scrophulariaceae
158	*Veronica polita* Fries, Nov	Scrophulariaceae
159	*Thesium humile* Vahl, Symb.	Santalaceae
160	*Lycium europaeum* L.	Solanaceae
161	*Nicotiana glauca* R.C.	Solanaceae
162	*Solanum nigrum* var. *nigrum*	Solanaceae
163	*Withania somnifera* (L.) Dunal.	Solanaceae
164	*Parietaria judaica* L.	Urticaceae
165	**Vitis vinifera* L.	Vitaceae
166	*Peganum harmala* L.	Zygophyllaceae
167	*Fagonia cretica* L.	Zygophyllaceae

Table 2: List of the plant species collected from Wadi Derna.

Classification groups		No. of species	No. of genera	No. of families
1. Pteridophytes		2	2	2
2. Gymnosperms		4	4	3
3. Angiosperms	Monocotyledons	26	22	8
	Dicotyledons	135	119	44
Total		167	147	57

Table 3: Plant groups in Wadi Derna.

No.	Families in flora of Libya	No. of species in flora of Libya	Families in The study area	No. of species in The study area
1	Asteraceae	240	Asteraceae	29
2	Poaceae	228	Poaceae	14
3	Fabaceae	200	Fabaceae	11
4	Brassicaceae	100	Brassicaceae	4
5	Apiaceae	75	Apiaceae	8
6	Caryophyllaceae	65	Caryophyllaceae	2
7	Lamiaceae	62	Lamiaceae	14
8	Chenopodiaceae	55	Chenopodiaceae	5
9	Boraginaceae	53	Boraginaceae	6
10	Liliaceae	42	Liliaceae	4

Table 4: The order of the families on the study area compared with flora of Libya.

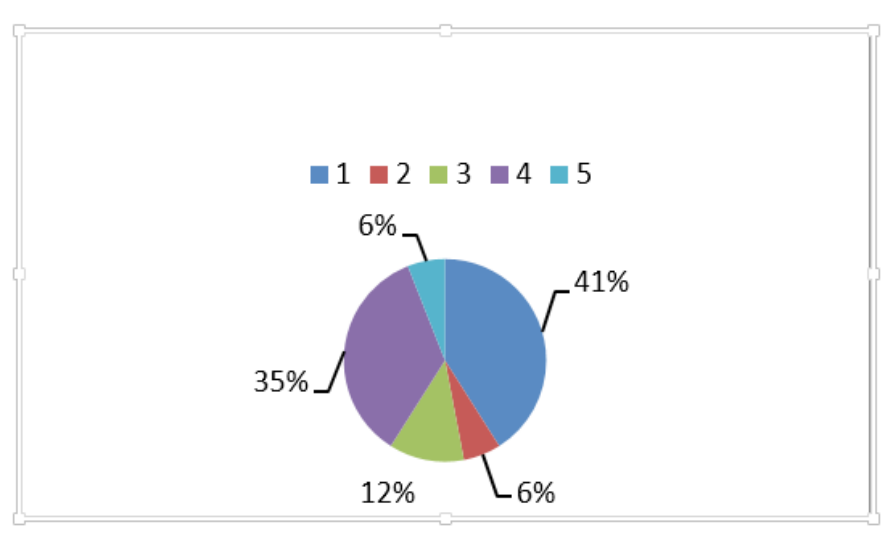

Figure 2: Life forms in Wadi Derna.

No.	Species	Family	Altitude (m)	Latitude and longitude
1	*Arum cyrenaicum* Hruby	Araceae	117	N°32 41’ 285” S°22 34’ 440”
2	*Cyclamen rohlfsianum* Aschers.	Primulaceae	191	N°32 42’ 451’ ‘ S°22 36’ 922’’
3	*Cynara cyrenaica* Maire & Weiller	Asteraceae	164	N°32 42’ 410” S°22 36’ 666”
4	*Stachys rosea* (Desf.) Bioss.	Lamiaceae	121	N°32 42’ 636” S°22 36’ 909”
5	*Teucrium barbeyanum* Aschers.	Lamiaceae	188	N°32 42’ 320” S °22 36’ 666”
6	*Romulea cyrenaica* Beguinot.	Iridaceae	102	N°32 42’ 408” S°22 36’ 541”
			212	N°32 42’ 123” S°22 36’ 756”

Table 5: Endemic Species with altitude recorded in Wadi Derna.

No.	Species	Family	Altitude (m)
1	*Ajuga iva* (L.) Schreber, Pl.	Lamiaceae	207
			257
2	*Apium graveolens* L.	Apiaceae	77
3	*Artemisia herba- alba Asso*	Asteraceae	86
			138
			202
			258
4	*Capparis spinosa subsp. orientalis*	Capparaceae	94
			178
5	*Ceratonia siliqua* L.	Caesalpiniaeae	98
6	*Chenopodium ambrosioides* L.	Chenopodiaceae	92
			204
7	*Chenopodium murale* L .	Chenopodiaceae	92
8	*Chrysanthemum coronarium* L .	Asteraceae	223
9	*Citrullus colocynthis* (L.) Schrader	Cucurbitaceae	260
10	*Cynodon dactylon* (L.) Pers.	Poaceae	255
			59
11	*Eucalyptus gomphocephala* DC.	Myrtaceae	42
12	*Ficus carica* L .	Moraceae	88
13	*Globularia arabica* Jaub & Spach.	Globulariaceae	194
14	*Haplophyllum tuberculatum* (Forsk.) Juss.	Rutaceae	247
15	*Helichrysum stoechas* (L.) Moench.	Asteraceae	168
16	*Ipomoea hederacea* Jacg.	Convolvulaceae	170
17	*Juniperus phoenicea* L.	Cupressaceae	142
			206
18	*Marrubium vulgare* L.	Lamiaceae	165
19	*Mentha pulegium* L.	Lamiaceae	113
			281
20	*Nerium oleander* L.	Apocynaceae	52
			90
			158
			210
21	*Nicotiana glauca* R.C.	Solanaceae	73
			51
			84
			160
			195
22	*Olea europaea* L.	Oleaceae	290
			239
23	*Papaver rhoeas* L.	Papaveraceae	147
			196
24	*Peganum harmala* L .	Zygophyllaceae	214
25	*Phagnalon rupestre* (L.) DC .	Asteraceae	102
			163
			240

26	*Phoenix dactylifera* L.	Arecaceae	104
27	*Pistacia lentiscus* L.	Anacardiaceae	238
28	*Polygonum equisetiforme* Sibth.	Polygonaceae	280
29	*Ricinus communis* L.	Euphorbiaceae	106
			185
30	*Rosmarinus officinalis* L.	Lamiaceae	115
31	*Scrophularia canina* L .	Scrophulariaceae	102
32	*Sonchus oleraceus* L.	Asteraceae	157
33	*Urginea maritima* (L.) Baker .	Liliaceae	201
			296
34	*Ziziphus lotus* (L.) Lam .	Rhamnaceae	123
			295

Table 6: Medicinal Plant species with altitude in Wadi Derna.

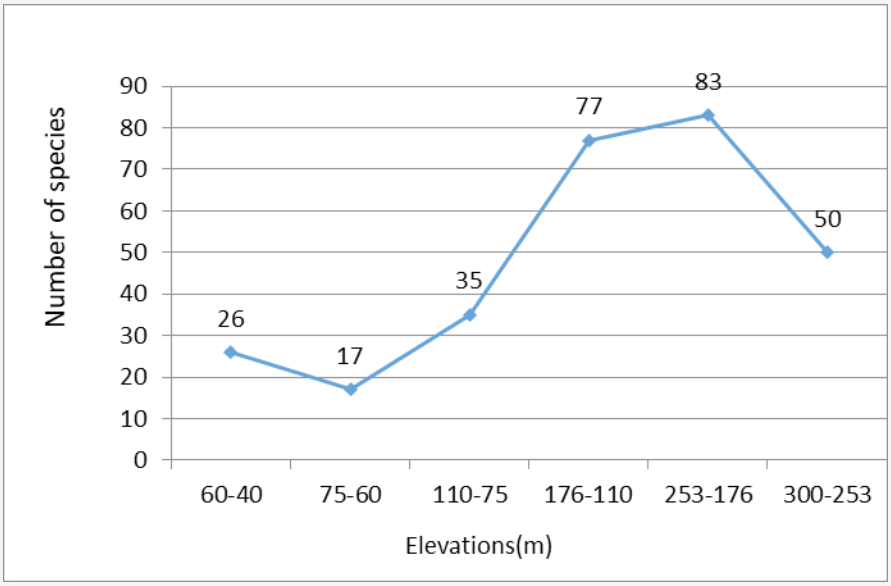

Figure 3: Distribution Plant species according to elevations in Wadi Derna.

Stand No.	Number of species	Alpha diversity	Beta diversity	Elevation (m)
1	26	17	17	40 - 60
2	17	10	10	60 - 75
3	35	21	21	75 - 110
4	77	47	47	110 - 176
5	83	51	51	175 - 253
6	50	30	30	253 - 300

Table 7: Plant diversity in every stand in Wadi Derna.

Conclusion

- The high percentage of Therophytes indicates the prevalence of drought and the high constancy of *Sarcopoterium spinosum* indicates drought and overgrazing.
- Anthropogenic pressure in this wadi are intensifying constituting serious threats to the vegetation of this important wadi, however diversity of plant species is low in this wadi especially at low levels.
- Endemic species constituted 3.7 % of species total number in the wadi are mainly located at high altitude, but are considered to be threatened species.

- High altitude places may play a role in protecting plant species and must be allocated as protected areas in the wadi especially when taking into account that the dominant palatable threatened species like *Artemisia herba alba* grows at these altitudes. Moreover *Artemisia* can be considered to be a keystone species as it plays a critical role in the biological communities in the Wadi, due to its status and because of the several anthropogenic pressure pressing in the form of over collection for ethnobotanical purposes and as a palatable species and because of the clearing of its areas of growth at low altitudes, in order to grow crops as barley and wheat.
- Once this species is removed the matter that will effect pollinators and seed dispersal and accelerates soil erosion which in turn, will alter many ecological functions by affecting many other members of the biological communities. Collection of medicinal plant species intensively threatens the biological diversity.
- Invasive species like *Nicotiana glauca* and *Nerium oleander* pose a challenge as a threat to the biodiversity in the different wadi areas, these invaders are found especially along the drainage lines, and disturbed areas around the several springs, this coincedes with *Steyn et al (2013).*
- *Sarcopoterium spinosum* may dominate the vegetation in the wadi in the coming future especially with increased rate of anthropogenic pressure in form pollution and drought due to climate change, especially when considering that this species is avoided by the grazing.
- According to *Shaltout et al. (2014) Sarcopoterium spinosum* density was high in the polluted and un-polluted area in El-Jabal El-Akhadar. According to *El-Barasi and Saaed (2013)* this species actually is considered to be a canopy species growing in dry pre-desert habitats south ward El-Jabal El-Akhadar where rainfall ranged between 25-200 mm/year.

With the wide spread trend towards the expansion of irrigated agriculture, by drilling wells, deforestation and applying chemicals in irrigated agriculture, pollution, habitat destruction in form of urbanization, tourism especially the area is of natural beauty, fire wood collection, charcoal production, medicinal plants collection in large quantities and fire due to human causes led to the removal of large areas of natural vegetation and the disappearance of many species that are not able to regenerate after fire.

Retrogressive succession is very clear with the disappearance of canopy species and the establishment of other shrubs an sub-shrubs.

If the above mentioned anthropogenic pressure continue at the same frequency, this will lead to more degradation an severe loss of the already poor plant diversity.

Therefore there must be a vision of an integrated an far-reaching plan to deal with environmental problems, including conservation of all natural resources in the wadi.

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