The North African Journal of Scientific Publishing (NAJSP)
مجلة شمال إفريقيا للنشر العلمي (NAJSP)
EISSN: 2959-4820
Volume 2, Issue 2, April – June 2024, Page No: 73-79
Website: https://najsp.com/index.php/home/index
SJIFactor 2023: 3.733 **0.63 :2023 (AIF) معامل التأثير العربي** **ISI 2023: 0.383**

Niches and different Ecological habitats in the area along the Al Marj-Al Baida motorway, Libya

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Received: March 01, 2024	Accepted: May 18, 2024	Published: May 24, 2024

Abstract:
The Al Marj-Al Baida motorway is a typical mountainous ecosystem area, in East Libya. The road has shortened the distance between al-Bayḍā and Al-Marj to about 100 km. The present study aims to investigate the population structure, in terms of size distribution, cover and density in their favourable habitats. 30 stands were sampled to analysis the vegetation of this area. 48 plant species were recorded (44 genera and 24 families). Phanerophytes constituted 31%, chamaephytes (25%) and therophytes (19%). Phytogeographical analysis of species in the study area, Mediterranean (ME) elements attained the highest species number among the monoregional elements. The properties of soil samples were determined for each stand. These habitats are dominated by the following species: *Arbutus pavarii, Cupressus sempervirens, Juniperus phoenicea, Olea europaea, Pistacia lentiscus, Pinu halepensis* and *Ceratonia siliqua.*

Keywords: Niches, Ecological habitats, Al Marj-Al Baida motorway, Libya.

Cite this article as: M. A. G. Abdalrhim, "Niches and different Ecological habitats in the area along the Al Marj-Al Baida motorway, Libya," *The North African Journal of Scientific Publishing (NAJSP),* vol. 2, no. 2, pp. 73–79, April – June, 2024.

المنافذ والموائل البيئية المختلفة في المنطقة الواقعة على طول الطريق السريع المرج-البيضاء، ليبيا

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الملخص
تعتبر طريق المرج - البيضاء السريع منطقة نظام بيئي جبلي نموذجي، شمال شرق ليبيا، وتبلغ مسافة الطريق حوالي 100 كم. وفي هذه الدراسة تم التعرف على التركيبة السكانية من حيث التوزيع الحجمي والغطاء والكثافة في بيئاتها المختلفة. تم تحديد الخصائص الفيزيائية والكيميائية لعينات التربة لكل موقف. تم تسجيل إجمالي 48 نوعًا تنتمي إلى 44 جنسًا و24 عائلة من منطقة الدراسة. شكلت النباتات الظاهرة 31% من إجمالي الأنواع، يليها النباتات المتقزمة (25%) والنباتات الحولية (19 %). والتحليل الزمني للأنواع في منطقة الدراسة حققت عناصر البحر الأبيض المتوسط (ME) أعلى عدد. ومن خلال العينات الغطاء النباتي والتربة في 30 مربع تمثل تباين في مناطق الدراسة. كانت السيادة التامة على هذه المجتمعات النباتية للأنواع التالية: الشماري *Arbutus pavarii* ، السرو Cupressus *sempervirens*، العرعر *Juniperus phoenicea* ، الزيتون *Olea europaea*، *البطوم Pistacia lentiscus*، الصنوبر *Pinu halepensis* و الخروب *Ceratonia siliqua*

Introduction

Al Marj-Al Baida Road is an asphalt road linking al-Bayḍā and Al-Marj in northeastern Libya. These limestone mountains rise steeply from the coast. The northern strip is characterized by a relative abundance of rainfall and soil fertility, which led to a diversity of plant communities and fluorescent composition.

Human activities over the centuries have greatly affected the biodiversity of this region. It is very important now to begin extensive environmental studies and conservation programs, including not only soil and biodiversity conservation but also beauty conservation and attention [1]. Soils are generally shallow and less developed with inadequate vegetative cover as a result of low annual precipitation accompanied with high temperature. All these factors lead to the instability of soil aggregates, and hence the soil erodibility hazards are more likely in comparison with soils in semiarid and humid regions [2].

Our study focuses on the Al Marj-Al Baida Road of El-Jabal El-Akahdar, this region could be made a highly attractive for tourism development and with its investment in agriculture and grazing the nearly coastal plain could produce fruits, vegetable and crops to supply the tourist market. Due to human driving forces, many terrestrial habitats are undergoing striking modifications, destruction and fragmentation at an increasing and historically unprecedented rate, drawing attention to ecosystems' resilience as a necessary condition for both biodiversity conservation and sustainable development.

The current study aims to identify the population structure, in terms of size distribution, cover and density in their favorable habitats.

Materials and Methods

The study area is considered one of the most important areas in Al- Jabal Al Khdar [3]. It is located between latitudes 33° and 31° N, and longitudes 20.30°–21.30° E Figure (1).

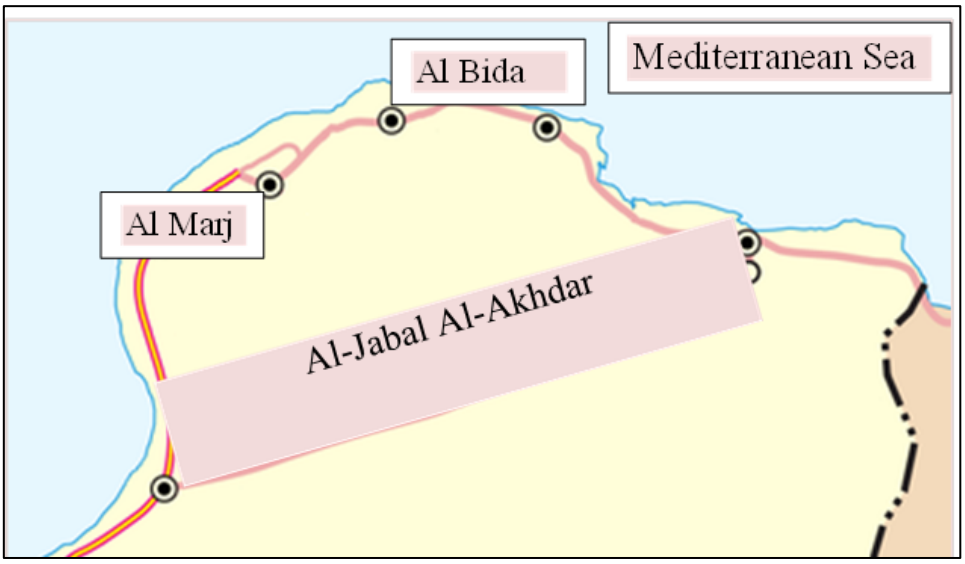

Figure (1): Location map.

The climatic data were obtained from some stations (Meteorological data of Al-marj station.) Table (1), the warmest month (with the highest average high temperature) is August (31.5°C). The month with the lowest average high temperature is January (16.8°C). The windiest months (with the highest average wind speed) are January and February (19.1km/h). The calmest month (with the lowest average wind speed) is October (15.9km/h). The months with the highest relative humidity are January and December (64%). The month with the lowest relative humidity is May (49%).

Table (1): Annual averages of high, low, mean temperature and average precipitation of study area during (2021-2022).

Climate data for Al Marj-Al Baida motorway												
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Temperature Max.°C	16.8	17.6	20.4	23.9	27.1	30	31.3	31.5	30	27	22.5	18.3
Temperature low. °C	11.8	11.7	13.1	15.5	18.8	21.8	23.4	24.1	23.2	20.9	17.1	13.6
Total rainfall mm/yr	37	24	11	5	3	1	0	1	5	15	11	30
Relative humidity %	64	62	56	51	49	50	57	60	58	57	59	64
Wind velocity km/hr	19.1	19.1	18.3	17.8	17.3	17.4	18.7	18.3	16.2	15.9	16	18
Source: (Meteorological data of Al-marj station)												

Data collection: thirty stands (25 m × 25 m) were selected on the Al Marj-Al Baida motorway in two different habitats (Clay depressions and Silt depressions). In each quadrate, the species list, the number of individuals and visual cover of each species were recorded [4,5,6,7,8]. Life forms of the recorded species were identified following the system of Raunkier [9]. Phytogeographical analysis of species [10]. Soil analysis was determined according to [11,12,13].

Results

Forty -eight species belonging to 44 genera and 24 families were recorded from different sample plots Table (2). The most highly represented families were Asteraceae and Lamicaceae.

Table (2): List of registered families with their species, life forms (LF) and chorotype (CH**).**

Family Name	Scientific Name	LF	CH
Alliaceae	*Allium ampeloprasum* L.	Ge	ME+IT
Anacardiaceae	*Pistacia lentiscus L.*	Ph	ME
Apiaceae	*Ammi majus* L.	Th	ME+IT+ES
	Conium maculatum L.	He	ME+IT+ES
	Thapsia garganica L.	He	ME
Araceae	*Arum cyreanicum* Hruby.	Ge	Endemic
Asparagaceae	*Asparagus aphyllus* L.	Ch	ME
	Drimia maritima (L.) Stearn.	Ge	ME
Asphodelaceae	*Asphodelus microcarpus* Salzm. & Viv.	Ge	ME
Asteraceae	*Anacyclus clavatus (Desf.) Pers.*	Th	ME
	Centaurea calcitrapa L.	Th	ME
	Centaurea cyrenaica Beg. & Vacc.	Ch	Endemic
	Conyza bonariensis (L.) Cronquist.	Ch	COSM
	Echinops spinosissimus Turra.	Ch	ME
	Helichrysum stoechas (L.) Moench. Meth.	He	ME
	Launaea mucronata (Forssk.) Muschl.	He	ME
	Launaea nudicaulis (L.) Hooker.f.	He	ME
	Onopordum cyrenaicum Maire & Weill.	Th	Endemic
	Pallenis spinosa (L.) Cass.	He	ME
Brassicaceae	*Sinapis pubescens* L.	Th	ME+SA
Caprifoliaceae	*Lonicera etrusca* Santi.	Ph	ME
Cistaceae	*Cistus parviflorus* Lam.	Ch	ME
	Cistus salvifolius L.	Ch	ME
Cupressaceae	*Cupressus sempervirens* L. var. *horizontalis* (Mill.) Gord.	Ph	Endemic
	Juniperus phoenicea L.	Ph	ME
Ephederaceae	*Ephedra altissima* Desf.var.*altissima* Pamp.	Ph	Endemic
Ericaceae	*Arbutus pavarii* Pamp.	Ph	Endemic

Euphorbiaceae	*Euphorbia dendroides* L.	Ph	ME
Fabaceae	*Ceratonia siliqua* L.	Ph	ME
	Lotus tetragonolobus L.	Th	ME
	Spartium junceum L.	Ph	ME
Lamiaceae	*Ballota andreuzziana* Pamp.	Ch	Endemic
	Micromeria nervosa (Desf.) Benth.	Ch	ME
	Phlomis crinita Cav.	Ch	ME + IT
	Phlomis floccosa D.Don.	Ch	ME + IT
	Rosmarinus officinalis L.	Ph	ME
	Salvia fruticosa Mill.	Ch	ME
	Teucrium polium L.	Ch	ME+IT
Oleaceae	*Olea europaea L.*	Ph	ME
Papaveraceae	*Papaver rhoeas* L.	Th	ME
Pinaceae	*Pinu halepensis* Miller.	Ph	ME
Poaceae	*Avena barbata* Pott ex Link.	Th	ME
	Stipa barbata Desf.	He	ME + IT+ES
Rhamnaceae	*Rhamnus lycioides* subsp. *oleoides* (L.) Jahand. & Maire.	Ph	ME
Rosaceae	*Rubus sanctus* Schreb.	Ph	ME+IT
	Sarcopoterium spinosum (L.) Spach.	Ph	ME+IT
Scrophulariaceae	*Verbascum sinuatum* L.	He	ME+IT
Urticaceae	*Urtica pilulifera* L.	Th	ME+ I T+ES

Phanerophytes constituted 31% of the total species, chamaephytes (25%) and therophytes (19%) Figure (2), the chronological analysis of species in the study area Figure (3) showed that mono-regional (ME) species representing 58% of the total.

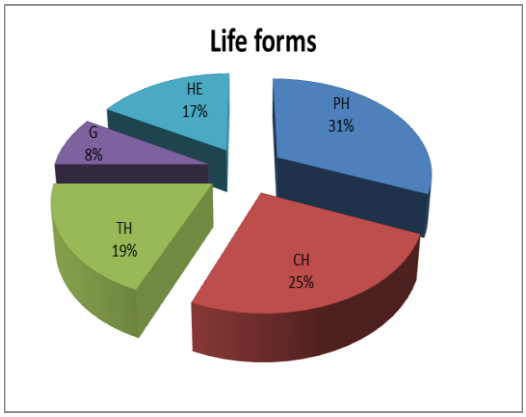

Figure (2): Life-form.

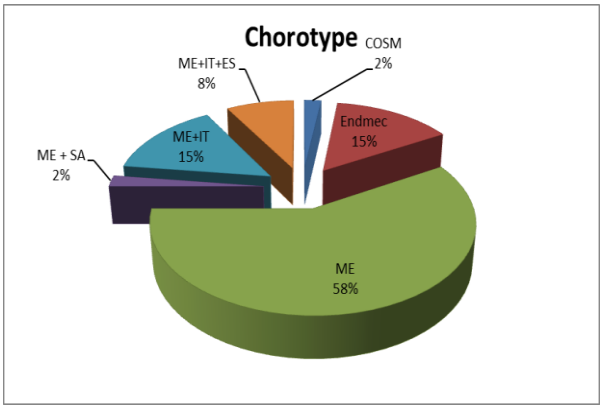

Figure (3): chorotype.

The natural vegetation of the area along the Al Marj-Al Baida motorway, Libya inhabiting two habitats, namely: Clay depressions and Silt depressions. These habitats are dominated by the following species Table (3):

1- Clay depressions are dominated by *Arbutus pavarii, Cupressus sempervirens, Juniperus phoenicea, Olea europaea, Pistacia lentiscus* and *Pinu halepensis.*

2- Silt depressions are dominated by *Ceratonia siliqua.*

Table (3): List of two habitats species with their frequency, cover and density.

Plant species	Relative frequency	Relative cover	Relative density
1- Clay depressions			
Allium ampeloprasum L.	1.2	1.9	1.43
Asphodelus microcarpus Salzm. & Viv.	1.2	0.74	1.1

Arbutus pavarii Pamp.	10.7	4	11.8
Cistus parviflorus Lam.	1.2	1.9	2.14
Cistus salvifolius L.	1.2	1.9	2.14
Cupressus sempervirens L. var. *horizontalis*](Mill.) Gord.	4.37	5.72	3.9
Drimia maritima (L.) Stearn	1.2	1.9	2.14
Ephedra altissima Desf.var.*altissima* Pamp	1.2	0.74	0.71
Juniperus phoenicea L.	10.7	6.2	16.42
Onopordum cyrenaicum Maire & Weill	1.2	1.9	0.71
Olea europaea L.	2.35	3.72	1.43
Pistacia lentiscus L.	5.4	3.72	8
Pallenis spinosa (L.) Cass.	1.2	1.9	1.43
Phlomis crinita Cav.	1.2	1.9	1.1
Phlomis floccosa D.Don.	1.2	1.9	1.1
Pinu halepensis Miller.	7.04	3.72	2.9
Rosmarinus officinalis L.	1.2	3.72	1.1
Sinapis pubescens L.	1.2	1.12	0
Sarcopoterium spinosum (L.) Spach	1.2	1.9	1.1
Salvia fruticosa Mill.	1.2	1.9	0.71
2- Silt depressions			
Ammi majus L.	1.2	0.74	1.1
Anacyclus clavatus (Desf.) Pers.	1.2	1.9	1.43
Avena barbata Pott ex Link.	1.2	1.9	0
Arum cyreanicum Hruby.	1.2	0.74	1.1
Asparagus aphyllus L.	1.2	1.9	0.71
Ballota andreuzziana Pamp.	1.2	1.9	1.1
Conium maculatum L.	1.2	1.9	1.1
Centaurea calcitrapa L.	1.35	1.24	1.9
Centaurea cyrenaica Beg. & Vacc.	1.2	1.9	0.71
Conyza bonariensis (L.) Cronquist.	1.2	1.9	1.43
Ceratonia siliqua L.	7.04	3	4
Euphorbia dendroides L.	1.2	1.9	2.5
Echinops spinosissimus Turra	1.2	1.9	2.9
Helichrysum stoechas (L.) Moench. Meth.	1.2	1.12	1.43
Launaea mucronata (Forssk.) Muschl.	1.2	1.9	0
Launaea nudicaulis (L.) Hooker.f.	1.2	1.9	0
Lotus tetragonolobus L.	1.2	1.9	0
Lonicera etrusca Santi.	1.2	1.9	0.71
Micromeria nervosa (Desf.) Benth.	1.2	1.9	0.71`
Papaver rhoeas L.	1.2	1.9	2.14
Rhamnus lycioides subsp. *oleoides* (L.) Jahand. & Maire.	1.2	1.9	1.43
Rubus sanctus Schreb.	1.2	1.9	1.43

Stipa barbata Desf.	1.2	1.9	1.43
Spartium junceum L.	1.2	1.9	1.43
Thapsia garganica L.	1.2	1.9	2.9
Teucrium polium L.	*1.2*	1.9	0.71
Verbascum sinuatum L.	*1.2*	1.9	0.71
Urtica pilulifera L.	*1.2*	1.9	1.43

Differences in the characteristics of soil samples collected from the studied sites of along the Al Marj-Al Baida motorway. In the study, Clay depressions are very low in $SO4^{--}$, and Mg^{++} (0.3and 0.14 m.eq./L. respectively). On the other hand, Soils at Silt depressions were characterized by the highest values of bicarbonate, sulphate and magnesium (1.8, 1 and 0.16 m.eq./L. respectively)Table (4).

Table (4): The soil characteristics in two habitats of along the Al Marj-Al Baida motorway.

Soil Characters	Clay depressions	Silt depressions
value PH	7.9	7.3
ds/m EC	0.4	0.2
Sand	18.7	24.5
Silt	34	44
Clay	45	30
$^{--}_{3}$CO	0	0
$^{-}_{3}$HCO	1.1	1.8
$^{--}_{4}$SO	0.3	1
$^{-}$Cl	1	0.7
$^{++}$Ca	0.2	0.2
$^{++}$Mg	0.14	0.16
$^{+}$Na	1.7	1.2
$^{+}$K	0.15	0.14

Discussion

A total of 48 plant species in 44 genera and 24 families have been recorded. In the current study, characterized by diverse habitats, including Clay depressions and Silt depressions, regarding the life forms in this study, Phanerophytes are the most frequent (31%), chamaephytes (25%) and therophytes (19%). this is similar to life forms in some areas of the Mediterranean [14]. The phanerophytes are mainly represented in the present study by hardy shrubs (1-6 m in height) where they dominate the vegetation [15,16,17]. Through the chronological analysis in the present study, Mediterranean (ME) elements attained the highest species number among the monoregional elements; the survival of Mediterranean species in the study area indicates a more mesic environment [18].

In the current study, human activities affecting the vegetation directly including cutting or uprooting of ligneous species for firewood, overgrazing, intensive collection of plants for various purposes and construction of roads. Affected the vegetation in the studied coasts such finding agreed with [19].

The distribution of plant species depended on the landform and climate *Arbutus pavarii, Cupressus sempervirens, Juniperus phoenicea, Olea europaea, Pistacia lentiscus* and *Pinu halepensis* are dominated the Clay depressions habitat of the Al Marj-Al Baida motorway. The variations in the diversity indices and species richness among the different habitat types may be attributed to the difference in soil characteristics. This is in accordance with the findings of [20].

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