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Plant species distribution and their relation to soil properties in Shada Mountain and wadi Sagamah at Al Baha area, Saudi Arabia

Mohammad. A. Al- Zubaidi[1], H. S. Al-Zahrani[1], Hameed Alsamadany[1]

Department of Biological Sciences, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia

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Abstract: Soil and flora in Shada Mountain and wadi Sagamah at Albaha area, Saudi Arabia that located in South Western of Saudi Arabia was investigated to study the relationships between soil properties and plant types. Results showed that two types soil units in study area, foothill, and coastal sand dunes and were found. Soil texture in foothills & coastal sand dunes was sandy & sand loamy it was loamy, Bulk density Silt and clay values ranged from 0 – 13.9 g/cm^3, whereas real density Fine sand varied between 1.18 - 33.1 g/cm^3. Total Coarse sand values ranging from 60.4 - 97.42 %. pH Values ware 7.3, 7.6 and 8.8 for three soil units mentioned respectively. These results indicating that soils were moderately to strongly alkaline. E.C values ranges from 0.52 to 5.2 Desm. /m. indicated that soils were normal to high sainality, organic carbon it was low in sand plains, O.M values ranges from 0.8 to 3.1 %. Sodium and potassium was very highly concentration near The Red Sea (0.5 ml/g), also k, Ca, B, Mg, Fe ware highly (0.12,0.12,0.0.1,0.02 and 0.0.7) respectively. *Aerva javanica*, *Cassia etalica*, and *Solanum incanum* in foothills and down the mountain and Wadi area. Soil types at the study area were determined to be sandy immature soil. Their horizon sequences were described as surface, subsurface and bottom layers, sand dunes were characterized by a relatively high calcium concentration in the soil horizons.

Key words: Soil texture, Shada Mountain and wadi Sagamah at Albaha area, Saudi Arabia, wild plants, salt effect, Organic matter

1. INTRODUCTION

Saudi Arabia is a part of the Arabian Peninsula covers and comprises several distinct physiographical regions, such as mountains, valleys (Wadis), sandy and rocky deserts, salt (Sabkhahs), lava a reas (Harrats) and ect[1]. it is a large dry desert with total area of about 2.25 million km2 covering the major part of the Arabian peninsula[2]. Saudi Arabia let 32' 34ºN–16' 83ºN, long 34' 36ºE–56'E, lies in the dry and semi dry part of the world. Significant variation in the climate can be attributed due to the large size of the country, its diverse landscapes and due to the Red Sea Coast on the Western side and the Arabian Gulf on the eastern side[3]. A hot weather generally characterizes the climate of Saudi Arabia in most year months due to northerly winds moving from the eastern Mediterranean towards the Arabian Gulf. Relative humidity is low except along the coastal zones where it reaches over 90%. The average annual temperature is 33.4 °C in summer and 14 °C in winter, a wide variation. For example, inland temperatures range from below zero at night to a maximum of 50 °C during summer.

In the northern part of Saudi Arabia, temperatures are very high in summer, the hottest month being July, while in south-east regions the hottest month is June and the coldest is January[4]. The vegetation of Saudi Arabia 2250 specie belongs to 132 families and 837 genera, about 105 species inhabit dunes, 90 are halophyte, 75 are trees and 12 are aquatic plants. It is also reported that no families or genera in flowering plants are endemic but that are some 246 species that are considered regionally endemic[1]. About 450 species of flowering plants in Saudi Arabia have direct benefits to man, 45 species are poisonous, 334 species are known to have medicinal value, 38 species are important palatable fodder plants,[5]. are important as fuel wood, 25 species are human food plants and 47 species are used as ornamentals or for other purposes. Although the kingdom of Saudi Arabia lies within a typical arid to semi-arid region, it is characterized by its unique biological diversity and species that could acclimatize to live under adverse ecological circumstances including weather and dry conditions[6]. About 450 species of flowering plants in Saudi Arabia have direct benefits to man, 45 species are poisonous, 334 species are known to have medicinal value, 38 species are important palatable fodder plants[5]. are important as fuel wood, 25 species are human food plants and 47 species are used as ornamentals or for other purposes . Although the kingdom of Saudi Arabia lies within a typical arid to semi-arid region, it is characterized by its unique biological diversity and species that could acclimatize to live under adverse ecological circumstances including weather and dry conditions[6].

Current study area includes two eco physiological and molecular studies on vegetation's of Shada Mountain and Wadi Sagamah at AL-Baha area of Saudi Arabia. Al-Baha region considered one of the highest diverse vegetation in Saudi Arabia. It has the highest mountains such as Shada al-a'la (2200 m a.s.l), which characterized by high diverse vegetation. Its flora represented about 12% of total plant species of kingdom where it has 230 plant species, these species in Al-Baha are a mixture of tropical African, Saudaninn plant geographical region and with very few of Sharo – Sendian, and Mediterranean regions[7]. Most of Al-Baha's flora belongs to sudanian region or Somalia-Masai region center of endemism[8]. The Sudanian element dominates the western mountains and parts of the high land plains, which are characterized by relatively high rainfall. The Mediterranean region element dominates the high mountain areas. The Saharo- Arabian element dominates the coastal plains, eastern mountain and the eastern and northern desert plains. Life-form composition is typical of desert flora; the majority of species are *therophytes* and *chamaephytes*. Wadi vegetation in general is not constant; it varies from year to year depending upon moisture levels.

Generally, growth, regeneration, and distribution of the plant communities in the wadis are controlled by many factors such as geographical position, physiographic features, and human impact[9]. The aim of this research is to study the distribution of plant species according to soil properties at Shada Mountain and

Wadi Sagamah **(Fig. 1)** is located in Al Baha area south western part of Saudi Arabia. It is situated between longitude 41/42E and latitude16/20N.

The specific aims of the present studies are identifying the patterns and sizes of dominant (first & second plants in the study area in terms of dimensions, size, structure and density) and discus the status of wild plants and soil in study area and suggests ways to preserve it and the possible of develop.

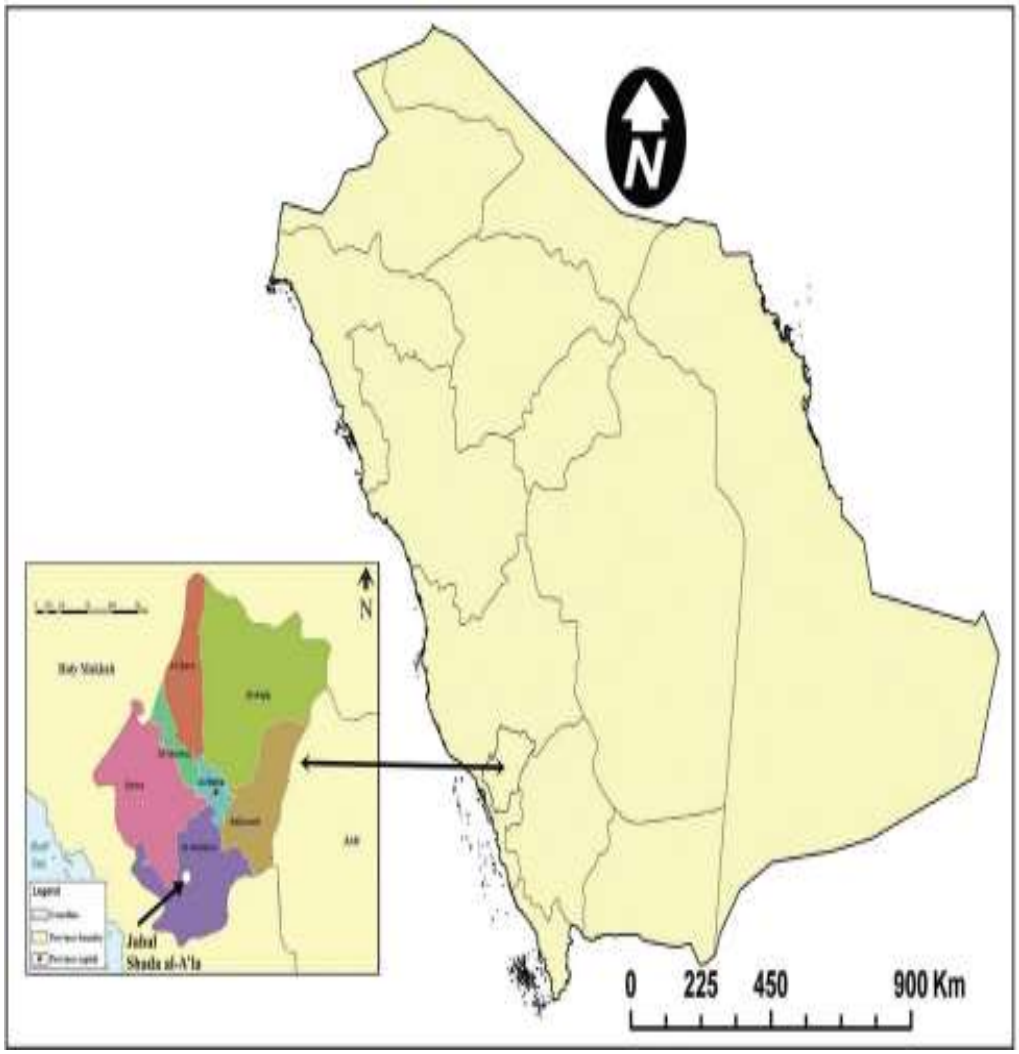

Figure 1: Map of Saudi Arabia showing Al-Baha Province and Jabal Shada al-A'la Nature Reserve.

2. MATERIALS AND METHODS

Plant samples and Measurments: 10 stands were selected to represent different soil units (1-4) in foothill (Shada mountain), and selected (5-10) sy in wadi Sagamah **(Fig 2).**The stand size (20 × 20) m. for each one, list of species, common species were recorded. The abundance and life form were calculated, Braun- Blanquet cover abundance scale as follows: Scale 5, 4, 3, 2, 1, + and r (rerlay) cover abundance,75%, 50-70%, 25-50%, 5-25%, 1-5%, few and solitary respectively[9,10].

Soil samples and analysis: In each stand 3 samples of soil were taken at 0-20 cm soil depth and mixed to gather making represented soil sample, then its where air dried and sieved by 2mm sieve. The following analyses: Soil color was identified using Munssel color (1990); Particle size distribution using seving method[10]. Chemical analyses which include O.M., ECe, bulk and real density, total porosity and

soluble cations[11]. Soil[12] reaction pH, were analyzed at the Department of Biological Sciences, Faculty of Science, King Abdulaziz University, Jeddah ,Saudi Arabia.

Figure2: Distribution of 10 stands along study area by using their coordinates (GPS)

Distribution and Growth Status of Plant Cover: Vegetation analysis for wild plants in Shada mountain and Wadi Sagamah shown that 29 plant species were found, classified to three plant communities according to dominant of plant types, the following is a brief description of these plant communities: Group I (foothill), Group II (Down the mountain), Group III (Wadi) This group include stands (1,2.3) dominated, Group II (Down the mountain)This group include stand (4), Group III (Wadi) This group include sites (5, 6, 7, 8, 9, 10). Acacia community: This plant community was found in all stands covering 100% from study area in Shada mountain and Wadi Sagamah as dominated wild plant, flowed by *Citrullus colocynthis* covering 80% , 70% *Ziziphus spina-christi*, 60% *Pergalaria tomentosa & Aderium obessum& Conzya incana& Heliotropium europaeum& Corallocarpus schimperi& Ricinus communis& Setaria pumila* and *Aristida adsconsionis*, 50% *Aristo lochia bracteolate& Pulicaria Arabic& Tagetes minuta& Morettia canscons* and *Cenchrus ciliaris*. *Aerva javanica* community: This plant community was found in most stands covering 90% from study area in Shada mountain and Wadi Sagamah as dominated wild plant, flowed by Citrullus colocynthis covering 80% , 70% *Ziziphus spina-christi*, 60% *Pergalaria tomentosa & Aderium obessum& Conzya incana& Heliotropium europaeum& Corallocarpus schimperi& Ricinus communis& Setaria pumila* and *Aristida adsconsionis*, 50% *Aristo lochia bracteolate& Pulicaria Arabic& Tagetes minuta& Morettia canscons* and *Cenchrus ciliaris* .*Solanum incanum* community: This plant community was found in most stands covering 90% from study area in Shada mountain and Wadi Sagamah as dominated wild plant, flowed by Citrullus colocynthis covering 80% , 70% *Ziziphus spina-christi*, 60% *Pergalaria tomentosa* & *Aderium obessum& Conzya incana& Heliotropium europaeum& Corallocarpus schimperi& Ricinus communis& Setaria pumila* and *Aristida adsconsionis*, 50% *Aristo lochia bracteolate& Pulicaria Arabic& Tagetes minuta& Morettia canscons* and *Cenchrus ciliaris* .Laboratory studies **Table (1)**

Table (1): Determination the abundance of species according to Braun- Blanquet cover-abundance scale.

Family		1	2	3	4	5	6	7	8	9	10	T	Pres	Abundance
Acanthaceae	*Justicia flava*	9	5	8	6	0	2	3	0	6	2	41	8	5.13
	Justicia minuta	8	11	4	5	4	1	0	2	0	0	35	7	5
Amaranthaceae	*Aerva javanica*	10	7	8	9	3	0	5	7	4	1	54	9	6
	Celosia trigyna	6	9	5	7	4	0	3	0	3	2	39	8	4.88
Apocynaceae	*Aderium obessum*	9	3	0	0	6	1	0	0	1	0	20	5	4
Aristolochiaceae	*Aristo lochia bracteolate*	7	6	3	5	0	0	0	3	1	2	27	7	3.86
Asclepiadaceae	*Pergalaria tomentosa*	8	0	8	5	3	0	4	2	0	0	30	6	5
Asteraceae	*Pulicaria Arabic*	6	5	7	0	6	3	0	0	2	2	31	7	4.43
	Tagetes minuta	3	0	3	5	4	0	0	1	2	0	18	6	3
	Conzya incana	12	8	0	3	0	0	3	3	0	1	30	6	5
Boraginaceae	*Heliotropium europaeum*	4	1	6	3	2	0	1	0	1	1	19	8	2.37
Cacurbitaceae	*Citrullus colocynthis*	6	4	2	0	1	0	3	0	1	0	17	6	2.83
Cappariceae	*Capparis spionosa*	0	0	3	7	3	6	2	1	0	5	27	7	3.86
Cleomaceae	*Cleome droserifolia*	2	4	0	1	0	1	0	2	0	0	10	5	2
Convolvulaceae	*Ipomea sinensis*	2	0	1	0	1	0	0	0	0	1	5	4	1.25
Crucifceae	*Morettia canscons*	8	4	4	0	1	0	1	0	3	0	21	6	3.5
Cucurbitaceae	*Corallocarpus schimperi*	1	4	2	0	0	4	0	1	2	2	16	7	2.3
Eupharbiaceae	*Ricinus communis*	4	6	1	4	2	1	0	0	1	0	19	7	2.71
Fabaceae, leguminosae	*Acacia hamulosa*	8	11	5	9	10	4	0	4	6	5	62	9	6.88
	Astagalus spinonsus	6	5	2	3	0	2	3	0	0	2	23	7	3.3
	Senna alexandrina	3	0	1	2	3	0	3	0	3	1	16	7	2.3
	Cassia etalica	4	4	1	0	2	2	0	3	0	2	18	7	2.57
Malvaceae	*Abutilom figarianum*	0	3	5	0	1	1	0	1	0	0	11	5	2.2
Poaceae,graminae	*Setaria pumila*	2	1	2	0	1	0	2	1	0	0	9	6	1.5
	Cenchrus ciliaris	0	2	2	2	1	1	0	0	0	0	8	5	1.6
	Aristida adsconsionis	0	0	0	1	2	2	1	3	0	1	10	6	1.67
Rhamnaceae	*Ziziphus spina-christi*	0	1	0	0	2	1	2	2	1	2	11	7	1.57
Solanaceae	*Solanum incanum*	13	6	6	3	0	7	1	4	3	3	46	9	5.11
Tiliaceae	*Grewia tenax*	6	1	4	2	4	0	1	0	0	0	18	6	3

Soil morphological characteristics Soil morphological characteristics are shown in **Table (2),** The soil types in the study area were determined to be immature sand; where soil color varied from light yellowish brown to dark yellowish brown. Soil texture ranging from sandy to silty loam, sand particles are common at the stands of foothills, hat clay particles are at all sits. Soil structure was ranging from single grains to massive structure. Bulk density ranged. Soil consentience was very low where it differs from loose (lo) slightly hard (sh) at dry soil, non-sticky (ns) to slightly sticky (ss) in moist soil and non-plastic (np) in wet soil **Table (2).**

Table 2: Mechanical analyses of soil horizons and moisture content under different plant community

Site.	Dep(cm)	Tss	PH	Soil type	Coarse sand	Fine sand	Silt and clay	Colure		Soil texture	Consistence		
								Dry	Moist		SOFT	Sticky	Plastic
Foothill 1	1-20	1.03	4.53	hill	97.09	1.18	1.0	10YR3l6 dark yellowish brown	10YR3l3 dark Brown	Sand	lo	ns	np
Foothill 2	1-20	1.09	4.72	hill	80.04	18.5	1.5	10YR3l6 dark yellowish brown	10YR3l3 dark Brown	Sand loamy	so	ss	sp
Foothill 3	1-20	1.02	5.86	hill	80	18.6	1.4	10YR5l6 Light yellowish brown	10YR3l3 dark Brown	Sand loamy	so	ss	sp
Foothill 4	1-20	0.74	6.56	hill	97.42	2.55	0	10YR5l4 Light yellowish brown	10YR5l4 Light yellowish brown	Sand	lo	ns	np
Wadi 5	1-20	1.61	7.16	sand dunes	82.9	13.7	3.4	10YR5l6 Light yellowish brown	10YR3l6 dark yellowish brown	Sand loamy	so	ss	sp
Wadi 6	1-20	1.43	7.33	sand dunes	91.7	7.67	0.63	10YR5l6 Light yellowish brown	10YR3l6 dark yellowish brown	Sand	lo	ns	np
Wadi 7	1-20	2.16	7.29	sand dunes	70.5	28.6	0.9	10YR5l6 Light yellowish brown	10YR3l6 dark yellowish brown	Sand loamy	lo	ss	sp
Wadi 8	1-20	1.91	7.47	sand dunes	81.2	7.3	11.5	10YR5l4 Light yellowish brown	10YR5l4 Light yellowish brown	Sand loamy	lo	ss	sp
Wadi 9	1-20	2.23	7.51	sand dunes	74	12.1	13.9	10YR5l6 Light yellowish brown	10YR3l6 dark yellowish brown	Sand loamy	lo	ss	sp
Wadi 10	1-20	3.12	7.74	sand dunes	60.4	33.1	6.5	10YR5l4 Light yellowish brown	10YR5l4 Light yellowish brown	Sand loamy	lo	ss	sp

(lo) = Loose**, (ns)**= non-sticky**, (np)** = non-plastic**, (sh)** = slightly hard**, (ss)** = slightly sticky**, (sp)** = slightly plastic**, (in)** = interference**, (cs)** = clear smooth, (ms) moderately sticky, **(so)**= soft, **(m)** = massive, **(sg)** = Slight green**.**

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Soil Chemical Properties*:* The soil chemical properties are shown in **Table (3)** shows results of 10 samples taken from the study areas divided between the mountain and the valley that represent the organic matter values (O.M). There is significant difference in the organic matter values. The organic matter values (O.M) varied from 0.8 to 3.1 as the value taken from the top of the mountain contained the least value of the organic matter (O.M) 0.8 while the value increased as we headed down the mountain to be 2.

The values of the samples of organic matter taken from the valley varied from 1.9 to 3.1 as the sample taken from the study area number 9 recorded the highest value among the valley values 3.1 while the sample taken from the study area number 5 in the beginning of the valley which represents the point that connect the valley with the mountain the least value of the organic matter (O.M),The results of the table also showed that the average (pH), (Ec) increases as we go down from the mountain to the wadi, The total value of the average LSD (pH) 15.309* .and The average LSD (Ec) 0.405* the reason for this is the difference nature and environment of Shada mountain from the wadi Sagamah, Result in **Table (3)** ,show that there is a significant difference in the pH values of the soil from different stand, it increase gradually from 7.3 at the Shada mountain to 8.8 at stand 10 in wadi Sagamah .

The statistical analysis showed a significant difference between different studies stands in soil reaction ($p \leq 0.05$) in **Table (3),** The results also show that there is a high significance difference between electrical conductivity EC in soil type units where the highest value is recorded in wadi Sagamah at stand 10, which the value for EC reach to 5.2 desm/m where the in other unites (foothill and sand dunes) was very low in **Table (3).** The mean value and standard deviation (LSD) for macronutrients analysis for the soil collected from Shada Mountain and wadi Sagamah shown **in Table (3).** The results show that P is the highest ion content in the soil from all other elements, the value reached (1.4 mg/g) near the top of the mountain. The values of P content are irregular with going down to the valley. The values of other elements are low in general comparing with P content.

The same pattern of P appears in all other elements. The soil content of Fe is ranging between 0.03 mg/g at stand 5,6 (area connecting the mountain and the valley) to 0.091 mg/g at stand 9 (in the valley). The values for the element Zn ranged between 0.1 mg/g at stand 5 (area connecting the mountain and the valley) and 1 mg/g at stand 9 (in the valley). The values for Cu ranged between 0.02 mg/g at stand 1 (top of mountain) and 0.3 mg/g at stand 5 (area connecting the mountain and the valley). The values for Mg ranged between 0.02 mg/g at stand 4, 7, 8,9,10 (down the mountain and the valley) and 0.08 mg/g at stand 1,2 (top and the high area of the mountain).

The values for Ca are ranged between 0.09 mg/g at stand 5 (area connecting the mountain and the valley) and 0.91 mg/g at stand 1 (top of the mountain). The values for K ranged between 0.12 mg/g at stand 10 (the valley) and 1 mg/g at stand 1 (top of the mountain). The values for B ranged between 0.1 mg/g at stand 2, 4,6,10 (different areas) and 0.5 mg/g at stand 1, 5,9 (different areas). The values for Al ranged between 0.3 mg/g at stand 1 (top of mountain) and 1.2 mg/g at stand 9 (the valley).

The values for Mn ranged between 0.002 at stand 3 (the middle of the mountain) and 0.1 mg/g at stand 9,10 (the valley). The values for Ni ranged between 0.02 mg/g at stand 1 (top of the mountain) and 0.08 mg/g at stand 8,9 (the valley). Finally, the values for Ba ranged between 0.2 mg/g and 0.7 mg/g.

Table 3: Mechanial analyses of soil horizons and moisture content under different plant communities at shada mountain and wadi sagamah at Albaha area Saudi Arabia

Sta.	Dep(cm)	Ec	pH	O.M %	Menaral Cations (mg / gm)							Heavy mattle Cations (mg / gm)					
					B	Fe	Mg	Ca	Na	K	P	Ba	Zn	Mn	Cu	Al	Ni
1	1-20	0.52	7.3	0.8	0.5	0. 1	0.08	0.91	0.1	1	1.2	0.2	0.4	0.02	0.02	0.3	0.02
2	1-20	0.66	7.2	1.2	0.1	0.05	0.08	0.82	0.3	0.9	1.4	0.5	0.3	0.0.2	0.1	0.4	0.03
3	1-20	0.73	7.2	1.7	0.4	0.04	0.03	0.66	0.2	0.79	0.9	0.5	0.2	0.0.02	0.15	0.6	0.04
4	1-20	0.73	7.3	2	0.1	0.04	0.02	0.22	0.3	0.73	1	0.5	0.2	0.02	0.25	0.6	0.04
5	1-20	0.93	7.1	1.9	0.5	0.03	0.03	0.09	0.4	0.65	1.22	0.5	0.1	0.02	0.3	0.6	0.07
6	1-20	0.99	7.3	2.6	0.1	0.03	0.03	0.31	0.3	0.5	0.9	0.7	0.8	0.03	0.1	0.9	0.06
7	1-20	3.3	7.2	2.4	0.2	0.09	0.02	0.11	0.4	0.5	0.2	0.4	0.9	0.04	0.13	0. 6	0.07
8	1-20	3.8	7.6	2	0.2	0.04	0.02	0.1	0.4	0.38	0.4	0.6	0.9	0.03	0.2	0.9	0.08
9	1-20	4.9	8.5	3.1	0.5	0.091	0.02	0.1	0.3	0.4	0.8	0.6	1	0.1	0.11	1.2	0.08
10	1-20	5.2	8.8	2.1	0.1	0.0.7	0.02	0.12	0.5	0.12	0.5	0.5	0.5	0.1	0.13	0.9	0.06
LSD					0.16 *	0.128 *	0.652 *	0.173 *	17.14 *	0.089 *	1.93 *	0.008 *	0.022*	0.016*	0.009 *	1.96 *	0.01 *

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DISCUSSION

The recorded species in the present study (29 species) **Table (3)** represent about 1.34% of the whole flora of Saudi Arabia and their families (20) represent about 2.34 %. From the biodiversity viewpoint. The present study can conclude that this area seems to be the highest area of the Kingdom. One of the main characteristics of the vegetation cover of Saudi Arabia is its low floristic diversity. The number of plant species that recorded in the country is 2172 species, many of which are in the wetter areas of its south–western part. Which include Sarrawat Mountains these species belong to 840 genera and 149 families[13]. The number of species increased to 2250 by adding subspecies, extinct and species that have not been identified yet[14].

Numbers of families, genera, and species are very low compared to Saudi Arabia's vast land area, which is probably, the result of the harsh environmental conditions that prevail in the Sahara-Arabian region which covers vast area of the country. The greatest plant diversity, approximately 74% of the total plant species of Saudi Arabia, is found in the mountainous western area which includes the study area due mainly to a greater rainfall[15]. It is evident that the composites (family Asteraceae) have the highest contribution, followed by graminoides (family Poaceae). These results similar to the whole flora of Saudi Arabia where the highest families in the Whole flora are Poaceae (262 species =12.1%), Asteraceae (233 species = 10.7%), and Fabaceaee (210 species = 9.7%) which represented by 705 species or 32.5% of the total plant species in the Kingdom Also, similar trend to the flora of other similar studied region in the Kingdom[1]. whom found that the major plant families present in the area in question were Poaceae (42 species) followed by papilonaceae (20 species), Euphorbiacea and Asteraceae (18 and 15 species, respectively), while 18 families were represented by only one species The study indicated that wild plants grow at low and high altitudes, they grow at altitude from 150 to 2800 m above sea level. This may due to animal browsing, human interference, poor seed–setting, change in land use patterns and prevalence of unfavorable climatic conditions[16]. It is necessary to consider all possible causes of vegetation change at high altitudes.

This is of particular significance in the case of endemic plants confined to high summits. At the species level, the changes observed must have not only affected the trees but also modified the distribution of associated taxa that are less easily detectable in aerial images[17]. The growth of spectral plants decreased due to human activity. And because of deforestation, which is one of the main factors leading to the diminishing regeneration of wood species. However, deforestation and overgrazing have reduced the vegetation cover of open shrubs and pastures[18]. There is a result of life spectra indicating that chemo and therophytes were the most representative.

The same results were obtained by Al-Sudani et al., 2014 and along the Sarawat, Taif, and Al Baha regions in southwestern Saudi Arabia. The groups identified in this study were similar to many others that were recorded around the area. For example, Acacia tortilis, Acacia ehrenbergiana, were recorded on rocky hills in Tihamah, the Asir Mountains and Hejaz Mountains (Vesey-Fitzgerald, 1955; Abdulfatih, 1992; El-Demerdashet al., 1994; Abd-El-Ghani, 1997; Chaudhary & Al-Jowaid, 1999; Al-Ghamdi et al., 2009). On the other hand, many of these groups were recorded from areas on the western Coast of the Red Sea in Sudan and Egypt[19]. Many authors have also described Am C along the coastline of the Arabian Peninsula[20].

Shada Highest Mountain and Wadi Sagamah at Al Baha Area may be due to the stress environmental factor such as temperature and humidity, this is agreement with results obtained by (Iqbal et al., 2010) [21] and Shaheen [22]. and Al masaodi, [23] whom noted that decreeing in total plant pigments in several plant species such as Camphor treecamphor and Lawsonia inermis leves tree, In the steep mountain slopes of

Shada Highest Mountain and Wadi Sagamah, the density of plants is less because of the large and many rocks.

The Orographic rise of air masses from the onshore wind provides an effective cooling mechanism, which causes rainfall. For example, areas exposed to the sea such as the southern slopes, receive more rainfall than the zones facing the interior plateau. Local topographic features cause similar effects, at correspondingly smaller scales. According to Koppen's climate classification system (1936), dry and semiarid climates (BWh) predominate in Arabian Peninsula. Almost the entire area of Al Baha and Shada Highest Mountain belongs to the climate class BWh of tropical/subtropical desert[24].

Altitude and rainfall are the most important environmental variables and increase along a gradient from. There is a strong relationship between the distribution of sample plots of vegetation types with altitude and rainfall and between the sample plots of eastern mountain slopes, Tihama foothills and coastal plains with landform. The sample plots of wadis and fallow lands are negatively correlated with altitude and moisture, while the sample plots of vegetation types, are positively correlated with altitude and rainfall. Sample sites of vegetation with variable landforms are negatively correlated with rainfall Sample sites of wadis are negatively correlated with rainfall and altitude.

CONCLUSION

include this study is at providing comprehensive phytosociological classification of plant in (Shada Highest Mountain and Wadi Sagamah groups along altitudinal gradients of vegetation zones in the Shada Highest Mountain and their relationships with environmental factors including climate, and geological components. The vegetation of the study area belongs to the Afro-Mountains and Somalia-Masai four vegetation zones and three types of vegetation were identified in study Area (*Aerva javanica*, *Cassia etalic*, and *Solanum incanum*) The results of the present work strongly suggested or enhanced more investigations on the ecology of this widely distributed species. This work will be followed by a future study on mapping the plant communities along the same area to make a full description of their structure, distribution and location of each community in relation to the chemical constituents' of the soil.

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Corresponding author: Mohammad .A. Al- Zubaidi ;

Department of Biological Sciences, Faculty of Science, King Abdulaziz University, Jeddah,SaudiArabia

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