IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 10, Issue 11 Ver. II (Nov. 2016), PP 45-54
www.iosrjournals.org

Assessment of Environmental Influences on the Vegetation of Taba Protected Area, South Sinai, Egypt.

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Abstract:*In light of the interest in the preservation at the state's wealth through the sustainable use of natural resources within the network of protected areas in South Sinai, the overall aim of this paper is to assess the influence of environmental factors and current anthropogenic activities on vegetation structure, distribution of plant communities as well as on how to develop management plans and conservation on scientific bases in Taba Protected Area (TPA), South Sinai region.TPAis one of Egypt's largest protected areas (about 2850 km2).includes a wide variety of landscape features supporting a high diversity of habitat types and biological components. The present study was carried out on four wadis at different elevation (Wadi El Mora at 1050-850 m a.s.l., Wadi El Zalaga at 1010-730 m a.s.l., WadiGhazala at 650-300 m a.s.l. and WadiWatier 400- 120 m a.s.l.), Thirty one stands were studied within the selected wadis, and a sampling site was selected every equal distance to cover all locations. For assessing and analyzing the available environmental factors, a multivariate analysis, GIS and descriptive analysis were needed to ensure the best orientation for the information. The obtained good outputs can help in support any conservation actions for the ecosystems .Results of this study showed that environmental factors the major influencing factors causing variation in vegetation distribution and plant community structure, This variation in plant community structure is the output of notable difference to most environmental factors such as gradient on the elevation, temperature, and rainfall among different locations. The total vegetation cover over the study area (2559.37 m^2), represented only about 16.51 % of the total area studied (15500 m2). The highest cover percentage for sampled sites was recorded in Wadi El Mora (910.22 m2 = 26.01%), while the lowest value was 368.44 m2 (10.53 %) recorded in WadiGhazala. WadiWatier and Wadi El Zalaga recorded 578.20 m2 (16.52 %) and 702.51 m2 (14.05 %) Cover, respectively.W. El Mora showed the highest species richness (41), while W. El Zalaga showed the lowest species richness (32), while W.Ghazala and WadiWatier recorded 38 and 35 species, respectively. Therefore, estimates showed that W. El Mora is the highest diversity index compared to the others.The present study could support area management and conservation strategies, directs the conservation efforts to care for the differences between environmental variables and human activities and to adapt our strategy now to be suitable with these variables.*
Keywords:*Environmental factors, Vegetation,Taba PA, South Sinai.*

I. Introduction

The TPA contains a wide range of microhabitats and landscapes that are consequences of varying microclimatic conditions, a wide range of altitudes, and variable topography. The landscape ranges from rugged mountains, which includes Mount El-Barqa (1165 m above sea level), and from the top of this mountain a look on the fantastic landscape all around till the Gulf of Aqaba in the east and the high mountainous area of Saint Katherine in the south, whose slopes are incised by Wadi Rivers. Wadi Rivers generally slope toward the east, in the direction of the Gulf of Aqaba.

An important goal of ecology is to clarify causal relationships that determine plant species distribution over broad spatial scales. It has long been thought that environmental conditions, particularly climate, are of great importance in determining the distribution of Earth's vegetation types **(Breckle, 2002)**. The fundamental connection between environmental conditions and plant community characteristics was described in early days of plant ecology **(Cowles, 1899)**. The distribution, pattern and abundance of plant species and communities in desert environments have most often been related to three groups of factors; physical environmental variables affecting water availability, soil chemistry and anthropogenic disturbance.

South Sinai, an arid to extremely arid region, is characterized by an ecological uniqueness due to its diversity in landforms, geologic structures, and climate that resulted in the diversity in vegetation types, which is characterized mainly by the sparseness and dominance of shrubs and sub-shrubs and the paucity of trees **(Helmy*et al*., 1996)**, and variation in soil properties **(Abd El-Wahab, 1995)**. Soils of South Sinai, as desert soils (arid sols), are characterizeby spatial heterogeneity, where soil properties vary over quite small distances. The causes of this heterogeneity include variation in plant cover, vegetation composition, slope, and topography. **Schlesinger *et al*.,(1996) and Moustafa and Zayed., (1996),** show that soils of South Sinai are gravelly in wadis and plains, rocky at mountains in surface, sandy to loamy sand in texture, alkaline, non-saline to slightly saline. They are characterize by low content of essential nutrients and CEC.

Topography is the principal controlling factor in vegetation growth andthe type of soils and the amount of rainfalls play secondary roles at the scale of hill slopes **(Dawes and Short, 1994).** The geographical distribution of species is a result of the action of both historical and ecological factors in time and space **(Vuilleumier&Simberloff, 1980)**. The number of species present at a given locality can be viewed as a variable that responds to the influence of several (local) ecological factors, while (largely temporal) historical factors are responsible for the biogeographic species pool from which the local community is derived **(Ricklefs, 1987)**.

Climate is one of the major factors governing the distribution of wild plant species, acting directly through physiological constraints on growth and reproduction **(Guisan and Zimmerman, 2000)** or indirectly through ecological factors such as competition for resources **(Shao and Halpin, 1995)**. When a species distribution is predicted using climate variables only, it is commonly referred to as a climate envelope model. In the arid and semi-arid region, although there is a correlation between mean rainfall and vegetation productivity over the growing season and the soil moisture is regarded as the determining factor in vegetation conditions, considerable uncertainty of the Vegetation response to climate change still remains **(Goward and Prince, 1995)**.

Conservationists need to evaluate multiple factors when considering how to invest scarce resources to conserve biological diversity. In order to establish an effective conservation program for plant species one should have enough information's about species demography, geography, population structure, habitat preference, etc. It is widely accepted today that the primary strategy for nature conservation is the establishment and maintenance of a system or network of protected areas **(Omar, 2014).**

II. Materials and Methods

1.1 Study Area

Taba protected area (TPA) is the fifth component of the South Sinai Protected Area Network. TPA is situate in the Southeast part of Sinai and is a part of the upper Sinai massif. It is located between 33˚ 55' to 34˚ 50' east, 28° 52' to 29° 36' North and Alt. 100 to 1150 m a.s.l. The study area (Map, 1) involves wadi systems. Taba has an extremely high recreational, conservational and scientific value, which is currently being compromised by human activities. It includes a wide variety of landscape features supporting a high diversity of habitat types and biological components.

Four wadis, representing the altitudinal range of the protectorate area. The first is Wadi EL Mora located between 850m to 1100m altitude. The second is Wadi El Zalaga located between 700m to 1050m altitude. The third is WadiGhazala which include two Part located between 300m to 650m altitude. In addition, the fourth is WadiWatier which located between 100m to 400m altitude (Map, 1).

Taba protected area includes samples of most geological zones of the South Sinai. **Shahin and Kora(1991)** described five Upper Cretaceous successions exposed in the Eastern Sinai, of which three are in the Taba protectorate namely Taba, El Sheikh Attia and Gebel Gunna. It is mainly situated within a sandstone area of primarily Mesozoic age (150 million years), which includes the Nubian sandstone and marine sandstones of upper Cretaceous/lower Cenozoic age. The northwest of the protected area includes the Eocene limestones and marls of the El-Tih plateau, the eastern sections include the Precambrian igneous basement.

TPA is characterize by very low cloud cover, has long summer (April - early November) and short winter (December - March). Summer temperature on land may reach 45°C. Rainfall in the studied area is about 22 mm per year, although exceptionally rainy years with as much as 70 mm, rainfall may occur. Flash floods through major wadis (in winter) transport terrestrial material into the Gulf of Aqaba, resulting in large deltas and incision of submarine canyons. Annual evaporation rates on land are three times as high as along the Mediterranean shore. Relative humidity in shore localities averages 30-55%. Wind direction is predominantly from the north (approx. 50% frequency) and from the northeast (approx. 20% frequency). A minor northwestern component, particularly in winter is present, while winds from the south are subordinate. Average wind speed is about 10-15 knots. Southerly winds in excess of 20 knots were observing mainly in winter **(Harhash, 2004)**.

The diversity of both landforms and geologic structures of TPA leads to the differentiation of a number of microhabitats. Each of them has its peculiar environmental conditions and unique flora, which are rich in medicinal and economic plants. The diversity in geomorphological and geological structures of TPA resulted in a unique landscape. Five landform types are identified in this landscape namely: wadis (valleys), oasis, mountains, canyons and flood plains.

1.2 Soilsampling

Soil samples were collecting during the work, from all 31 stands for the determination of their physical and chemical characteristics. The surface samples (excluding the surface crust) were taken from the depth of 20 cm. Soil texture was determined by using a series of sieves: fine gravel (2 mm), coarse sand (500µm), fine sand (212µm), silt (106µm) and clay (53µm). These samples were then taken for the laboratory, weighed and dried to constant weights at 105˚C. The difference between the fresh and oven dry weights of each sample was considered to represent the moisture content and was expressed as percentage of the oven dry weight **(Jackson, 1967)**.

For assessing soil chemical properties, five hundred ml of distilled water were water added to 100 g of air – dried soil (with < 2 mm diameter), and were shaken for two hours. The heavier particles were allowed to settle, and the supernatant liquid was decanted by filtration. After repeated filtrations, clear soil solution was obtained to analysis the pH, EC, T.D.S, Org. matter, CaCO3, Ca ++, Mg++ ,HCO3, Cl and SO4 **(Jackson, 1967)**.

1.3 Topographique attributs analysais (Elevation and Slope)

Topography is the principal controlling factor in vegetation growth and that the type of soils and the amount of rainfalls play secondary roles at the scale of hill slopes **(Dawes and Short, 1994)**. Elevation, aspect, and slope are the three main topographic factors that control the distribution and patterns of vegetation in mountain areas **(Titshall et al., 2000)**.

The elevation of a geographic location is its height above a fixed reference point, often the mean sea level. Elevation, or geometric height, is mainly used when referring to points on the Earth's surface, while altitude or geopotential height is used for points above the surface. A topographical map is the main type of map used to depict elevation, often through use of contour lines. The slope is defineas the ratio of the "rise" divided by the "run" between two points on a line, or in other words, the ratio of the altitude changes to the horizontal distance between any two points in the line**(ESRI, 2001)**.

In a Geographic Information System (GIS), digital elevation, models (DEM) are commonly used to represent the surface (topography) of a place, through a raster (grid) dataset of elevations. Digital terrain models are another way to represent terrain in GIS **(ESRI, 2001)**. Altitude was recording at each site using GPS fix recorded in decimal degrees and datum WGS84 using Garmin 12 XL receiver. All data collected from the field will be classified according to elevation in order to detect the effect of elevation.

1.4 Climatic variables analysis (Temperature and Rainfall)

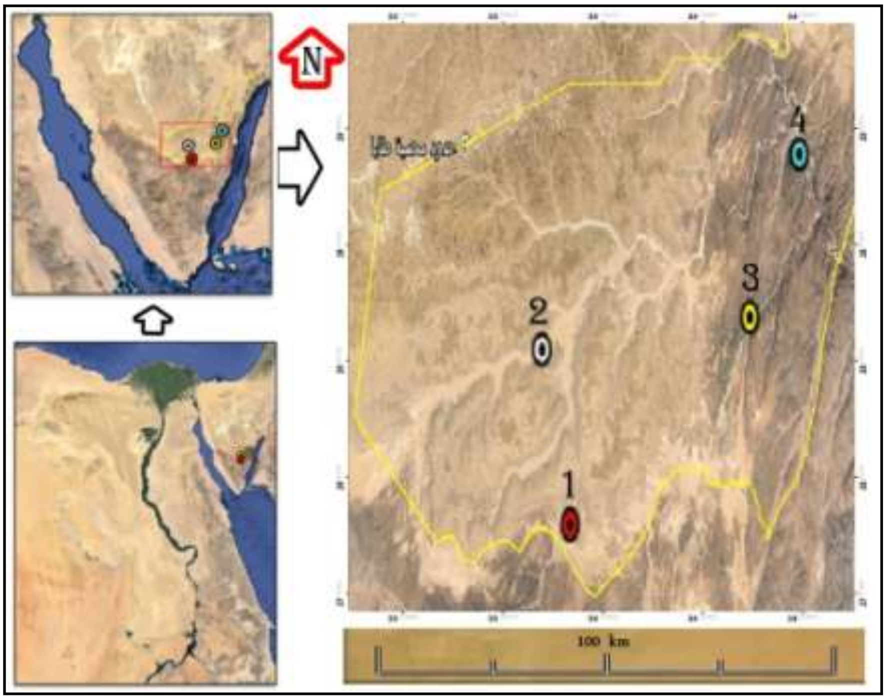
DIVA-GIS is a free computer program for mapping and geographic data analysis a geographic information system (GIS), BIOCLIM is a bioclimatic prediction system which uses surrogate terms (bioclimatic parameters) derived from mean monthly climate estimates, to approximate energy and water balances at a given location **(Nelson et al., 1997)**. The present version can produce up to 19 bioclimatic parameters based on the climate variables maximum temperature, minimum temperature, rainfall, solar radiation and pan evaporation. If some of these climate variables are unavailable, fewer bioclimatic parameters are produce. DIVA-GIS provided us to collect bioclimatic parameters (maximum temperature, minimum temperature and rainfall).

1.5 Vegetation description

The present study was carried out during the period between January 2014 to September 2014. Quadrate Transect techniques were using to study vegetation within four Wadis inside TPA. A sampling site was selected every equal distance to cover such locations. 31 stands were studied within the selected four Wadis; Number of sampling sites (stand) for each wadi depended upon the length of this wadi. In each stand five quadrates with size 10X10 m for each quadrate were studied. Sampling was done encompassing the whole microhabitat types for each stand to represent the variability of the sample sites and to assure the comprehensiveness of sampling and reduce the bias induced by spatial patterns, and variable habitat types. Microhabitat types were designating as following: wadi beds, slopes, terraces and runnels **(Abdullah, 2013)**.

At each site, a GPS (Geographical Position System) fix was recorded in decimal degrees and datum WGS84 using Garmin 12 XL receiver. The fix was recorded to the fifth decimal digit. Arc View GIS (Geographical Information Systems) 9.2 was used to plot the study sites. Wadi boundaries were digitized from 1:50,000 topographic maps with Egyptian Transverse Mercator projection (Blue belt).

According to **"Shukla, and Chandel, (1989)"** in each of the 31 stands, 155 quadrates to have been set up to determine the following vegetation parameters namely: Abundance, Relative Abundance, Density, Relative Density, , Frequency, Relative Frequency, Cover, Relative Cover and Importance Value Index.



Map2: Location map of study area, 1- W. El Mora, 2- W. El Zalaga, 3- W. Ghazala and 4- W. Watier.

III. Results and Discussion

Table 1. Summary of Environmental and Vegetation data recorded during study among different four Wadi

	Variable	W. EL Mora	W. El Zalaga	W. Ghazala	W. Watier
		1050-850m a.s.l	**1010-730m a.s.l**	**650-300m a.s.l**	**400-120m a.s.l**
	Vegetation characteristics				
Vegetation analysis	Density	1.41	0.69	1.38	0.25
	Frequency	643	406	551	583
	Abundance	245.22	59.11	87	52.22
	I.V.I	28.45	45.6	28.85	26.6
	Sp. Richness	41	32	38	35
	No. Of families	17	13	18	16
	Vegetation Cover m2 (%)	0.38	0.19	0.26	0.28
	Main plant community	*Artemisia judaica*	*Haloxylonsalicornicum*	*Acacia tortilis*subsp. *raddiana*	*Zygophyllumcoccineum*
	Environmental Factors Soil characteristics				
Physical properties	Water Content %	1.44	1.21	11.27	1.44
	Fine gravel	84.11	67.05	77.78	55.25
	Coarse sand	11.79	22.46	15.75	25
	Fine sand	4.1	10.49	6.46	19.75
Chemical properties	pH	8.66	8.9	8.84	8.76
	EC µs/ cm	0.42	0.32	0.34	0.44
	T.D.S ppm	249.6	174.93	171.2	321.6
	Org. matter %	12.21	11.45	12.06	11.94
	CaCO3 %	42.14	46.4	41.57	50
	Ca ++ meq/L	18.43	9	11.07	7.71
	Mg++ meq/L	4.14	3.35	3.07	6.21
	HCO3- meq/L	3.21	2.95	3.14	2.79
	Cl-meq/L	21.86	12.15	22.5	32.79
	SO4-- meq/l	67.76	66.59	70.93	73.57
Topography	Elevation effect m.a.s.l	950	870	475	260
	Slope effect d.	89.95-89.98d	89.95-89.98d	89.98-89.99 d	89.98-90.00 d
Climatic variables	Temp. mean 0 C	17.4	17.55	19.5	21.05
	Annual Mean Temperature	17.5	17.4	19.5	21.1
	Rain mm	20	20	16	16

1.6 Soil analysis

Results of soil analyses reveal great variations in the average physical and chemical characteristics of soil collected from the four wadis. While soil texture was sandy loamy in, Wadi El Zalaga and WadiGazala, Loamy sand in Wadi El Mora, it was Loamy inWadi. Chemical properties of soil showed great variation among the different location according to elevation ranks. Soil pH values (8.66, 8.89, 8.84 and 8.76), HCO3 values (3.21, 2.95, 3.14 and 2.79), and organic matter values (12.21, 11.45, 12.06 and 11.94) increased with elevation while CaCo3, CL, SO4 and EC decreased with elevation without Location Wadi El Mora (Table -1, 2).

Statistical analysis of soil results indicated significant differences is soil content of sand, silt, clay, CaCO3 and Cl, While it showed non-significant differences to moisture content, pH, T.D.S, EC, Organic matter Ca++, Mg, HCO3 and SO4 of the four studied wadis; Wadi El Mora, Wadi El Zalaga, WadiGhazala and WadiWatier (Table 2).

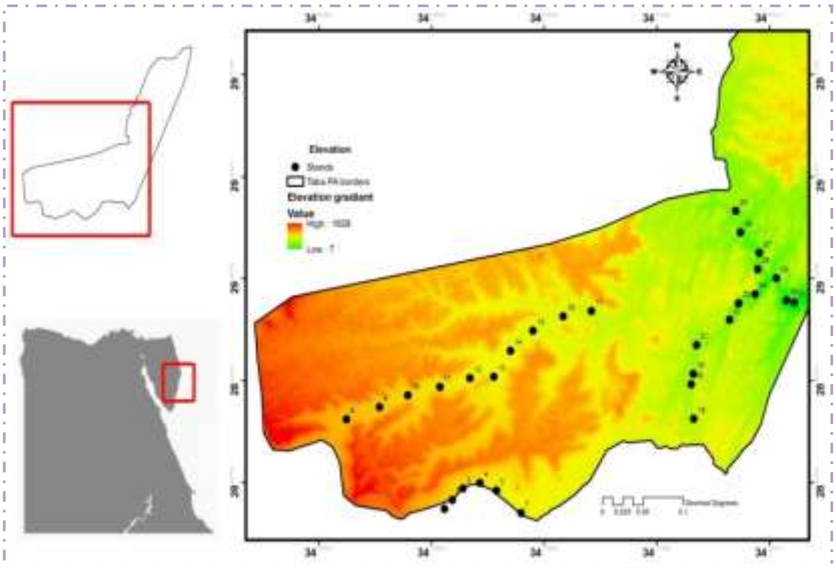
Table 2. Soil chemical and physical properties of the different wadis; One-way analysis of variance (ANOVA); significantly different according to LSD = significant at $P < 0.05$ and non-significant at $P > 0.05$

Location Names	W.El Mora	W.EL Zalaga	W.Ghazala	W.Watier	F	Sig.
& Elevation above sea level	±922 6m a.s.l.	±881 m a.s.l.	±491 m a.s.l.	±262 m a.s.l.		
Water content (%)	1.44	1.21	11.27	1.44	0.753	NS
Sand (%)	84.11	67.05	77.78	55.25	4.757	**
Silt (%)	11.79	22.46	15.75	25	3.565	**
Clay (%)	4.1	10.49	6.46	19.75	3.537	**
pH	8.66	8.9	8.84	8.76	1.678	NS
EC µs/ cm	0.42	0.32	0.34	0.44	0.363	NS
T.D.S. ppm	249.6	174.93	171.2	321.6	0.363	NS
Organic matter (%)	12.21	11.45	12.06	11.94	0.31	NS
CaCO3 (%)	42.14	46.4	41.57	50	7.555	**
Ca++ meq/L	18.43	9	11.07	7.71	1.426	NS
Mg++ meq/L	4.14	3.35	3.07	6.21	1.336	NS
HCO3- meq/L	3.21	2.95	3.14	2.79	0.263	NS
Cl-meq/L	21.86	12.15	22.5	32.79	3.745	**
SO4-- meq/l	67.76	66.59	70.93	73.57	0.346	NS

1.7 Topographic attributs analysais (Elevation and Slope)

The lowest elevation point in the study area was recording at Wadi. Watier (120 m a.s.l.), and the Highest was recorded at W. El Mora (1050 m a.s.l.) and this makes high altitudinal range of 930 m (Map. 2). Results showed that the slope degree of the populated sites was high, as the species was found in slope between 89.95 and 90 degree, WadiWatier is located in high slope at 90 degreeas, while wadi El Zalaga recorded lower slop slope degree at 89.95.

In this study, results showed that Artemisia judaica species is the major plant community in the studied stands of Wadi El Mora at 950 m asl. Haloxylonsalicornicum species is the major plant community in the studied locations of Wadi El Zalaga at 870 m a.s.l. Acacia tortilis subsp. raddiana is the major plant community in the studied sites of WadiGhazala at 650 m a.s.l., and Zygophyllumcoccineum is the major plant community in stands of WadiWatier at 260 m a.s.l. Moreover, the total vegetation cover percentage in each wadi according to altitudinal variation, in W. EL Mora the percentage plant cover reached 26 %, while it amounted 17 %, 11 % and 14 % for W. El Zalaga, W. Ghazala and W. Watier respectively (Table 1). From the above-mentioned results, it could be concluded that the altitudinal gradient is correlated with significant differences in soil physical and chemical characteristics, plant community and vegetation cover in between the four locations, which studies and this totally agrees with Khafagi et al., 2013.

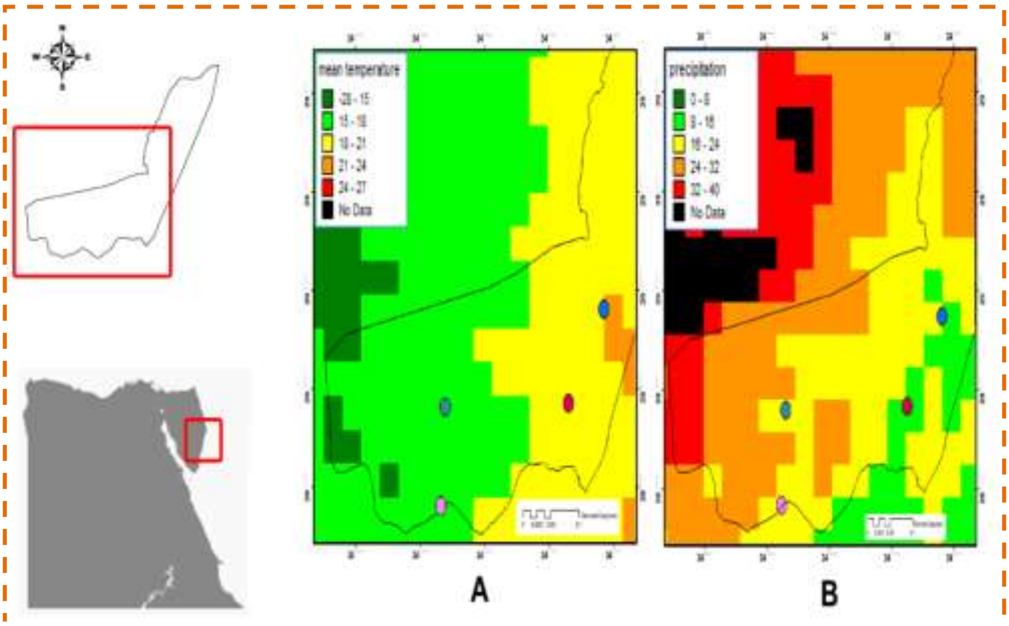


Map 2. Elevation map for study area Altitude showed different elevation ranks.

1.8 Climatic variables analysis (Temperature and Rainfall)

Results extracted from DIVA GIS regarding temperature and precipitation pattern showed variation among the four locations of the current study. Reverse correlation was observed between mean annual temperature and elevation in Wadi El Mora (922 m a.s.l.) and WadiWatier (262m a.s.l.); Annual precipitation recorded as the highest value in W. El Mora and W. El Zalaga (20.00 mm) while in W. Ghazala and W. Watier recorded the lowest value (16.00 mm). The previous status is reverse when dealing with temperature; the highest values (21.05 C°) were recording in W. Watier, while the lowest temperature (17.40 C°) was recorded at. W. El Mora.

The previous results could be explained by two words “altitudinal gradient”; because Wadi El Mora is the highest elevated point, it received cool temperature and high rain W. Watier is the lowest one in this area, it receives high temperature and low rains (Table 1); however, for each 1,000-foot rise in altitude there is a 4°F drop in temperature. Results show that there is a negative correlation between temperature and precipitation. The superimposed map (Map 3) of BIOCLIM annual Min-temperature, Max-Temperature and studied Wadis distribution indicates that naturally occurs in the low-temperature zones range from 11.6 - 15.3C at winter and from 23.2- 26.8C at summer season.



Map 3. Variation in climatic factors among the different locations, Annual (A) Temperature and (B) Precipitation.

1.9 Vegetation description

In order to extract a complete picture about community structure, and the environmental factors which affect the all community? From all the above, and in one table (Table 1) vegetation characteristics variation can observed easily. The highest Density was recorded at W. El Mora (1.41) and the lowest was at W. Watier (0.25) while W. Ghazala and W. El Zalaga were (1.38, 0.69). The highest Frequency was recording at W. El Mora (643) and the lowest was at W. Ghazala (551) while W. Watier (583) and W. El Zalaga (406). The highest Abundance was recording at W. El Mora (245.22) and the lowest was at W. Watier (52.22) while W. Ghazala (87) and W. W. El Zalaga (59.11).

Important Value Index also showed variation ranged, The highest value was recorded at W. El Zalaga (45.60) and the lowest was at W. Watier (26.60), while WadiGhazala (28.85) and W. El Mora (28.45), The other two sites were so close (28.85 and 28.45). Generally, this variation may come from the variation in Individual species numbers and the way that this species distribute within the studied wadis. In this study, WadiGhazala showed the highest No of Families as 18 while Wadi El Zalaga showed lowest No of Families as 13, Wadi El Mora and WadiWatier has recorded 17 and 13 families (Table 1). Species number gives the indication of the diversity of any community in this study. Wadi El Mora showed the highest species richness as 41 while Wadi El Zalaga showed lowest species richness as 32, WadiGhazala and WadiWatier has recorded 38 and 35 species richness value as presented in.

Species cover is an important factor that reflects the status of this species within its habitat; the total vegetation cover over the study area was determined as 2559.37 m2, which represent only about 16.51 % of the total area studied (15500 m2). The maximum cover percentage for sampled sites was recorded in Wadi El Mora (910.22 m2 = 26.01%), while the lowest value was 368.44 m2 (10.53 %) recorded in WadiGhazala. WadiWatier and Wadi El Zalaga were recorded 578.20 m2 (16.52 %) and 702.51 m2 (14.05 %) cover (Table 1).

Results showed that seven species recorded as dominant species with the four studied locations. Haloxylonsalicornicum (Moq.) Bunge ex Boiss. was recorded as the highest frequency in this issue, especially in Wadi El Zalaga (8 stands), also Artemisia judaica L. represent the most frequently dominant species within Wadi El Mora (4 stands)., Zygophyllumcoccineum L., represent the most frequently dominant species within WadiWatier (4 stands). While Acacia tortilis subsp. raddiana (Savi) Brenan, (Table 1).

- **Modeling species response curves**

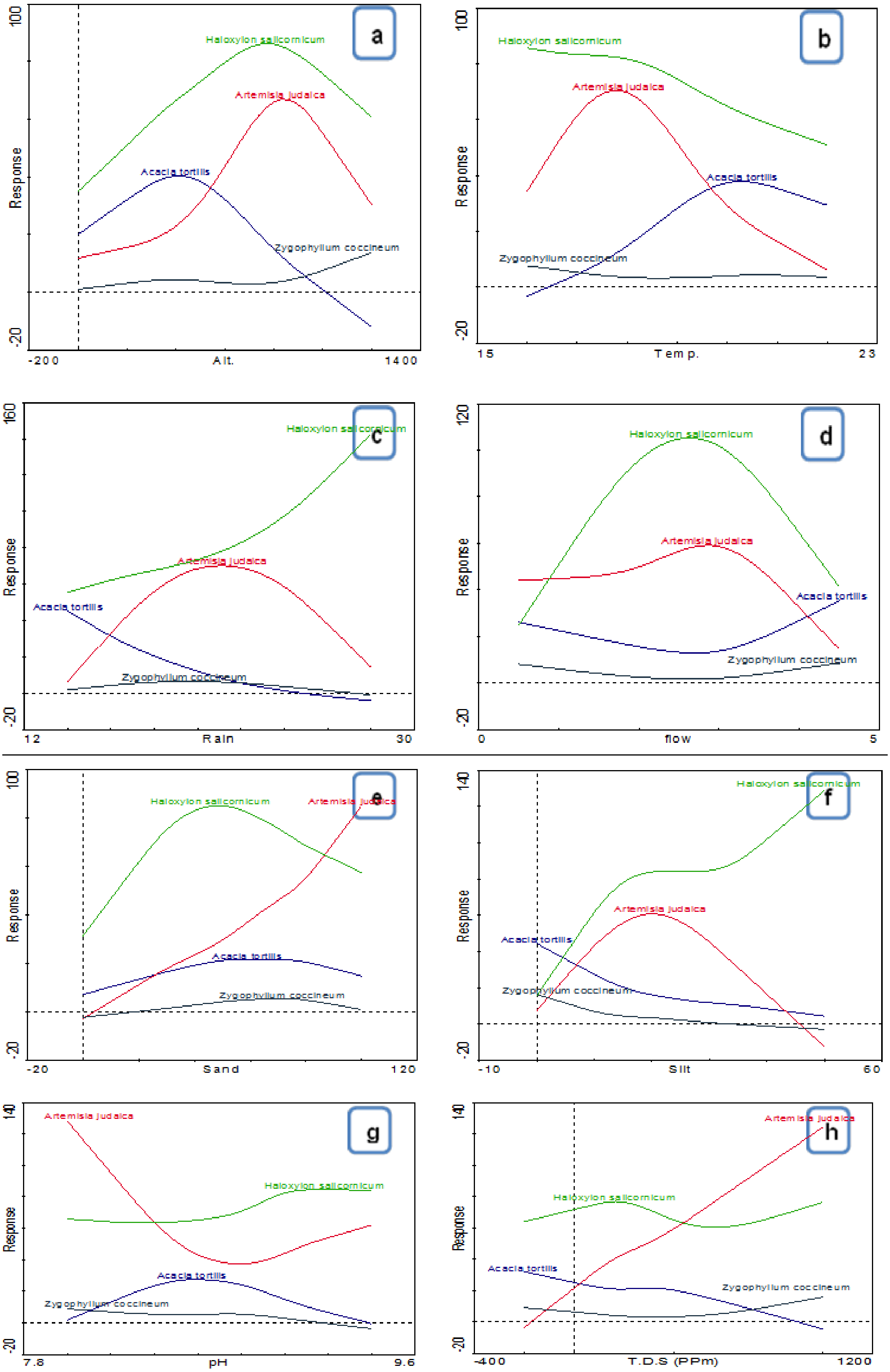
Regarding to important values index of dominant species withen studies Wadis, the species response curve for ***Artemisia judaica, Haloxylonsalicornicum, Acacia tortilis and Zygophyllumcoccineum*** reveals that there is different projection (negatively & positively correlated) with the Altitude, Temperature, Rain, Flow, Sand, Silt, pH, T.D.S, Org. Matter, CaCO3, CL and SO4 gradients.

The projection of *A. judaica*important value index reveals that the optimum elevation range is from 1000 to 1200m a.s.l., the optimum Temperature range is from 16 to 18 C°, and the optimumRain range is from *22* to 24 mm.And *Artemisia judaica*important value index is positively correlated with the sand, T.D.S and SO4; But Itsnegativily correlated with the pH, Organic matter and Cl gradients (Fig. 3).

The projection of *H. salicornicum*important value index reveals that the optimum elevation range is from 950 to 1150m a.s.l., the optimum Flow is 3.5, the optimum Sand range is from 25 to 40, the optimum T.D.S at 200 ppm, the optimum Org. matter range is from 8 to 12 and the optimum Cl is range from 10 to 20 meq/L.*Haloxylonsalicornicum*important value index is positively correlated with the Rain, Silt, CaCO3 and SO4; In the otherhand, negativily correlated with the Tempreture gradients. The plant is growing in pH soil higher than 9.2 gradients (Fig. 3).We can see from Fig. 3.

The response curve of *A. tortilis*species reveals that the optimum elevation range is from 200 to 600m a.s.l., the optimum Temperature range is from 20 to 21 C° and the optimumpH range is from *8.4 to 8.8*. *Acacia tortilis*important value index is positively correlated with the Flow , Org.matter and Cl gradients . ButItsnegativily correlated with the T.D.S gradients.

The response curve of *Z. coccineum*species explain its positively correlated with the Altitude , Flow and T.D.S. However Itsnegativily correlated with the Tempreture , Silt, CaCO3 and SO4 gradients; the plant is growing in a weak acidic soil (Fig. 3).


a
Haloxylon salicornicum
Artemisia judaica
Acacia tortilis
Zygophyllum coccineum
100
Response
-20
-200
Alt.
1400
b
Haloxylon salicornicum
Artemisia judaica
Acacia tortilis
Zygophyllum coccineum
100
Response
-20
15
Temp.
23
c
Haloxylon salicornicum
Artemisia judaica
Acacia tortilis
Zygophyllum coccineum
160
Response
-20
12
Rain
30
d
Haloxylon salicornicum
Artemisia judaica
Acacia tortilis
Zygophyllum coccineum
120
Response
-20
0
flow
5
e
Haloxylon salicornicum
Artemisia judaica
Acacia tortilis
Zygophyllum coccineum
100
Response
-20
-20
Sand
120
f
Haloxylon salicornicum
Artemisia judaica
Acacia tortilis
Zygophyllum coccineum
140
Response
-20
-10
Silt
60
g
Artemisia judaica
Haloxylon salicornicum
Acacia tortilis
Zygophyllum coccineum
140
Response
-20
7.8
pH
9.6
h
Artemisia judaica
Haloxylon salicornicum
Acacia tortilis
Zygophyllum coccineum
140
Response
-20
-400
T.D.S (PPm)
1200

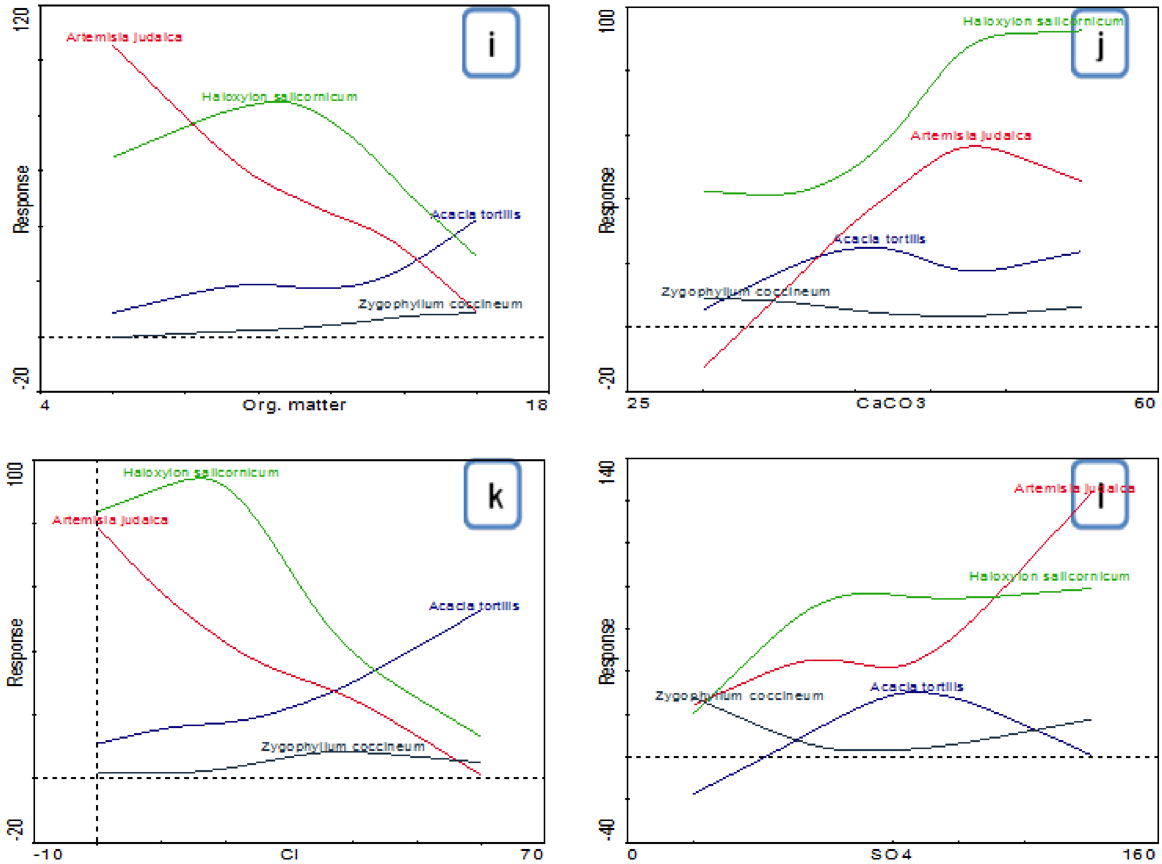


Figure 3.Importance Value Index of four dominant species : *Artemisia judaica*, *Haloxylonsalicornicum*, *Acacia tortilis* and *Zygophyllumcoccineum* plotted against the most important environmental gradient prevailing in the four studied wadis(geographical, climatic & Soil factors (alt, temperature, rain & flow, sand & silt, pH, T.D.S, Org. Matter, CaCO3, CL and SO4).

IV. Conclusion

- The environmental factors are owner of the major role that affects the response of vegetation distribution and plant community structure to gradient in most environmental factors such as the elevation above sea level, temperature, and rainfall noticed among the four different locations of the present study.
- Clear from the survey, whenever increased elevation in the study area was occurred decrease in the average temperature. On the contrary, there has been an increased in rainfall, water content and organic matter. On the other hand, there improvements in vegetation cover density and abundance, and richness of species according to the increase on elevation.
- The use of GIS & DIVA GIS played a crucial role in analysis, management and extract of spatial variation for different habitats by using simple information collected from filed will give the great analysis just by using such programs; 3D analyst tools show advanced spatial analysis. Elevation, slope and contour maps easily arise by these applications, which it has been used in a deeper understanding of the vegetation structure and distribution of plant communities.
- Based on the findings, which have been substantiated, which were based on field surveys suggest the recommendations, to possible for decision-makers to take advantage of that study during the development of the strategic plan for the sustainable use of natural resources.

Acknowledgements

The authors really appreciate the great effort given by the team of Taba Protected area during this research. We offer our sincerest gratitude to Dr. Karim Omar, Environmental researcher / GIS specialist at Nature Conservation Sector (NCS), for his continuous support in applying new technics during this research. Also we thank Dr. Khaled Alam the General Manager of South Sinai Protectorates for our work facilitation.

References

[1] A. Abdullah, *Spatial variation in vegetation structure of some wadis in Saint Katherine protectorate, South Sinai, Egypt,* M.Sc. Thesis, Botany Dep., Facu. Of Sci. Al-Azhar Univ., Egypt, 2013.

[2] A. Guisan, and N.E. Zimmerman, Predictive habitat distribution models in ecology. *Ecol. Model.*2000, 135: 147–186.
[3] A. Shahin, and M. Kora, Biostratigraphy of some Upper Cretaceous succession in the Eastern Central Sinai, Egypt. *NeuesJahrbuchfürGeologie und Paläontologie, Monatshefte*, 1991, 11, 671e692.
[4] A.M. Moustafa, and A.M. Zayed, Effect of environmental factors on the flora of alluvial fans in southern Sinai. *Journal of Arid Environments*, 1996, 32: 431-443.
[5] A.Nelson, G. LeClerc, and M. Grum, The development of an integrated Tcl/Tk and C interface to determine, visualize and interrogate intraspecific biodiversity. *Internal CIAT document. GIS Laboratory, CIAT, Cali,* Colombia, 1997, 104-140.
[6] ESRI, ArcGIS Spatial Analyst: Advanced GIS Spatial Analysis Using Raster and Vector Data. *White Paper*. 2001, Available online at: www.esri.com.
[7] F. Vuilleumier, andD. Simberloff, Ecology vs. history as determinants of patchy and insular distributions in high Andean birds. *Evolutionary Biology*, 1980, 12, 235–379.
[8] G. Shao, and P.N. Halpin, Climatic controls of eastern North American coastal tree and shrub distributions. *Journal of Biogeography*, 1995, 22: 1083–1089.
[9] H. C. Cowles, The ecological relations of the vegetation of the sand dunes of Lake Michigan. *Botanical Gazette,* 1899, 27: 95–117.
[10] K. A. Harhash, *Diversity of some groups of terrestrial animals in Taba protected area.* M.Sc. Thesis, Zoology Dep., Facu. Of Sci. Cairo Univ., Egypt,(2004).
[11] K. S. Shukla, and P. S. Chandel, *Plant Ecology and Soil Science. S.* Chand and Co. New Delhi, India, 1989.
[12] K.Omar, Ecological and Climatic Attribute Analysis for Egyptian Hypericumsinaicum. *American Journal of Life Sciences,* 2014, 2(6): 369-381.
[13] L.W. Titshall, T.G. O'Connor, and C.D. Morris, Effect of long-term exclusion of fire and herbivory on the soils and vegetation of sour grassland. *African Journal of Range and Forage Science,* 2000, 17: 70–80.
[14] M. L. Jackson, *Soil chemical analysis, Prentice-Hall of India private,* New Delhi, India. 1967, 498 pp.
[15] M.A.Helmy, A.A. Moustafa, R.H. Abd El-wahab, and K.H. Batanony, Distribution behavior of seven common shrubs and trees growing in South Sinai, Egypt. *Egyptian Journal of Botany*, 1996, 36(1): 53- 70.
[16] O.Khafagi, E.E. Hatab, and A.A. Abdullah, Effect of Spatial Variation on Plant Community Structure in South Sinai, Egypt. *UJERT Journal*, 2013, 2: 242-254.
[17] R.E. Ricklefs, Community diversity: relative roles of local and regional processes. *Science,* 1987, 235, 167–171.
[18] R.H.Abd El-Wahab, *Reproduction ecology of wild trees and shrubs in Southern Sinai, Egypt,* M.Sc. Thesis, Botany Department, Faculty of Science, Suez Canal University, Ismailia, Egypt,1995.
[19] S.N.Goward, and S.D. Prince, Transient effects of climate on vegetation dynamics: Satellite observations. *Journal of Biogeography*, 1995, 22: 549– 563.
[20] S.W. Breckle, Walter's vegetation of the earth. The ecological systems of the Geo-Biosphere. *Berlin -Heidelberg, Springer-Verlag*,2002.
[21] W. H. Schlesinger, J. A. Raikes,A. E. Hartley and others, on the spatial pattern of soil nutrients in desert ecosystems. Ecology, 1996, 77: 364–374.
[22] W. R. Dawes, and D. Short, The significance of topology for modeling the Surface hydrology of fluvial landscapes. *Water Resources Research*, 1994, 30:1045- 1055.