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The Influence of the Environment on the Distribution of Vegetation Communities in Rawdhat Salasil, Saudi Arabia

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Abstract:

Ecological and botanical survey were conducted on Rawdhat Salasil, Al-Qassim region, Saudi Arabia. The survey also includes the study of the plant communities in the study area by sampling the associated species in each community using the List Count Quadrant method to study the density, frequency, and plant cover. The present study has shown an account of the under-mentioned five different communities: Haloxylon persicum Bunge ex Boiss. community is a dominant perennial shrub with an importance value of 47.88%. 20 associated species represent this community. The chemical analysis of the soil of this plant habitat exhibits more alkalinity with low salinity. Tamarix nilotica Ehrenb. community is a perennial shrub with an importance value of 60.48%. 14 associated species represent this community. The chemical analysis of the soil of this plant habitat demonstrates richness in alkalis with high salinity. Salsola imbricate Forssk. community is a perennial herb with an importance value of 60.18%. 17 associated species represent this community. The chemical analysis of the soil of this plant habitat exhibits richness in alkalis with low salinity. Panicum turgidum Forssk. is a perennial herb with an importance value of 65.1%. 11 associated species represent this community. The chemical analysis of the soil of this plant habitat exhibits richness in alkalis and an absence of salinity. Pulicaria undulate L. community is predominantly an annual shrub with an importance value of 91.79%. 16 species represent this community. The chemical analysis of the soil of this plant habitat exhibits richness in alkalis and an absence of salinity.

Keywords: rangelands, plant communities, Rawdhat Salasil, edaphic factors

Introduction

Saudi Arabia covers about 80% of the Arabian Peninsula. There are a lot of different characters like vegetation, climates, soil and climates over this region. About ¼ of western Saudi area is composed of sand dunes. A lot of studies on ecology have been carried out to identify why these variations occur in this region (33, 38, 41). There have been several works ranging from (2) to (9) and all these studies have concentrated on vegetation cover in Saudi Arabia. The observations are that edaphic and climatic factors have significant effects on the type of groups of the plant as well as the distribution of the vegetation in this Arabian Peninsula country.

Various printed works on the plant life in the country exist and they show many details including flowers (10). Other reports on the distribution of vegetation in other parts of the country have also been recorded, and the one example of such a study (11) reflects on Asir region. Study number (12) was on Qassim area and the other study illustrated Hail region (13; 14). People living in desert and semi-desert areas experience many challenges. These include the use of wood as a source of fuel and for coal production (15). The people living in these areas do not realize that they can revert to other sources of fuel rather than use wood found in the dry areas.

There are close relationships between groups of plants and saline soils over the world, (16), (17), (18), and (19). High saline soils discourage the growth of plans and also inhibit their re-development. Through the use of Sodium adsorption ratio (SAR), electrical conductivity (EC). and pH, (20) suggested that there was a relationship between selected species of salt brush in both Arizona and New Mexico. About their adaptability to the tests, the species got ranked from the highest to the lowest. The species arranged in order of adaptability from the most adaptable to the least adaptable are: *Atriplex corrugata, A. obovata, A. cuneata, A. flacata, A. confertifolia* and *A. canescenes*. (21) conducted the analysis on salt grass meadow, and realized that sodality, physical characteristics, salinity, and fertility affect the vegetation cover and the composition of species in an area.

There is an increase in the invasion of Gardner's saltbush ecosystems by halogeton, which is an annual halophyte that lowers the biodiversity of plants by increasing the salinity in the surface soil (17). The researchers found that transplants of Russian wildrye and forage

kochia lowered the frequency of halogeton by 52% compared to the control. The fact that Russian wildrye and kochia transplants reduce the population of halogeton offers an opportunity to rehabilitate areas that are invaded by halogeton.

The outcomes of (18) show that when it comes to grazing wheatgrass pastures, if spring grazing is reduced, mostly in the booting stage, the herbage would increase. Reduction in spring time grazing can increase both the quality and the yield of the wheatgrass pastures. In case the objective of increasing the wheatgrass pastures through reduced grazing in spring is to have adequate amounts of hay in winter or silage, then the pasture should be cut in the early stages of ear emergence as this keeps the quality and quantity of herbage at maximum.

A study was conducted in Al-Qassim region to identify the poisonous plants that survive in these areas and those that have effects on the health of both human and animals. 42 species that belong to 39 different genera and 23 families were taken into account. It was found that five species of family Poaceae were the most toxic to the plants that produced flowers (19). Closely following this were plants from families Boraginaceae and Chenopodiaceous that each had four species. It is reported that the toxic plants constitute about 10% of the total plant population in the area. Most of them grow in wadi beds, sand ridges, and Riyadh. These habitats support different plants with Wadi beds supporting tall shrubs and trees and underneath them survive some short bushes. Tussock grasses and deep-rooted shrubs are mainly found on the sand ridges. Riyadh is a habit characterized with excessive precipitation runoffs that go through the water-courses. When the conditions are favorable, these areas form conducive grazing grounds. Grasses and mesophytic annual herbs usually grow during the cold season creating the foraging environments. Most people who live in the region find these places conducive for grazing their livestock. The paper will try to reflect on species and various groups of plants found in the Rawdhat areas. It will identify and bring out the relationship between the properties of soil (chemical and physical) and the effects that they have on the growth of various plants.

(19) conducted a study the varieties as well as relationships of the quality and yield relationship of two harvest management techniques in tall wheatgrass. The researchers looked at the different

results when crops receive one cut annually and when they are cut twice annually. The results of the study show cutting the vegetation twice a year produced lower yield with high quality. However, the one cut management procedure had higher yields with relatively low quality. This shows that frequent cutting of vegetation tends to improve dry matter yield.

Vegetation has a strong influence on the functioning of the ecosystem because among other things (20), it affects the nutrient distribution within the landscape. The volume of vegetation has an effect on the chemical properties of the soil. Different plants have different effects on the chemistry of the soil. However, desert shrubs such as *Sarcobatus vermiculatus*, *Atriplex* spp., *Coleogyne ramosissima*, and *Larrea tridentate* have the most effects on the soil, particularly on the concentration of nitrogen and potassium ions under their canopies. Also, the extent to which vegetation affects the characteristics of soil also depends on soil's initial characteristics.

In the current periods, Rawdhat Salasil is under the management of the municipal council of Uyun Al Jiwa. People are not allowed to graze in the area until annual seeds get set. To the delight of the locals, the government does not set a limit on the quantity of livestock that a person can have. The animals that are kept by most grazers are camels, goats, and sheep. The annual plants highly influence the production of forage during the rainy seasons.

Figure 1: Map of Uyun Al Jawa in which the study was conducted (Source: Google Maps).

Figure 2: Map of the the study area showing the distance from the sea. (Source: Google Maps).

Climatic Condition

The climate in the region is a hyper desert that involves hot summer and a relatively mild winter. The average maximum and minimum temperatures are 33` C and 25` C respectively. The annual precipitation averages 100mm pa characterized by a significant variation each year. 70% of the annual precipitation falls between January and April.

Materials and Methods

Study Area

This study was carried out in Rawdhat Salasil located around 70 kilometers in northern Buraydah with geographical descriptions as (26° 24` 58" E). The location is about 30 km towards the north of Uyun Al Jiwa city. It is a depression that runs center wards, and it covers about 87,500 square kilometers. Three wadis that run eastward feeds the place with rainfall water. Wadi alraan supplies the area in the east north; Nadheem supplies the southeast part while Wadi Zarrar provides the east. The other wadi, Alowaini, contains the northern part with water. Various mountains surround Rawdhat to the east and south as well as the northeastern regions. On the other side, the west of the place is covered by gravel soil that has a few vegetation.

Figure 3: Map of Northern Buraydah where the study was conducted. (Source: Google Maps).

Methodology

The area of study got divided into 50 squares that measured 5 square meters each. There were ten squares in each group of the plants. Much care was observed while selecting the squares to make sure that significant degree of physiognomic and physiographic homogeneity found about the ecological factors like vegetation and the habit. (23) Put forth those particular standards were applied to cover the main physiographic differences observed in this place. In each stand, a count-floristic list was handled, and the relative frequency, as well as the density of various existing species, were worked out, and the relative vegetation cover was found out through an application of the line intercept method.

Importance value (IV) for these species was discovered by addition the relative cover, relative density, and relative frequency. Records of annual species for each stand were noted. The importance value refers to the measure of the dominance of a species in a given area. The relative cover refers to the relative area covered by a plant species as a percentage of the area occupied by other species in the region. The relative density refers to the density of a single plant species as a percentage of the total plant density. The relative frequency refers to the percentage of the total quadrats containing at least one rooted individual of a certain species.

Figure 4: Satellite image of Northern Buraydah where the study was conducted. (Source: Google Maps).

Soil Analysis

Samples of soil up to a depth of 50 cm got derived from each of the stands, and they got tested in the laboratories found at King Saud University in Saudi Arabia. The analysis got conducted to determine the soil texture and its contents like silt, salt and clay and the total organic matter in the soil. Materials, pH, and electrical conductivity tests got applied to the soil samples (Na+, K+, Ca++, Co-3%, Cl-%. These were the test carried in the laboratory. The study to identify the plant species was adapted from previous studies on plants in the country (26), (27), (10), and (28). The distribution of the data was got from Migahid (26).

Results

Plant communities widely distributed in the chosen transect and the other parts of the study area are in Table 1. Five plant communities and a semi bare soil across the transect were observed in the transect. They got arranged as follows 1/*Haloxylon persicum* Bunge ex Boiss. community, 2/*Tamarix nilotica* Ehrenb. community, 3/*Salsola imbricate* Forssk. community, 4/*Panicum turgidum* Forssk. community, 5/Pulicaria undulata L. community:

1 – *Haloxylon persicum* Bunge ex Boiss. Community:

In this community, the *Haloxylon persicum* Bunge ex Boiss. is a dominant perennial shrub with an importance value of 47.88%. This community's representation was seven perennial plant species associated and 14 plant species annual distributed in the dune micro-habitats in Rawdhat. The soil texture of different layers in the

community from sand. Soil pH is alkaline and ranged between 8.76 and 8.83. Electrical conductivity (EC) varied from 0.137 mmoh/cm to 0.131. Organic matter (O.M. %) ranged from 0.174% to 1.68%.

Figure 5: Image of *Haloxylon persicum*. (Source: Author).

Sodium cation concentrations ranged between 17.46 meq/l to 17.38; Potassium cation concentration ranged between 10.56 meq/l to 10.46 and Calcium cation ranged between 10.46 meq/l to 10.52. Chloride anion concentrations ranged between 0.017 meq/l to 0.016 and Carbonate anion concentration ranged between 0.022 meq/l to 0.020. Table (1, 2)

2 – *Tamarix nilotica* Ehrenb. Community:

In this community, the *Tamarix nilotica* Ehenb. is perennial shrub with an importance value of 60.48%. This community is represented by nine perennial plant species associated and five plant species annual distributed in the clay micro-habitats of the northern part of the Rawdhat. The soil texture of different layers in the community from sand. Electrical conductivity (EC) varied from 12.93 mmoh/cm to 5.93 mmoh/cm. Soil pH is alkaline and ranged between 8.56 and 8.69. Organic matter (O.M. %) ranged from 0.174% to 0.160%.

Figure 6: Image of *Tamarix nilotica*. (Source: Author).

Sodium cation concentrations ranged between 25.85meq/l to 20.98; Potassium cation concentration ranged between 10.99 meq/l to 10.53 and Calcium cation ranged between 30.08 meq/l to 20.51. Chloride anion concentrations ranged between 0.021 meq/l to 0.017 and Carbonate anion concentration ranged between 0.023 meq/l to 0.020. Table (1, 2)

3 – *Salsola imbricata* Forssk. Community:

The *Salsola imbricate* Forssk. is a perennial herb with an importance value of 60.18%. This community is represented by seven perennial plant species associated and 11 plant species annual distributed in the sandy-clay soil of the central part of the Rawdhat. The soil texture of different layers in the community from sandy-clay. Electrical conductivity (EC) varied from 0.186 mmoh/cm to 0.169 mmoh/cm. Soil pH is alkaline and ranged between 8.30 and 8.43. Organic matter (O.M. %) ranged from 0.189% to 0.178%.

Figure 7: Image of *Salsola imbricata*. (Source: Author).

Sodium cation concentrations ranged between 18.89meq/l to 18.46; Potassium cation concentration ranged between 11.76 meq/l to 11.43 and Calcium cation ranged between 11.76 meq/l to 11.43. Chloride anion concentrations ranged between 0.029 meq/l to 0.024 and Carbonate anion concentration ranged between 0.034 meq/l to 0.029. Table (1, 2)

4 - *Panicum turgidum* Forssk. Community:

The *Panicum turgidum* Forssk. is a perennial herb with an importance value of 65.1%. This community is represented by four perennial plant species associated and eight plant species annual distributed in the edge of the Rawdhat and Wadi bed and often grown in sandy-clay soil. The soil texture of different layers in the community from sand. Electrical conductivity (EC) varied from 0.175 mmoh/cm to 0.147 mmoh/cm. Soil pH is alkaline and ranged between 8.20 and 8.61. Organic matter (O.M. %) ranged from 0.185% to 0.177%.

Figure 8: Image of *Panicum turgidum*. (Source: Author).

Sodium cation concentrations ranged between 18.86meq/l to 18.40; Potassium cation concentration ranged between 11.24 meq/l to 10.83 and Calcium cation ranged between 11.65 meq/l to 11.22. Chloride anion concentrations ranged between 0.019 meq/l to 0.015 and Carbonate anion concentration ranged between 0.026 meq/l to 0.018. Table (1, 2)

5- *Pulicaria undulata* L. Community:

The *Pulicaria undulate* L. community is predominantly an annual shrub with an importance value of 91.79%. This community is represented by five perennial plant species associated and 12 plant species annual distributed in the little habitats of the northern parts of the Rawdhat. The soil texture of different layers in the community from sand. Electrical conductivity (EC) varied from 0.167 mmoh/cm to 0.162 mmoh/cm Soil pH is alkaline and ranged between 8.53 and 8.66. Organic matter (O.M. %) ranged from 0.186% to 0.180%.

Figure 9: Image of *Pulicaria undulate*. (Source: Author).

Sodium cation concentrations ranged between 18.75meq/l to 18.60; Potassium cation concentration ranged between 11.66 meq/l to 11.55 and Calcium cation ranged between 11.67 meq/l to 11.45. Chloride anion concentrations ranged between 0.029 meq/l to 0.025 and Carbonate anion concentration ranged between 0.033 meq/l to 0.029. Table (1, 2).

Discussion

Vegetation in Rawdhat Salasil characterized in density plant species decline, and suggests studies carried out by each of (29), (30), (31), (32), (33), (34), (35), (7), (5), and (6). The environmental stress causes the decrease in plant density of the natural vegetation. The stress due to the natural environmental that these plant types face in the study zone are caused by the severe drought resulting from the lack of rainfall and its irregularity. Besides, the extreme temperature and high rates of evaporation play a huge role in making plant life difficult. All these factors combine to reduce the density of species in general. It seems that within the environmental stress framework, other irreverent environmental factors lead to additional stress and play a significant role in reducing the density of species, and they are represented in habitats with characteristics which are formed by plant communities. That can be cited by identifying the habitats'

characteristics developed by plant communities and its relationships to plant species density in these communities.

According to (21), plants that grow in the wetlands of America help in identifying the borders of the wetland. These plants also help in the identification of their evolutionary characteristics that helps them survive and thrive in a saturated environment. However, more than 50% of American wetlands have disappeared since the time of European settlements while the remaining patches remain threatened by alterations of the landscape by humans. Also, some invasive plants have displaced the native and more desirable species. (16) discuss the three main categories of ecosystem that are dependent on ground water. These include the ecosystems that reside inside groundwater such as stygofauna and karsts, ecosystems that require the surface expression of ground water such as wetlands and springs and ecosystems that depend on the ability of the sub-surface ability to produce groundwater based on the depth the plants can drive their roots into. Also, the research shows ways to increase the availability of groundwater such as remote sensing, modelling and other complicated modelling applications.

Plant species density in plant communities that live in sand dunes within *Haloxylon persicum* Bunge ex Boiss. The community has a low density due to the nature of its moving sands and the fact that this environment is exposed to many factors which increase the transpiration and evaporation as a result of its direct exposure to high winds blowing and this would increase erosion. Due to the lack of water, this environment contains few plant species like perennials adapted to live in such conditions, which bear sands and can grow quickly above the heaped sands. (1) established the importance of winds hitting Saudi Arabia from the North East, North and North West. Within the Kidian North area, the wind mainly comes from the northern areas and include the Simoom, Haboob and Shamal. The study shows the movement and effects of the wind and its findings can be used in selecting the locations for the development of wells and other facilities in the region.

(24) show that the potential to denitrify the soil depends on the hydrological conditions of the soil in question. Most of the people living in areas with wetland soils use NirS-type denitrifies. In areas that receive occasional floods, there are higher incidences of nosZ and nirK genes. The composition of the soil affects the presence of

particular genes in various wetland soils. Moreover, there is a difference in the relationship between the gene and the environment.

Field work done in Saudi Arabia's southern and central regions as well as in agricultural areas by (27) have resulted in the collection of four vascular plants that are new to the kingdom's wetland and terrestrial plant population. Examples of these new plants include the addition of a new genus *Malvastrum* A. Gray (*M. coromandelianum*) subsp. *capitato-spicatum* (O. Kuntze) S.R. Hill, *Potamogeton perfoliatus* L. (Potamogetonaceae), *Euphorbia tirucalli* L. (Euphorbiaceae) and *Sesuvium portulacastrum* (L.) L. (Aizoaceae). With these new discoveries, (27) recommend that Saudi Arabia is need of a serious exploration of flora.

The density of plant species in *Tamarix Nilotica* Ehrenb. community which forms an internal salt march environment is also low because the soil contains high concentrations of salts, especially sodium ions which may cause the toxicity of plants if their concentration is high in addition to carbonate ions which form a layer of the soil where it hinders the movement of water or reduces the ability of plants' roots, which are growing. The variables in the environment that affect the distribution and diversity of species in an area include the texture of the soil, the soil's electrical conductivity, the altitude as well as the concentration of Manganese, Magnesium and Calcium ions (30). An increase in the herbaceous species in an area increases the turnover, richness, cover and evenness of other plant species. Plant populations vary from one species to another and affect inter-specific relations.

Between 1964 and 1999, the *Salicornia* species of Saudi Arabia were mistakenly treated as the European species *S. europaea* L. However, explorations made in the recent years show that there are two allopatric species of *Salicornia* in Saudi Arabia found in the salt marshes of Najd and in the coast of the Arabian Gulf (33). Ecological, exploratory and morphological studies confirm that the two species are distinct. This shows the importance of doing a full exploratory study on the plants in Saudi Arabia.

The species density in *Panicum turgidum* Forssk. community is low because of the dry environment, which is partly due to the scarcity of rainfall; the available water source in its environment. There are also other factors including transpiration and evaporation which have an apparent impact on the fact that its environment is open

and more exposed to dry, hot and fast winds. The plant's species density in *Tamarix nilotica* Ehrenb, *Panicum turgidum* Forssk. and *Pulicaria undulate* L. communities is low because of the overgrazing in vegetation, which reduces the plant species density.

One of the primary causes of the degradation of rangelands in Saudi Arabia is livestock grazing. In order to conserve biodiversity, fencing appears to be the ideal way to exclude grazers. The exclusion of livestock results in a significant increase in plant cover, species richness and density of grasses, trees, shrubs and other annuals. (31) conclude that the establishment of livestock exclusion could be a sustainable tool that helps in the restoration of vegetation and conservation of the diversity of plants in degraded rangelands.

(36) conducted a vegetation assessment in the arid regions of Kuwait between 2008 and 2009. The study made an analysis of the richness of vegetation in relation to human activities such as recreational camping and grazing. The study showed that the open grazed land not only had fewer species, but also a low vegetation cover. The conditions of the habitat were particularly poor NS. (36) conclude that the low plant diversity in the unprotected areas demonstrates the need for a fresh perspective on the rehabilitation of ecological habitats.

The chemical analyses of soil types in communities and sectors show that the organics are minuscule, ranging between (0.160 and 0.189%), and it is a well- known phenomenon in the arid lands where the organics do not exceed 4% (36) and (37). (29) note that for over one hundred years, ecologists have tried to discover the driver of species diversity. Answering this question is important today more than ever because of issues such as the loss of biodiversity and the importance of having a rich diversity in species for the functioning of the ecosystem. (29) test the hump-backed model, which is a model that uses a unimodal relationship to explain the richness of plants that are above the surface of the ground and the plant biomass.

The pH number shows (pH in soil samples. It tends to alkalinity ranging between (8.30 – 8.83). This may be due to the absence of organic matter (37) as well as the scarcity of rainfall, and thus the lack of soil washing process to get rid of the elements released by various weather factors (38). The pH number is one of the most important characteristics of the chemical soil, which affects the availability of nutrients and the vital activity of microorganisms. The

electrical conductivity (E.C) which is a considered as a good indicator of concentration degree of the total dissolved salts in the soil that affect the growth of plants and reproduction are ranging between (0.131- 12.3 mm hos/cm), and this shows that the soluble salts are very few due to the increase of washing and removal processes, especially after rainfall. Therefore, the concentration of the total dissolved salts in the soil of study zone is suitable for plants growth.

(37) argue that soils in the arid and semi-arid areas are strongly affected by the accumulation of carbonated and other soluble salts. Gypsum and carbonates have a significant effect on the chemical properties of the soil. This calls for development of fast, reliable and cheap techniques to measure the concentration of gypsum and carbonates within the soil. (25) show that the interaction that organisms have with one another and their environment contributes to the functioning of the ecosystem, the cycling of nutrients as well as biogeochemical processes. For example, soil microorganisms affect the availability of soil enzymes as well as the dynamics of organic matter within the soil.

With the improved techniques that help in the study of soil and its characteristics, it is possible for scientists to study ecology, microbiology and biochemistry of soil to great depths. The botanical studies in a number of centers for plant diversity in Saudi Arabia have resulted in the discovery of a pair of genera that were not considered part of the natural flora of Saudi Arabia. After giving the descriptions and distributions of the *Operculina turpethum* (L.) Silva Manso (Convolvulaceae) and *Parthenium hysterophorus* L. (Asteraceae), (26) also present a distribution map. With these two additions, the vascular genera in Saudi Arabia are currently 855 while the total number of species is 2,290.

As a result of high (pH) number, element sodium had recorded a remarkable increase in all samples in the study zone. The concentration is ranging between (16.98- 18.89 ppm), and that is because of washing processes of the soil caused by little rainfall. The primary nutrient analysis shows that it is weak and small because of sandy soil and removal of these items to the lower layers of soil by the rain. Potassium (K) in the soil samples, which are taken from study zone, had ranged between (10.46 - 11.83 ppm), and this is extremely low level. Perhaps the extremely low level of potassium in the samples is due to its washing or because of rainfall. In general, the

appropriate potassium level for plant growth is estimated at 175 ppm. Also, the increase of sodium reduces the absorption and accumulation of potassium (Flowers et al., 1977). The calcium (Ca) had recorded an increase ranging between (10.51-11.76 ppm), while the carbonate had registered a severe decline and its value ranged between (0.018 - 0.034%), and chlorides which its value ranged between (0.015 - 0.029%).

(39) did a study to study the spatial pattern and the relationship between vegetation and environmental factors in the Jazen area. The outcomes showed that moisture, pH, organic carbon, electrical conductivity and the presence of soil cations affect the growth of vegetation.

Haloxylon persicum Bunge ex Boiss. community exists in the north of the Kingdom as (34) had pointed out. This community consists of the various sandy structures. Data from the table 2 show the soil texture of the environmental habitat (15). The soil has a sandy texture in the depth of (5cm). That is what (27) had found out when he mentioned that the plant which lives on little sand is halophyte. Both (34) have referred that the soil texture controls the structure and the distribution pattern. (42) studied the vegetation types and composition patterns in Al Baha in Saudi Arabia. The outcomes of the study showed that plant species in the wadis, sandy plains, rocky outcrops and drainage lines correspond to the area's topography and elevation.

Tamarix nilotica Ehrenb. community exists in the center of the Kingdom as (30) pointed out, and in the south too as (39) have previously mentioned. *Salsola imbricate* Forssk. community is in the center of the Kingdom according to (40). *Panicum turgidum* Forssk. community exists in the west of the Kingdom (41) and (31), and the south of the Kingdom (39) (42) mentioned that this community exists in the southwest of the Kingdom. Also, in the center of the Kingdom according to (7), (5) and (40). The structure of this community and its distribution pattern is related to many factors including some physical characteristics like water content as (41) and (31) have pointed out, and some chemical components represented in the total dissolved salts and the concentration of Sodium. *Pulicaria undulate* L. community exists in northwest of the Kingdom according to (35) and in the center according to (7). This community forms a low habitat in rainwater course, and its structure and distribution pattern is associated with several factors including some physical characteristics like soil texture

and water content (35) and some chemical characteristics like the rate of organic matter.

On stressing the importance of understanding soil reactions and aquatic environments, (23) discuss the effects of pesticides, organic pollutants and fertilizers on the availability of nutrients and quality of groundwater. (23) show that the reactions on the soil and constituents of soil can be measured using a variety of techniques. Also, the interaction mechanisms with organic pollutants and pesticides have harmful effects to the composition and biology of soil.

Table (1): The value of the relative importance of plant communities and associated species in Rawdhat Salasil

Plant Species	**Plant community**				
	Haloxylon persicum Bunge ex Boiss**.**	***Tamarix nilotica*** Ehrenb.	***Salsola imbricata*** Forssk**.**	***Panicum turgidum*** Forssk.	***Pulicaria undulate*** L**.**
	Importance Value (I.V)				
Anthemis deserti Boiss.	**16.81**				
Aizoon canariensis L.					**7.53**
Arnebia hispidissima Lehm.	**11.72**	**21.17**	**7.45**		**25.67**
Atractylis carduus Forssk.	**3.92**	**29.15**			
Astragalus eremophilus Boiss.					**7.25**
Asphodelus fistulosus L.			**9.79**		
Calednula tripterocarpa Rupr.					**5.50**
Citrullus colocynthis L.	**8.12**			**6.78**	
Cynodon	**10.99**	**17.91**	**19.09**	**19.42**	**14.87**

dactylon L.					
Cyperus rotundus L.		**22.58**	**35.74**		**6.71**
Eremobium aegyptiacum Sprengel.	**35.08**	**47.40**	**21.47**	**64.94**	
Emex spinosus L.	**9.28**		**6.57**		
Haloxylon persicum Bunge ex Boiss.	**47.88**	**6.44**			
Koelpinia linearis Palla, Reise.	**19.84**		**7.10**		
Launaea nudicaulis L.	**19.05**			**28.50**	**10.97**
Lycium shawii Roemer & Schultes.	**6.62**	**9.44**			
Malva parviflora L.	**5.14**	**9.01**	**16.91**		**8.07**
Medicago laciniata L.					**5.59**
Moltkiopsis ciliata Forssk.				**8.96**	
Panicum turgidum Forssk.	**9.41**			**65.01**	
Plantago boissieri Hausskn.	**28.67**	**2.57**	**20.87**	**53.36**	**19.95**
Plantago ovata Forssk.	**11.69**				
Plantago coronopus L.			**8.48**		**6.29**
Picris babylonica			**9.19**		**6.65**

hand.-Mazz.					
Pulicaria undulate L.		**6.52**			**91.79**
Salsola imbricata Forssk.	**6.84**	**21.16**	**60.18**	**10.64**	**19.58**
Schimpera Arabica Hochst.	**12.12**				
Schismus barbatus L.	**10.68**	**20**	**11.02**	**16.20**	**19.67**
Seidlitzia rosmarinus Bunge ex Boiss			**9.91**		
Silene villosa Forssk.	**6.46**				
Stipa capensis Thunb.			**6.62**	**8.03**	
Suaeda aegyptiaca Hasselq.		**8.22**	**6.48**	**10.30**	
Tamarix nilotica Ehrenb.		**60.48**	**28.69**		**38.10**
Teucrium oliverianum Ging.	**7.62**				
Trigonella hamosa L.					**5.81**
Tripleurospermum auriculatum Boiss.	**12.42**				
Zygophyllum simplex L.			**14.43**	**7.86**	

Table (2): Means and standard deviation of the different edaphic factors representing the different vegetation communities of the study area. Soil texture, Organic content (%), carbonate (%), Chlorides (%) and Na+, K +, Ca + +.

Soil factors	Soil Depth (cm)					
		Haloxylon persicum	*Tamarix nilotica*	*Salsola imbricata*	*Panicum turgidum*	*Pulicaria undulata*
Soil texture	5	Silt Soils	Silt Soils	Sandy clay	Sandy Soils	Sandy Soils
	50	Sandy Soils	Sandy Soils	Sandy Soils	Sandy Soils	Sandy Soils
Soil pH	5	8.76±0.10	8.56±0.26	8.30±0.09	8.20+0.20	8.53±0.23
	50	8.83±0.06	8.69±0.16	8.43±0.13	8.61±0.17	8.66±0.25
E.C. Mmoh /cm	5	0.137±0.009	12.3±1.33	0.186±0.015	0.175±0.057	0.167±0.010
	50	0.131±0.007	5.93±0.43	0.169±0.021	0.147±0.019	0.162±0.009
Organic Matter (%)	5	0.174±0.015	0.174±0.007	0.189±0.010	0.185±0.015	0.186±0.006
	50	0.168±0.014	0.160±0.002	0.178±0.013	0.177±0.008	0.180±0.007
Na +	5	17.46±0.39	25.85±1.24	18.89±0.28	18.86±1.40	18.75±0.28
	50	17.38±0.36	20.98±0.52	18.46±0.65	18.40±1	18.60±0.23
K +	5	10.56±0.31	10.99±0.62	11.76±0.32	11.24±0.44	11.66±0.32
	50	10.46±0.31	10.53±0.15	11.43±0.57	10.83±0.44	11.55±0.35
Ca ++	5	10.46±0.36	30.08±0.65	11.76±0.17	11.65±0.59	11.67±0.23
	50	10.52±0.32	20.51±0.12	11.43±0.56	11.22±0.56	11.45±0.15
$Co^{-}3$(%)	5	0.022±0.003	0.023±0.004	0.034±0.006	0.026±0.009	0.033±0.008
	50	0.020±0.003	0.020±0.001	0.029±0.006	0.018±0.08	0.029±0.006
Cl^{-} (%)	5	0.017±0.003	0.021±0.002	0.029±0.004	0.019±0.007	0.029±0.006
	50	0.016±0.003	0.017±0.007	0.024±0.004	0.015±0.004	0.025±0.004

Conclusion

This study was a botanical and ecological survey in Rawdhat Salasil, Al-Qassim region, Saudi Arabia. The plant communities in the area of the study were examined through sampling using the List Count Quadrant method. There are several highlights from the study. For example, the study established that human activities such as grazing and recreational camping has a negative effect on the plant communities in the region. Another highlight of the study is that there are several species that are in Saudi Arabia, that were not recorded as part of the local species. There were also other species that were confused for foreign plan species, but further analysis of their morphology and genetics indicated that that the species, while looking almost similar to the foreign plants, are actually part of Saudi Arabia's complex plant biodiversity. Therefore, it is important that a full exploration of the plant species in the kingdom be done to identify all the previously unrecorded plant species and also, to determine the species that are in danger of extinction so as to come up with measures to protect and restore the plant population. While fencing remains the most effective way to guard against herders, it is important that public education is enhanced so that herders will know the benefits of not herding their animals in every place because ultimately, it is impossible to fence every place.

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