African Journal of Environmental Science and Technology Vol. 5(9), pp. 668-672, September 2011
Available online at http://www.academicjournals.org/AJEST
DOI: 10.5897/AJEST11.009
ISSN 1996-0786 ©2011 Academic Journals

Full Length Research Paper

Ecological study on Uyun Layla in Saudi Arabia

Wafaa Mohammed Al-Ghanem

Department of Botany, Faculty of Science, Princess Nora University,Al-Riyadh- Saudi Arabia. E-mail: taia_taxonomy@hotmail.com

Accepted 11 July, 2011

Soil characters and vegetation types have been investigated in the desiccated Uyun Layla lakes from October, 2007 till May, 2010, except during the summer months. The vegetation in and between the 23 dolines was very poor. Twenty xerophytic species were recorded mainly *Zygophyllum coccineum, Zygophyllum simplex, Salsola* spp., *Traganum nudatum, Haloxylon salicornicum, Zilla spinosa, Rhanterium epapposum* and *Gymnocarpos decandrum*. The importance value (I.V.) of all the species has been calculated and their taxonomic position has been described. The soil was sandy, yellowish white and very poor in minerals. In spite of that, the total soluble salts, calcium and copper contents were considerably high. The results have been discussed and interpreted according to the environmental changes occured in this area.

Key words: Al-Aflag, Uyun Layla, soil characters, vegetation.

INTRODUCTION

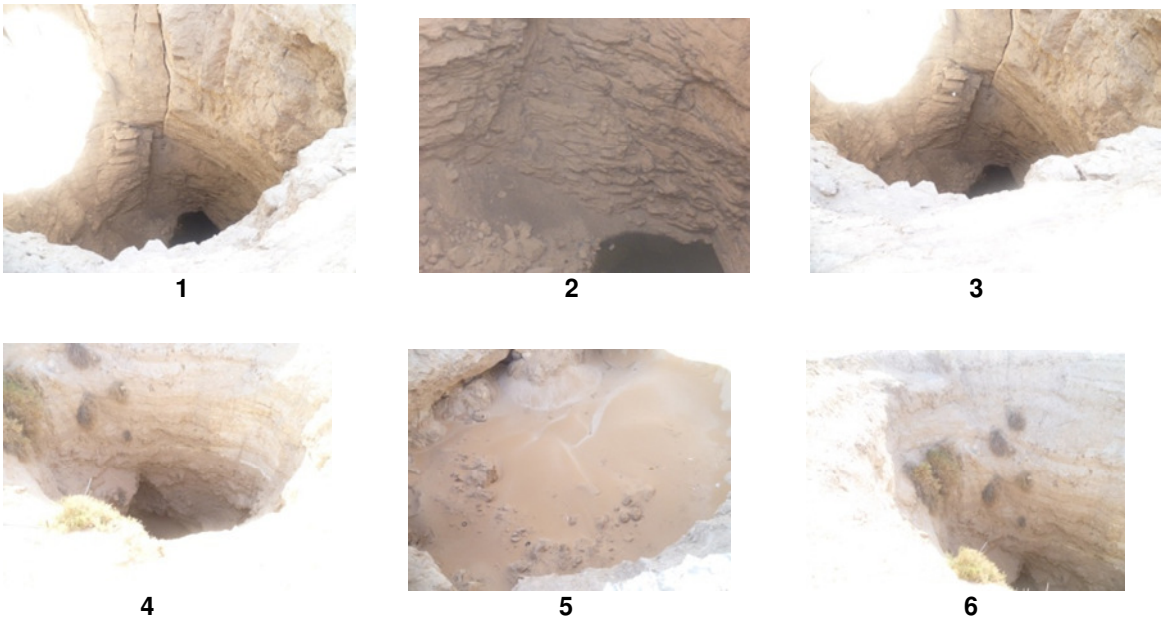
Wetlands in Saudi Arabia have been subjected to high pressure from both human activities and global warming. The report of the IUCN (1984) indicated the destruction of the wetlands and change in the habitats in Saudi Arabia. Mackey (2007, cited in Taylor and Figiis) predicts an interaction between climate change and other drivers of biodiversity that will increase extinction risk from what occurred in periods of rapid climate change in the past. Sambas and Symens (1993) pointed to the great loss of the wetlands in the Gulf area. Frazier and Stevenson (1999) described the Middle East area as being largely semi-arid to arid and they pointed to the lack of information in these areas. This is the state of Saudi Arabia, but there are some coastal or lowland areas receiving great amount of rainfall leaving ponds or sometimes lakes behind. Uyun Laila was an example of these lakes which originated from severe rainfalls during the winter season. These lakes, located 10 km south Layla town in Al-Riyadh Province, are a series of small to medium sized limestone karst lakes, which were unique in the Arabian Peninsula (Newton, 1995). The lakes were popular recreational area in the past, given its proximity to Riyadh and al Kharj. These lakes have been subjected to direct human pumping for cultivation, resulting in the current dryness situation. Due to the change in water availability, the vegetation and the soil characters have been altered. Al-Ghanem (2011) described the vegetation in these lakes by being scarce, restricted to few halophytic species. Accordingly, more works are needed to investigate the ecological change in this area. For this reason, the present study is one of the projects used to evaluate the amount of salts and minerals in the soils of the dry dolines and the effect it has on the vegetation.

Study area

The site area is about 3,000 ha. it is with an altitude of 540 m and 330 km. It is located south of Al-Riyadh city, the capital of Saudi Arabia. It comprises a total of 23 doline and sinkhole subsidence craters, of which five are shaped irregularly, the largest at about 1,500 by 500 m, and the other four ranging in size down to 250 by 75 m. The remainders are circular in shape, of which four measure between 100 and 175 m in diameter, and four are less than 100 m in diameter. Nearly all the craters are completely dry. Over-abstraction has caused extreme desiccation of the shallower dolines and sediments forming the crater walls and surrounding terrain.

MATERIALS AND METHODS

Monthly visits were done to the studied area from October, 2007 to May, 2010, excluded the summer times, to record the different plant species grown in this area. No quadrates have been done, but the



Photographs 1 to 6. The different dry dolines.

plant species grown in each doline have been recorded throughout the time of study. The importance value (I.V.) for each species was calculated as follows:

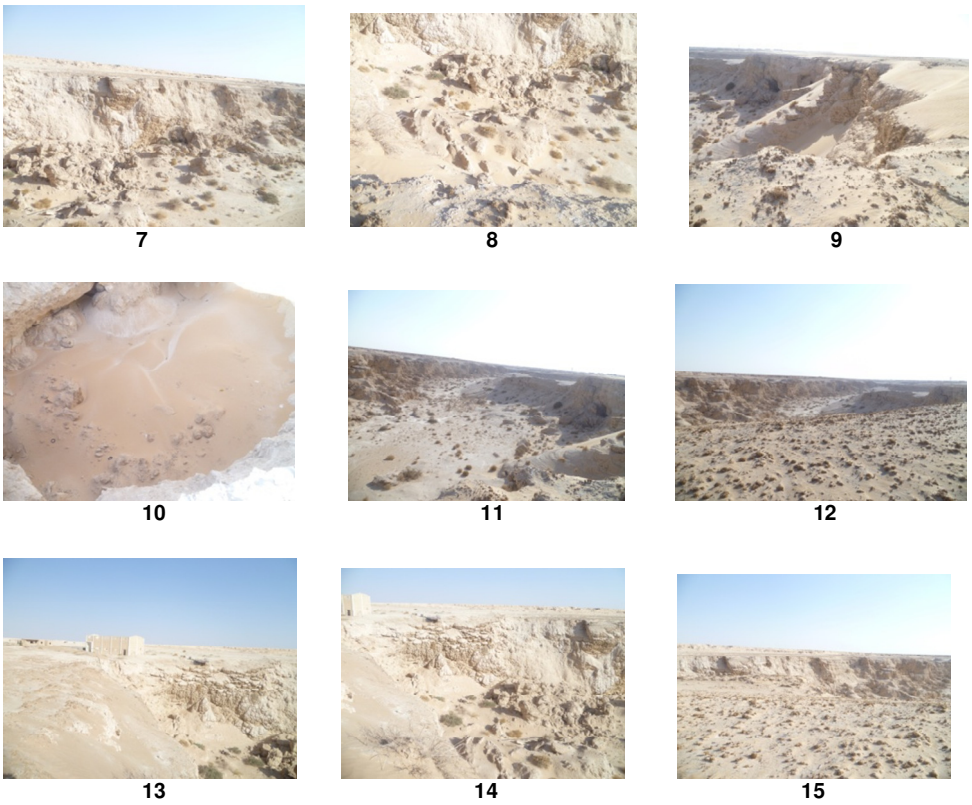
I.V.= Relative Frequency+ Relative density+ Relative cover.

Soil samples from the 10 selected dolines have been taken from 25 cm depth of the dolines for chemical analyses. Soil chemical analyses were done using X-ray method. Photographs of selected doline have been taken. The different species have been identified and put in its systematic position in the faculty herbarium for further investigation.

RESULTS AND DISCUSSION

Succulent perennial species mainly xerophytes are dominating in and around the desiccated lakes. Twenty perennial species were recorded during the studied period. These species are *Zygophyllum coccineum, Zygophyllum simplex, Aeluropus lagopoides, Cressa cretica, Limonium axillare, Pennisetum divisum*, *Lasiurus scindicus*, *Ochradenus baccatus* and *Fagonia bruguieri* scattered in these dolines. While *salsola* spp., *Traganum nudatum, Haloxylon salicornicum* and *Haloxylon persicum* are widely distributed at the flat bottom of the lakes. Meanwhile *Artemisia* spp., *Zilla spinosa, Rhanterium epapposum, Astragalus spinosus, Gymnocarpos decandrum, Achillea fragrantissima, Halothamnus bottae, Tephrosia apollinea* are found as scattered individuals at the sloping edges of the desiccated lakes (Photographs 1 to 15). Not all of these species were found during all the studied period, but they were recorded during the whole period. The abundant species were *Z. coccineum, Z. simplex, salsola* spp., *T. nudatum, H. salicornicum, Z. spinosa, R. epapposum* and *G. decandrum.* The taxonomic position according to Cronquist (1981) and the importance values (I.V.) of these species are listed in Table 1. Generally speaking the vegetation was poor during all the studied period, it was scarce and restricted to few xerophytic species. The soil at the bottom of the dolines was loose, sandy and yellowish white, while the wall was calcareous and grayish white (Photographs 1 to 15). Analysis of the chemical contents of the soil listed in Table 2 and illustrated in Figures 1 - 4 shows that the soil is alkaline with high amount of total salt and calcium ions (Figures 1 and 2). The amount of the investigated cations and anions is very low in all the analyzed dolines (Figure 2 and 3). The soil was poor in phosphorous as its maximum amount was 2.9. Meanwhile the copper content was considerably high reaching up to 15.4 (Table 2 and Figures 1 and 3).

This data coincide with that obtained by Jackson (1958), Daubenmire (1959), Al-Sheikh and Yousef (1981) and Al-Ghanem (2002). They found that the soil in the deserts is poor, alkaline with high soluble salt contents due to the rarity in rainfall. While the amount of Cl^- and S^- is in reverse proportion where the increase in Cl^- and decrease in S^- is expected in the deserts as found by Al-Moneyeri et al. (1986). The phosphorous content was very low due to the poor vegetation in this area as shown by Al-Homaid et al. (1990 b). The high contents of copper have its poisonous effect on plant growth (Al-Haish, 1985). This increase in copper contents may be due to the pollution from urbanization and human activities in the area.



Photographs 7 to 15. The poor vegetation and the sandy calcareous soil.

Table 1. Species recorded and their taxonomic position and I.V.

Species	I.V.	Order	Family	Phylla
Zilla spinosa	38.9	Capparales	Brassicaseae	Magnolophyta
Ochradenus baccatus	11.7		Resedaceae	
Zygophyllum coccineum	107.3	Geraniales	Zygophyllaceae	
Zygophyllum simplex	112.5			
Fagonia bruguieri	6.89			
Halothamnus bottae	7.4	Caryophyllales	Amaranthaceae *s.l.*	
Haloxylon salicornicum	89.5			
Haloxylon persicum	11.7			
salsola spp.	109.4			
Traganum nudatum	84.2			
Gymnocarpos decandrum	20.4		Caryophyllaceae	
Astragalus spinosus	5.8	Fabales	Fabaceae *s.l.*	
Tephrosia apollinea	3.8			
Limonium axillare	5.7	Plumbaginales	Plumbaginaceae	
Cressa cretica	1.8	Solanales	Convolvulaceae	
Rhanterium epapposum	22.6	Campanulales	Asteraceae	
Achillea fragrantissima	8.2			
Aeluropus lagopoides	5.8	Poales	Poaceae	Liliophyta
Lasiurus scindicus	7.2			
Pennisetum divisum	10.4			

Table 2. Mineral contents of the soil from 25 cm depth of 10 dolines.

Min. \ Dolines	1	2	3	4	5	6	7	8	9	10	Used materials
Mg	4.9	7.0	8.8	7.8	4.4	3.3	8.5	5.9	3.4	5.2	MgO
Si	6.2	6.9	8.4	8.9	6.2	6.1	8.4	6.4	5.8	6.2	Quartz
P	2. 8	2.1	1.7	2.1	2.2	1.9	2.9	2.0	2.1	2.2	GaP
S	4.0	2.6	3.2	2.9	2.4	2.6	3.8	3.8	4.1	2.8	FeS2
Cl^-	9.4	10.4	9.5	9.2	8.1	7.5	10.2	9.2	10.4	10.1	KCl
K^+	10.4	9.2	10.1	9.8	8.6	8.2	10.3	6.7	10.2	8.8	MAD
Ca^{++}	35.6	36.6	41,6	44.2	52.0	60.2	54.3	52.1	41.6	39.2	Wollas
Cu	15.4	13.4	6.4	7.9	7.2	6.1	5.2	7.1	10.8	15.3	Cu
Zn	11.3	11.8	10.3	7.2	8.9	4.1	7.3	6.8	11.6	10.2	Zn
Sum	100	100	100	100	100	100	100	100	100	100	

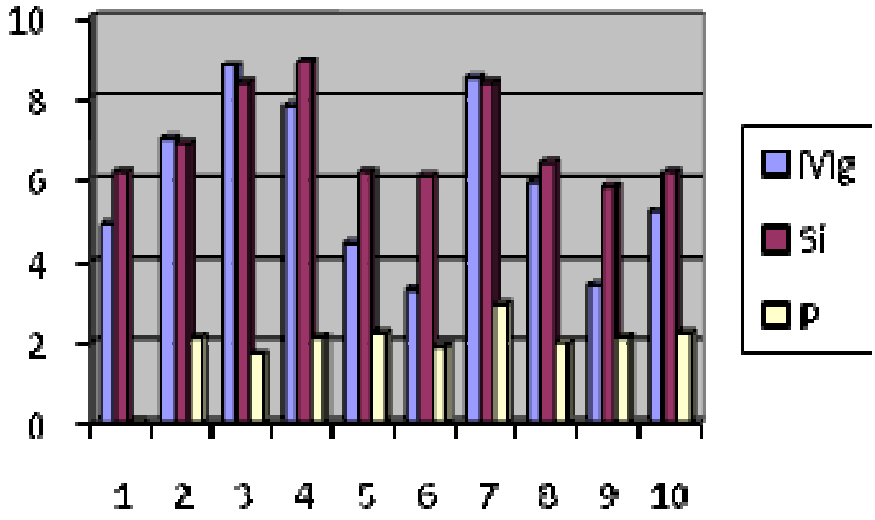


Figure 1. Show the element contents Mg, Si and P in 10 dolines.

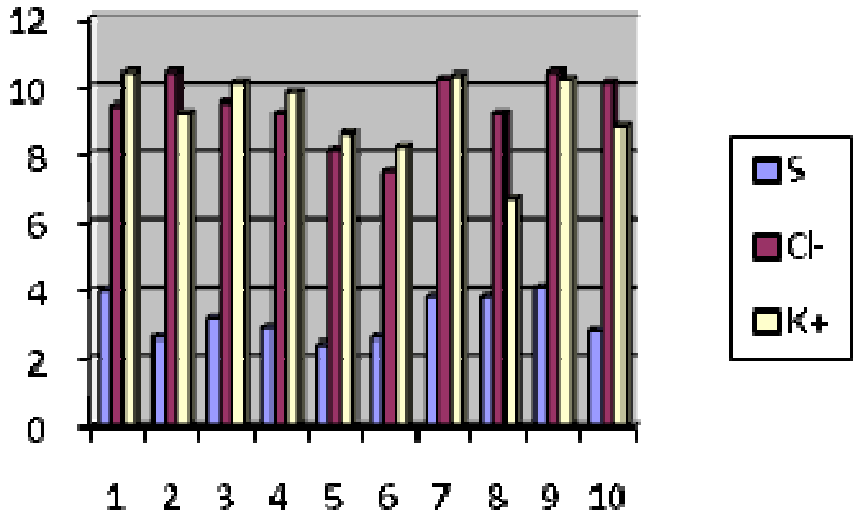


Figure 2. Show the element contents S, Cl^- and K^+ in 10 dolines.

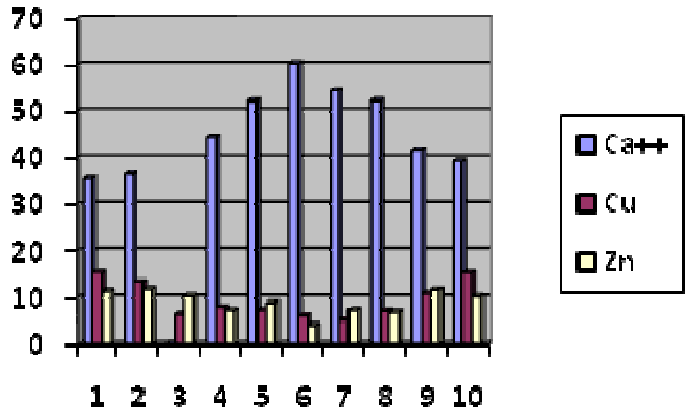


Figure 3. Show the element contents of Ca^{++}, Cu and Zn^{+} in 10 dolines.

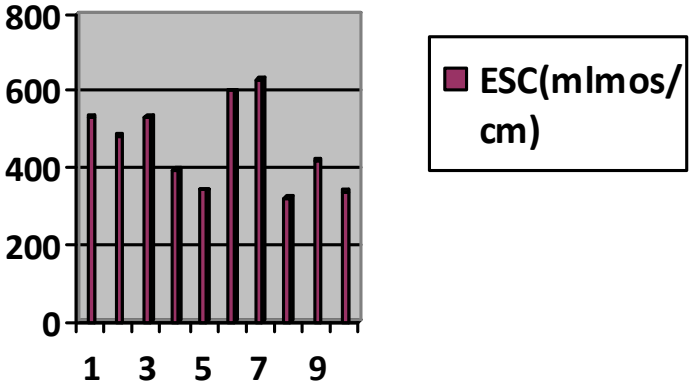


Figure 4. The total soluble contents.

The vegetation in and between these desiccated dolines is greatly affected by the soil characters and environmental changes that were happening in this area. According to Kent and Coker (1992) the main purpose of studying the vegetation is to know the dynamic and to develop strategies to protect the threaten species. In the studied area, we recorded twenty perennial xerophytic species only, with low I.V. This can be due to soil characters, dryness and climatic stress as found by Shaltout et al. (1997). Meanwhile the absence of annual species can be due to the sandy soil which cannot hold sufficient rain water in the surface area, in spite of the elevation of the sea level in Najd plateau, where Uyun Layla located.

From this study we can conclude that, pumping of water from Uyun Layla has led to a severe damage to the ecological conditions in this area. This change caused desertification, and alteration in soil characters and vegetation type. It is therefore an urgent task to develop plans to sustain the wild life in this area and improve the habitats in this area.

REFERENCES

Al-Ayesh FM (1985). The effect of copper and cadmium pollution on the growth and productivity of *Zea mays*. M.Sc. thesis, King Abdul Aziz Univ. Fac. Sci. Biol. Dept., Jeddah, K.S.A.

Al-Ghanem WM (2002). Comparative ecological studies on the natural vegetation of three different transects within Al-Riyadh region. Ph.D. thesis, Girls College of Education, Al-Riyadh, K.S.A.

Al-Ghanem WM (2011). Ecological report on the vegetation of Uyun Layla in Saudi Arabia. Alex. Sci. Exchang. J., 32(2): Under publication.

Al-Homaid N, Khan MH, Sadik M (1990). Ecology and some desert plant communities of the eastern province in Saudi Arabia. Arid Soil Res. Rehab., 4(4): 253-260.

Al-Monayeri MO, Khafagi OA, Ahmed AM, Al-Tantawy HE (1986). Contribution to the chemical composition of plants belonging to various ecological groups in the Red Sea area. Bull. Desert Inst., 36: 405-430.

Al-Sheikh AM, Yousef M (1981). Halophytic and xerophytic vegetation near Al Kharj springs. J. Coll. Sci. Univ. Al-Riyadh, 12(1): 5-21.

Cronquist A (1981). An integrated system of classification of flowering plants. Columbia University Press, New York, New York, USA.

Daubenmire RF (1959). Plants and Environment. A text book of plant autecology. John Willey and Sons Inc.

Frazier S, Stevenson NJ (1999). Review of wetland inventory information in the Middle East. In Global Review of Wetland Resources and Priorities for Wetland Inventory, eds Finlayson CM, Spiers AG, Supervising Scientist Report, Canberra, Australia.

IUCN/MEPA (1984). Report on the distribution of habitats and species in the Saudi Arabian Red Sea: Part 1. Saudi Arabia Marine Conservation Programme, Report No. 4. IUCN, Gland, Switzerland, and Meteorology and Environmental Protection Administration, Jeddah, Kingdom of Saudi Arabia. Cited in World Mangrove Atlas, eds Spalding M, Blasco F, Field CC 1997, International Society for Mangrove Ecosystems, Okinawa, Japan.

Jackson ML (1958). Soil Chemical Analysis. Constable and Co. Ltd. London.

Kent M, Coker P (1992). Vegetation description and analysis. A practical approach. CRC Press, Boca Raton, Ann Arbor, Belhaven Press, London, 363 p.

Mackey B (2007). Protected Areas: buffering nature against climate change. In Taylor, M., Figgis, P. eds. Proceedings of a WWF and IUCN World Commission on protected Areas symposium, Canberra, 18-19 June. Sydney: WWF-Australia, pp. 90-96.

Newton SF (1995). Kingdom of Saudi Arabia. In A Directory of Wetlands in the Middle East, ed DA Scott, IUCN, Gland, Switzerland and IWRB, Slimbridge, United Kingdom.

Sambas A, Symens P (1993). Developing a conservation plan for wetlands in Saudi Arabia: The NCWCD system plan for protected areas. In Wetland and Waterfowl Conservation in South and West Asia, Proceedings of an International Symposium, Karachi, Pakistan 14–20 December 1991, eds Moser M, Van Vessem J, IWRB Special Publication No. 25, AWB Publication No. 85, IWRB, Slimbridge, United Kingdom, and AWB, Kuala Lumpur, Malaysia, pp. 109–112.

Shaltout KH, Al-Halawany EF, Al-Garawany MM (1997). Coastal lowland vegetation of Eastern Saudi Arabia. Biodiv. Conserv., 6: 1027-1040.