



LOW AL-FAWWAR AND INVESTMENT POTENTIAL OF ITS BIODIVERSITY TO ACHIEVE SUSTAINABLE DEVELOPMENT : A REVIEW

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Abstract

Faydhat al-Fawwar is one of the most prominent natural lowlands in the desert of Al-Muthanna, in southwestern Iraq. This area is characterized by its unique natural properties. It includes a source of underground water which provides the region with water with sulfuric characteristics, where sulfur concentration is higher than other wells in Neighboring areas. It is also characterized by sandy loam soil that can be cultivated with different field crops or cultivated as pastoral areas. This area is the destination of many shepherds to graze their flocks. This region is characterized by a significant biodiversity (plant and animal). Rues (*Peganum harmala*) is one of the most prominent plants there. it spreads very intensively specifically in this region. In addition, this region can be considered as a destination and a safe resort for many species of domestic and migratory birds. Some of these species are at risk of extinction globally. The nature of the region in the middle of the desert and the availability of water and food helps to attract the birds from different places to stabilize in this lowland. So the recent study intended to discuss the possibility of developing this area to maintain the site characteristics from the deterioration as well as the possibility of benefiting from them to achieve sustainable development in the desert of Al-Muthanna.

Keywords: Faydhat Al-Fawwar, Biodiversity, Investment and Development

Introduction

The wetland (lowlands) are geomorphological aspects scattered in desert areas, including the western desert of Iraq. They are unique and distinct phenomena of what exists in other aspects in terms of form and biodiversity. It is varying its surface and its numerous manifestations (Mohammed, 2010). The advantage of location of the desert lowlands is the fact that they attract water, floods and sediments due to their slope. It provides them with water and thick sedimentary soil suitable for investment in agricultural production. Moreover, these lowlands are an area of intensive plant diversity, as well as important pastoral areas in the desert generally. They provide fodder plants. Moreover, the wild animals such as reptiles, birds and mammals are available there. Therefore, the lowlands are areas that encourage investment because of the good natural characteristics of their location that as compared to the nature of the desert region adjacent to them, especially in the drought climatic conditions of Al-Muthanna Desert in general.

Study objective

This study was conducted to investigate the natural characteristics of Faydhat Al-Fawwar and its geographical nature, as well as its biological and animal diversity, and the possibility of investing these characteristics to achieve economical and sustainable development.

Research Hypothesis

The idea of this research is based on that the area of study characterized by natural characteristics that can be invested to achieve sustainable development in Al-Muthanna Desert.

Site of study area

Faydhat Al-Fawwar is a natural lowland. Its area is estimated at about 50 Ha and Al-Faydah located in the center of the south of Al-Muthanna Desert (map 1). It is about 280

km away from the Samawah district. The area is located within geographical coordinates at latitude (N 30.059 87) and longitude (E 45.248) to the east.



Map 1: Site of Area of Study (google map 2019)

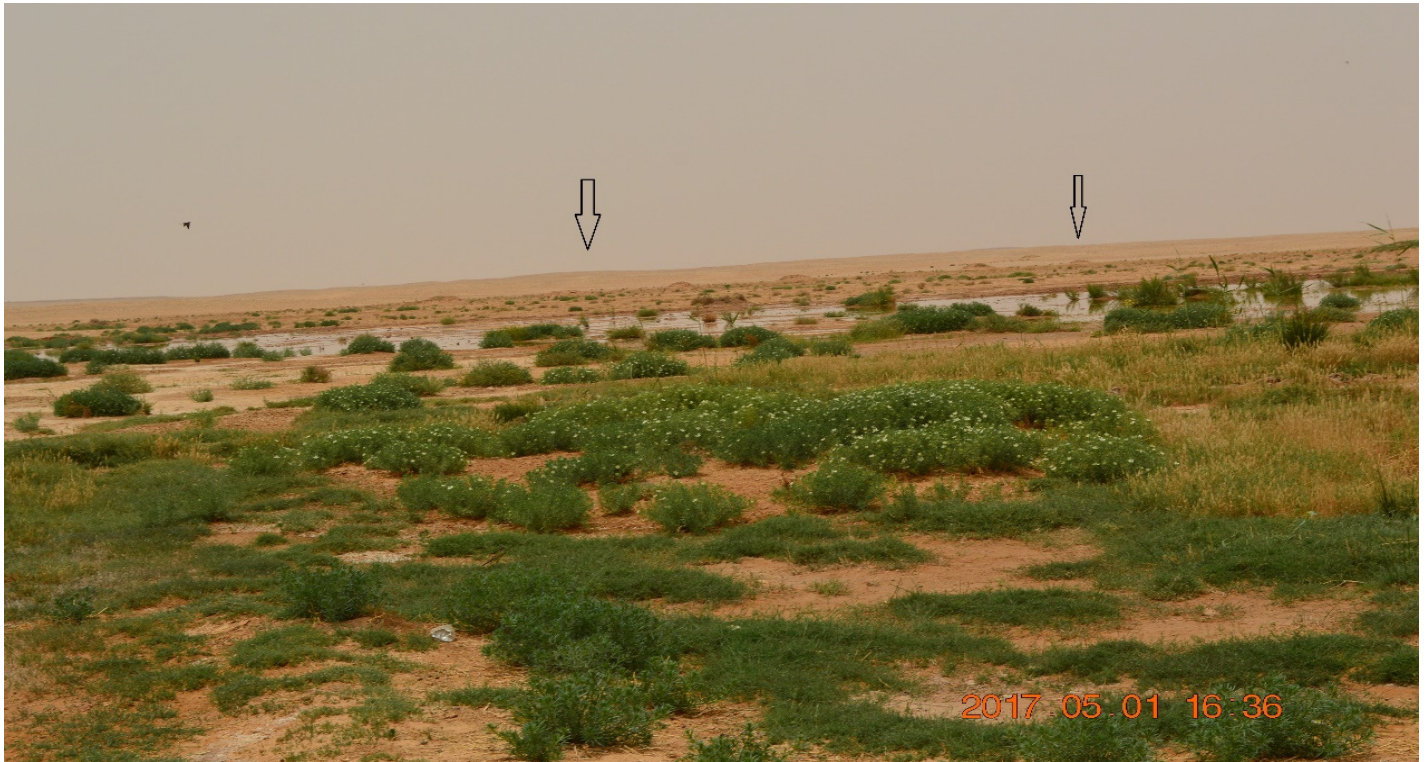
Surface and soil characteristics

The lowlands are flat surface lands below the level of adjacent areas, filled with sediment deposits coming from valleys or surrounding areas and sometimes by running water or torrents during heavy rains (Mahdi al-Sa *et al.*, 1983).

The lowland of al-Fawwar is a typical and distinct terrain appearance, and the area is lower than the adjacent area of the plateau. It is Surrounded by low hills from different sides which represent the natural level of the general desert surface see Picture1. The area is located at heights of 213- 273 m (Depending on the application of the digital elevation model DEM)). Above the sea level, the lowland is located within the extended stone land in southwestern Iraq, which covers large parts of the Salman

Desert and well known for its stone-covered soil. They are interspersed with a group of valleys and lowlands with sedimentary soil. It is brought by floods from the high areas and deposits in the low areas which represent lowlands and floods. One of these low lands is the area of study which characterized by soils consist of sand, gravel, gypsum, lime

and mixed with clay and silt. These soils are distinguished by their moderate salinity, their good depth and the availability of organic matter in them. Therefore, these soils can be cultivated. In some areas, these soils are exposed to driftage due to water erosion.



Picture 1: Faydhat Al-Fawwar
Field study was conducted on 1/5/2017.

Climate characteristics

The study area is in the dry desert climate, where temperature is very high, especially in the summer, with a decrease in the winter season. The annual temperature average is 25.8°C and 24.9 °C at Al- Salman and Al-Samawah station respectively. Moreover, the annual and monthly temperature range is high and reached 16.6 °C in July at Al-Samawah station, accompanied by high evaporation rates with an annual rate of 269.2 mm at Salman Station and (280.2 mm) at Al-Samawah station. The highest rate in July and August reached about (511.1 and 480.3) mm respectively in the Samawah station.

The region suffers from a lack of humidity, with an annual average of 40.9% and 40.5% in Al-Salman and Al-Samawah respectively, and an annual rainfall of 98.6 mm and concentrated in the Winter. The rainfall is also characterized by fluctuation, with an annual total of about (329.3) mm in 2001 and about 173.1 mm in 1998 at Al-Salman Station. The common winds there is the Northwest winds, which increase in the summer in June and July, reaching a speed of 3.9, 3.8 m / s, respectively. However, it reaches its lowest speed in November (2, 4) m/s at Al- Samawah station (Ministry of Transport 1980-2015).

Table 1 : Climate data of Al-samawah Station for the Period (Ministry of Transport 1980-2015)

| Rain Fall (mm) | Evaporation Rate (mm) | Average Temperature (°C) | Temperature (°C) | | Wind speed m/second | Humidity % | Mon. |
|----------------|-----------------------|--------------------------|------------------|---------|---------------------|------------|------|
| | | | Maximum | Minimum | | | |
| 21.1 | 85.8 | 11.3 | 17.1 | 5.9 | 2.7 | 65.7 | Jun. |
| 14.8 | 117 | 13.7 | 20.4 | 7.7 | 3.2 | 56.9 | Feb. |
| 15.2 | 197.9 | 18.5 | 25.5 | 12 | 3.5 | 47.4 | Mar. |
| 8.8 | 271.5 | 25.1 | 32.1 | 17.8 | 3.6 | 37.8 | Apr. |
| 5.3 | 378.4 | 31.3 | 38.5 | 23.5 | 3.7 | 28.7 | May |
| 0 | 469.4 | 35 | 42.8 | 26.4 | 3.9 | 22.9 | Jun. |
| 0 | 511.1 | 36.8 | 44.6 | 28 | 3.8 | 22.3 | Jul. |
| 0 | 480.3 | 36.3 | 44.6 | 27.4 | 3.4 | 23.9 | Aug. |
| 0.2 | 371.1 | 32.9 | 41.3 | 23.5 | 3 | 27.08 | Sep. |
| 4.552 | 258.7 | 26.6 | 34.8 | 19.3 | 2.7 | 37.4 | Oct. |
| 18.1 | 134.9 | 18.3 | 25.6 | 12.5 | 2.4 | 53.5 | Nov. |
| 13.5 | 86.2 | 13.2 | 19.2 | 7.7 | 2.6 | 62.6 | Dec. |

Water Resources

Rain is the source of table water in the Winter that fills the lowlands with water temporarily, but the most important source of water is the ground water. The area of Al- Fawwar consists a source of a spring of fizzy water and hence it is called Al- Fawwar. This fizzy water has a well salinity with EC of (5.6) mS/cm. The PH value is 8.5 and the quantity of total dissolved solids (TDS) was (2.9) mg / l. The Na Cl percentage in this water was (11.2) %. The results of these

laboratory tests showed that this water is suitable for irrigation of some crops and the growth of natural plants.

This water is sulfuric water as laboratory tests indicated that the sulfur content reached in the water about (7000) L / mg equivalent to (7) L / G. It should be noted that the residents of the region, pastoralists and nomads people use this water to treat their patients who infected with scabies by Immersing them in the spring water of Faydhat Al-Fawwar (Laboratory analysis, 2017).



Picture 2 : Sulfuric water of Faydhat Al-Fawwar

⁴The climatic data for Salman station for the period (1970-2002) were adopted because the station is the closest climatic station to the study area. The station was closed and stopped working after 2002. The Samawah station was adopted for the climatic period of 1980-2015.

Table 2 : Results of the bacteriological tests (Laboratory analysis (2017)).

| ت | Site Coordinates N 30.05987 E 45.948901 | <i>E. coli</i> | Fecal coliforms | Total coliforms | <i>P. aeruginosa</i> | T.P.C |
|---|---|----------------|-----------------|-----------------|----------------------|-------|
| 1 | Al-Fawwar Lowland | 3.6 | 3.6 | 3.6 | Negative | 140 |

Analysis of test results

The evidence of pathogens transmitted through water and their effects on public health concluded from the bacteriology tests of water samples taken from the water source. The presence of fecal coliforms is a general indicator of water contamination and always associated with *E. coli*, which causes the disease and the total T.P.C is 140 in the culture media. However, *Pseudomonas aeruginosa* was negative in culture media. According to Basic Environmental Health, *E. coli* should not be present in a 250 mL sample since, its effects on public health are high and their resistance to chlorine is low. According to these data, the water of Al-Fawwar is not suitable for human consumption, such as drinking, cooking and washing.

The physical properties of the water quality indicate a colorless and strong odor that is attributed to sulfur from a distance. As for chemical tests, the pH of water sample was 7.3 and indicate neutral water. AT 25.3 °C Temp, all elements are stable and no side reactions, while SO4 values have increased to 2266.4 exceeding the permissible limit of 400 according to the latest update of water quality standards No. (671). While the rate of TDS (3978).

There is a clear increment for the rest of the elements in the water sample as shown in Table (3). When comparing these results with the permissible limit for these elements in the water, there is a clear increment in these values as shown in Table (4) (Laboratory analysis (2017)).

Table 3 : Results of physical and chemical tests of water well of Al-Fawwar. (Laboratory analysis (2017).

| Turb unt | Temp °C | PH | E.C µS/cm | TDS mg/L | CL mg/L | SO ₄ mg/L | Na mg/L | TH mg/L | Mg mg/L | Ca mg/L | NO ₃ mg/L | PO ₄ mg/L | Colour |
|-------------|------------|-----|--------------|-------------|------------|-------------------------|------------|------------|------------|------------|-------------------------|-------------------------|--------|
| 7.49 | 25.3 | 7.3 | 5850 | 3978 | 656.04 | 2266.4 | 600 | 2280 | 180.9 | 592 | 8.99 | 0.315 | |

Table 4

| E.C (µS/cm) | TDS (mg/L) | CL (mg/L) | Na (mg/L) | TH (mg/L) | Mg (mg/L) | Ca (mg/L) | Element type |
|----------------|---------------|--------------|--------------|--------------|--------------|--------------|---------------------------|
| 5850 | 3978 | 656.04 | 600 | 2280 | 180.9 | 592 | Values in water sample |
| | 1000 | 350 | 200 | 500 | 100 | 150 | Permissible limit |

An increment was found in the rate of sodium (600) mg in the water of the spring of fizzy water, which is higher than the permissible limit of 400 mg. The amount of magnesium was (180.9) mg, while the limit in accordance with global measurements is (100). As well as high calcium content which about 592 and permissible limit is (150) mg. As for NO₃, its concentration is less than the permissible limits of 0.1, as well as for phosphate, which has helped the phenomenon of vegetative prosperity and this was obvious in the plant groups. We conclude from the analysis of the water of fizzy spring in the research area that the water is suitable only for the treatment of animals from scabies due to the high concentrations of sulfur by Immersing them with water. As for the soil, cumulative concentrations over 40 years have increased to 7G / L, equivalent to three times the normal rate. So, The region's water can be invested for therapeutic medical purposes and as a natural treatment. Nowadays, It suffers from the lack of a paved road that is easily accessible. So, it is one of the important natural unused places (Results of laboratory analysis in the laboratories of the Environment on 2017). It is possible to develop this area and invest it after extending the roads to it because it is so far in the depth of the desert and difficult to reach it. Also, Fayadht Al- Fawwar is one of the most promising desert areas that can be exploited for agricultural investment. However, some of them (in other parts of the desert) are exploited and have a high productivity of up to (1.5) tons. They can also be used as natural reserves, to provide the most suitable natural factors of sandy terrain, sandy loam soil and table water resources from feeding ponds because of rainfall, as well as the existence of groundwater wells that are suitable for most investments (Abdullah Sa, 2014)

Biological diversity in Faydaht Al Fawwar and the possibility of its investment and development

Deserts Lowlands are in dry environments. They are among the most important natural phenomena that are characterized mostly by their vastness and flat surface level, as well as the availability of groundwater and arable soil. These resources need to be organized to keep them from deteriorating. They also require planning programs such as Comprehensive development programs of countries for their social, economic and military importance (Mohammed *De Ah*, and Fawaz *Ah*, 2009).

The area of the study contains a distinct biological diversity that encourages its development, including different species of plants as well as different types of domestic and migratory birds. The presence of water sources helped to the biological diversity. It is an important factor to attract birds and growth of plants in this region. The laboratory analysis results showed that this water is suitable for irrigation of some crops and the growth of natural plants because it has good salinity which suitable for irrigation. So, it is possible to be invest in agriculture also and to develop the economy of the region. High density of growth of wild plants in this lowland, including aquatic plants (plants grow in water), such as plants *Typha australis*, *Phragmites australis*, *Ceratophyllum demersum*, *Hardela* and *Najas armata*. Also, growth of wild plants like rues which can be invested because it has medical advantages and grows in high density in this region. As well as the growth of other wild plants such as wild Christ's thorn jujube etc.

Table 5 : Aquatic plants in the study area(Mohammed *Ab*,2017)

| S.No. | Common aquatic plants in Al- Fawwar area | | Plant location of water surface |
|-------|--|-------------------------------|---------------------------------|
| | Common local name | Scientific name | |
| 1. | Canes | <i>Phragmites australis</i> | above the water |
| 2. | Typha | <i>Typha australis</i> | above the water |
| 3. | hornwort | <i>Ceratophyllum demersum</i> | Underwater |
| 4. | floating fern | <i>Salvinia natans</i> | Floating |
| 5. | Scirpus | <i>Scirpus littoralis</i> | above the water |
| 6. | Hardela | <i>Hardela</i> | Underwater |
| 7. | Najas | <i>Najas armata</i> | Underwater |
| 8. | water silk | <i>Spirogyra</i> | Underwater |



Picture 3 : Wild Christ's thorn jubebe in Faydhat Al- Fawwar
Faydhat Al-Fawwar also contains truffles, mushrooms and others. As noted in the pictures below.



Picture 4 : Truffles in Faydhat Al-Fawwar















Picture 5 : Some types of mushrooms in the Faydhat Al-Fawwar

This area is especially characterized by the influx and reproduction of local and migratory bird species in the desert. It is noted from the field visit field that different types of birds rise and landing on the land of this area. They are from

different varieties and different forms. The most important types of observed birds are shown in the pictures. It is noted in the picture's different types of domestic and migratory birds that reproduce in this region.

Table 6 : Types of domestic and migratory birds found in the study area

| S. No. | Bird Arabic Name | Bird English Name | Scientific Name | Bird Image |
|--------|-----------------------------|---------------------------|-----------------------------|---|
| 1 | Ablak Al-Sahra | Pied Wheatear | <i>Oenanthe pleschanka</i> |  |
| 2 | Qita Iraqi Mosanan Al-thail | Pin-tailed Sandgrouse | <i>Pterocles alchata</i> |  |
| 3 | Qita Aswad Al-Batin | Black –bellied Sandgrouse | <i>Pterocles orientalis</i> |  |
| 4 | Qita Muraqat | Spotted Sandgrouse | <i>Pterocles senegallus</i> |  |
| 5 | Al-Raho | Demoiselle Crane | <i>Anthropoides virgo</i> |  |
| 6 | Al-Smaan | Quail | <i>Coturnix coturnix</i> |  |
| 7 | Qubra Huddia | Hoopoe Lark | <i>Alaemon alaudipes</i> |  |

| | | | | |
|----|-------------------------------|----------------------------|-----------------------------|---|
| 8 | Balshon Abaidh Sagheer | Little Egret | <i>Egretta garzetta</i> |  |
| 9 | Bqwaqa Swdaa Al-thail | Black-tailed Godwif | <i>Limosa limosa</i> |  |
| 10 | AlRaho | Demoiselle Crane | <i>Anthropoides virgo</i> |  |
| 11 | Hamrawi | Common Pochard | <i>Aythya ferina</i> |  |
| 12 | Habari | Houbara Bustard | <i>Chlamydotis undulata</i> |  |

Development of Natural Pastures and Establishment of Natural reserves

The area of study is located within the limits of natural pastures in Iraq, as the natural pastures in Iraq occupy an area of 46% of the total area of Iraq. It represents the Iraqi deserts, including the study area. The pastures suffer from the situation of. The area of deteriorated land is very large as (80-90)% out of total deserts (208.7 thousand km²) which forms part of the total area of Iraq (435052 km²) (Ramadhan, *Ab Ha*, and Muayad, 1994) due to of overgrazing, cutting and wooding.

The reasons of this deterioration in natural pasture are mainly due to the indiscriminate grazing and the lack of harmony between the number of animals and the capacity of the pasture or so-called pastoral pressure as well as the climatic conditions of drought and the lack and fluctuation of rain (Walaa *Ka Sa*, 2011). The study area also suffers from over hunting by residents as well as amateur hunters coming from other provinces. As shown in the picture of the Bullet covers used to hunt birds in this area.

Which explains the danger that threatens biodiversity, especially as it lies in the deep of the desert. Therefore, it is

necessary to protect this region from over hunting and preserve its biological diversity by making it as natural reserve by fencing and protecting it in absolute or partial protection due to the importance of its geographical location is the depth of desert. In addition, to preserve its identity because it is an area of important biodiversity. The area contains a source of fresh water, which is intended by many animals to get water, making it a cornerstone for the sustainability of life and conservation of biodiversity in the desert of Al-Muthanna.

The most important goals for the establishment of natural reserves:

1. Conservation of natural resources (vegetation, wild animals, natural environments).
2. Conduct research and scientific studies.
3. Preserving heritage and monuments which have a great scientific, cultural and recreational value and supports the orientation towards development (Ali *Ka*, Ali *Sa* and Saad 2004).
4. Preserving the biodiversity of the area by conserving genetic Origins.



Picture 6 : Bullet covers used to hunt birds speared Faydhat Al-Fawwar

Conclusion

1. The study area is natural lowland characterized by a relatively flat surface. Its height varies from 213-273 m above sea level with sandy loam soil.
2. There is a well or a fizzy water spring provide the wetland (lowland) with water consist sulphate up to 2266.4 exceeding the permissible limits of (400). The water is neutral and pH value was (7.3) at Temp 25.3°C. All elements were stable and there were no side reactions, while TDS was 3978 according to laboratory analysis.
3. The study area is categorized by its diverse natural characteristics of natural resources and plant varieties, especially rues, as well as other aquatic plants such as Canes, Typha, hornwort and etc., as well as its distinctive animal diversity, especially local and migratory birds.

Recommendations

1. It is possible to invest water of the well of Faydhat Al_ Fawwar which contain sulphate for therapeutic purposes as a natural treatment.
2. The wetland (low land) can be used as reservoir for water harvesting which can be investment for agricultural purpose.
3. Making the study area a national natural reserve to preserve its distinctive biodiversity from the risk of degradation and tampering.
4. Conducting a deep study on wetlands (lowlands) in the desert, especially in the case of Fayadht Al Fawwar and conducting Comprehensive laboratory tests for fizzy water well and evaluate the possibility of investing economically in a way that does not harm their natural status and achieve sustainable development

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