



## Used satellite images and GIS to study the degradation lands in the western desert upper Euphrates, Anbar Province, Iraq

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### Abstract

The study explained the state of land degradation in Western Desert, Upper Euphrates, which located in Anbar province/Iraq, assessed in relation to the productive capacity of the land, through the interpretation Land sat TM and many different satellite, and image processing by a GIS for the area, which associated with a database, and the visual and numerical interpretation of satellite images and topographic maps, various, thematic maps and many field checks. Beforehand, standards states of reference have been established in order to evaluate the various states of degradation observed. The study explained the uses of remote sensing for direct identification of degradation in the area, and study the loss of organic matter in the upper layer of soil, and how we can make classification for isolated the degradation areas from other healthy areas. The study discovered, the heavily degraded areas cover about 5% of Western Desert, Upper Euphrates, while the little or no degraded part still occupies the other area. one reason of weakly production potential agricultural is the degradation of soil in the area of study. Therefore must produce a map, for classification the areas of degradation for area of study, and published a map in future, to serve as a baseline for soil monitoring and the environment in the coming decades for all country.

**Keywords:** western desert, upper euphrates, land degradation state, remote sensing

Wafur Abdulrazzaq RMW (2020) Used satellite images and GIS to study the degradation lands in the western desert upper Euphrates, Anbar Province, Iraq. Eurasia J Biosci 14: 665-670.

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### INTRODUCTION

The Algazera program, financed by the Ministry of Irrigation and coordinated by the Baghdad University, is committed to the end of the 1990. The result was the publication of the western desert of Iraq map scale 1:1000000, showing the state of soil degradation, as a result of rain scarcity and human activities, the observation of land degradation, especially in west desert, the work is conducted in more detail, and on a greater to includes all the areas of Iraq, the program must conducted an evaluation to all lands, from 1991 to 1994 but the war has prevent that in 1980. One of the themes of this program is the state land degradation and the environment throughout the country. This work must realize in 2016. In 1991, Baghdad University and the Iraqi Geological Survey used the remote sensing technique by Land sat and other images of many satellite comp. e.g. Earth Observation Satellite and they are made a study of land degradation environment conditions in Western Desert, and assessed in terms of produce capacity, by GIS database, which prepared from many resources, e.g. Topographic maps, various thematic maps, and ground information, Satellite

images, visually and digitally interpreted, to measure the various state of degradation observed.

### LOCATION OF THE STUDY AREA

The study area is located, in the western part of the Western Desert in Anbar province of Iraq, between Rutba and Al-Qaim towns, Northing 34° 41' 56.9" and Easting 40° 84' 47.6" and N34° 24' 13.2", E 40° 84' 20.2". **Photo 1.**

### AIM OF STUDY

1. Use remote sensing and GIS application in interpretation of Degradation lands.
2. To produce thematic map, scale 1:1000000 for the degradation lands of the western desert.

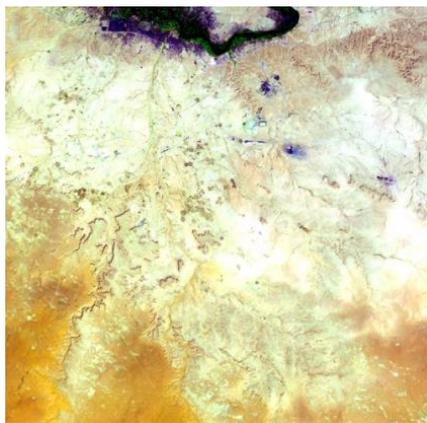
### GEOLOGY OF STUDY AREA

The study area is located within the stable shield of the Arabian shield, Gaara area forms a high, known

Received: July 2019

Accepted: October 2019

Printed: March 2020



**Photo 1.** The study area

locally, Rutba uplift, Jassim (Jassim et al. 1984, Buday 1980) and Buday (Oldeman et al. 1990), it rises about 650 meters above sea level, and consists of wide plateaus intersected with wide wadys, like Gaara and Hauran, increasingly dense and roughness towards the Gaara depression, especially in the southern part, and there are many isolated hills present in the region, see the Google satellite images, **Photo 1**, which are taken from Google Earth. Geological formations of the study area are deposited from a long time, ranging from the Permian - Carboniferous to the Quaternary age. This area is rich in phosphates and other minerals such as quartzite, dolomite, sands and heavy sands, and important metals such as zircon, tourmaline, monazite, and purslinite are present there. The presence of phosphate in Iraq is limited to Western desert, especially in the Akashat region, Iraq is the second country in the world in terms of reserve. The industrial productions was calculated in Akashat, and invested in financing, the phosphate plant for manufacturing phosphate fertilizers, with a capacity of more than one million tons annually. The Geological Survey revealed in September 2011 the discovery of large quantities of phosphate of "good quality" in the Anbar province of Iraq, and estimated the Iraqi reserves phosphate 5.75 billion tons, or 9% of reserves Global. The natural color band combination of study area appear, the green color for healthy vegetation, brown and yellow for unhealthy vegetation, roads are gray, and the other colors for the urban. **Photo 1**.

### SATELLITE IMAGES

This is the most important material for carrying out the program. We have easily access to three products: Land sat TM and image of earth observation system EOS, products. We calculate the risk of degradation from existing data, such as water logging, terrain slope, vegetation cover, etc. This can give sometimes-reliable results, but also to make mistakes when the impact of the human factor is badly impaired or unexpected. On the other hand, to decrease a state of degradation is a

**Table 1.** Land sat TM characteristics

Details	Landsat TM
Coverage area	28.900 km <sup>2</sup>
One image coverage distance	(170 x 170 km)
Resolution power	30 m
Theoretical number of scene to cover	1
Western Desert	2

result of observation, and not of calculation. It is a question of knowing in which region is present the state of land degradation is. When the perimeter to be observed is small and accessible by vehicle, it is relatively easy. When it is necessary to make an evaluation on all the surface of the country in a sufficient time you have to use another method. This is possible thanks to remote sensing aerospace.

The study refers to the degradation of soil and land because of human activities and in relation to agricultural production. This point, rarely mentioned, must be precise. Let us give an example to illustrate it. Sun shine, on the red lands of the South Western Desert, Upper Euphrates for example (ferritic soils) becomes very acidic, which leads to a reduction in productivity of crops, it is a form of degradation of Earth. Otherwise, there is no care about the acidification, if this same sector is exploited to make building bricks; the acidification has no importance for the user this sector will not be considered as a user degraded area. Four types of material are used the documentations, satellite images, and the equipment of GIS, and field checks.

### EXISTING THEMATIC DOCUMENTATION

Useful documentation first includes topographic maps of the study area, scale 1:250000 and the various thematic maps available, geological maps, soil maps. We acquired the TM coverage by completing it with one image for border areas. Images in digital form are first processed by a process that allows produce a deferent images in many channels, to produce a classification image for the area of study **Photos 2-4**.



Photo 2. Infrared color



Photo 3. Border image

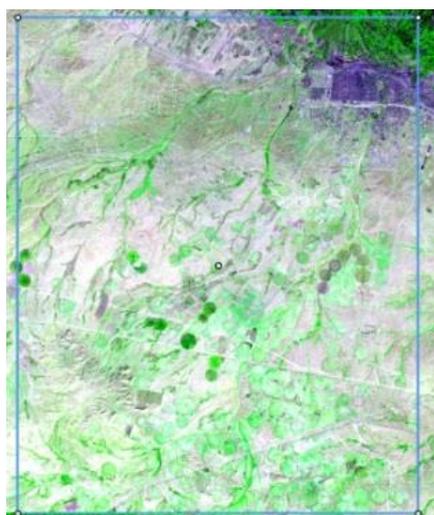


Photo 4. False color



Fig. 1. The map of study area

### EQUIPMENT FOR GIS

After we used Arc GIS software to store the data, and the thematic information, to updating the information derived from them and do classifications of the images, and updating for the map of the area and any information, which we need.

### METHODOLOGY OF RESEARCH

The method used is simple, and consists of the following successive steps:

- a - Observation the different reflectance, between the topographic features depended upon wavelength band, and exploitation of thematic maps.
- b- Interpretation of satellite images, and storage of data in GIS, and Publication of results on paper or storage in the computer.

### Observation the Different Reflectance, Between the Topographic Features Depended Upon Wavelength Bands, and Exploitation of Thematic Maps

This is the first necessary step; we have taken as a reference the map of the region **Fig. 1**. The soil degradation of the study area was clear in the satellite images photo. Then we completed, by fieldwork, the soil degradation of the study area was clear in the satellite images, do classification to it, and determine the affected land. The study defined the meaning of erosion strictly. It is the displacement of the soil material to the great or less distance from the site. It causes loss of soil volume, effects often detrimental to the environment, Examples: acidification or salinization of ground Oldeman et al (Oldeman et al. 1990). Moreover recent study is concentrated on the application of remote sensing and GIS for creating digital elevation model DEM, from ground contour map, from this method we can find the general slope of the ground features to estimating the quantities of sediments which are accumulated or removed due to weathering and erosion processes during different periods to attention about any

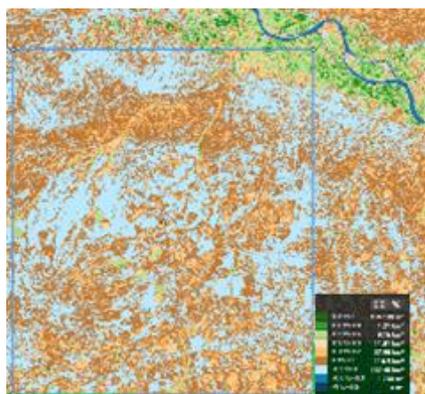


Photo 5. Supervise Classification of study area

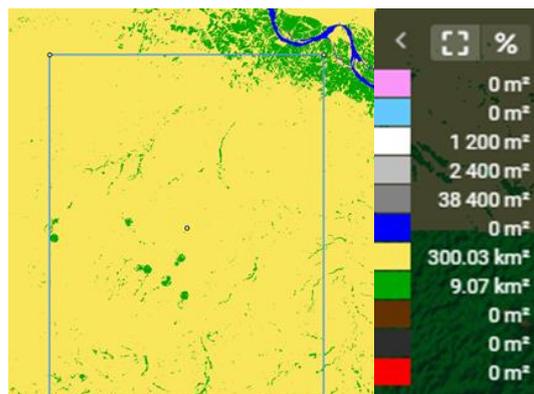


Photo 6. Un supervise Classification

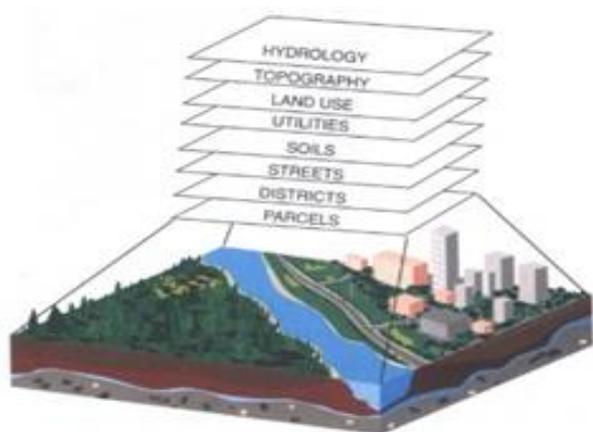


Fig. 2. GIS layers of the area

changes to degradation, Wafur (Wafur 2010) This appreciation is the current state of degradation of the earth's environment. We have distinguished five classes ranging from a state of no degradation to an extreme state, and divided these five classes to 5 sectors (Photo 5).

These sectors are scanned into the GIS and numbered, and described each of them in the database associated with GIS and storage in the PC.

While the exploitation of thematic map consists, the uses of thematic maps to delimit physiographical large units, (natural terrain units or wetland unit) to classified (Brabant 1992). In Western Desert, lands are generally exploited in crops with low levels of input, because many influence factors are there, e.g. Soils type, sand dunes, protected areas (parks, reserves, Factories), high and low areas, human density, etc.

From the topographic maps and interpretation of images, we digitized the information of Western Desert, Upper Euphrates in six distinct layers by used GIS Fig. 2, which are the contours lines, the hydrographic network, the lines of communication, the farms of crops and the vegetation cover, and geographical coordinates and human activities. To produce topographical map for each layers, scale of 1/250000 to facilitate visual interpretation of the images. Then created supervised

classification for the layers Smmone 1995 (Smonne 1995), and display or print from the PC if we want.

The classification is included the green color for green areas, the yellow color for the heath area, the pink color for the degradation area, the grey color for the human facilities (Photo 6).

### Interpretation of Satellite Images, And Storage of Data in GIS. And Publication of Results on Paper or Storage in the Computer

The first phase takes place in the laboratory. Logical inference means that the interpreter applies reasoning, in reasoning the interpreter will use his professional knowledge and experience, logical inference is for example, concluding that a rectangular shape is a swimming pool because of its location in a garden and near to a house (Wafur 2007). A provisional map is drawn up degradation, by examining satellite images and referring to the documents themes. Protected areas are identified, zones are degraded because uninhabited and not cultivated, rural areas and the urbanized areas. Numerous markings are made in the field to refine the interpretation digital laboratory and complete the visual interpretation. This step is a general interpretation of the images. it is one visual interpretation and the other a numerical interpretation in the PC, to study degradation described as medium to low, moreover we can see the boundaries between classes, especially between the crops, and wetland. The final step is to carry out the final field checks carried out in these areas. We then move on to the final drawing of the state map of degradation. Field checks made in Western Desert, Upper Euphrates consisted of observing the state of the canopy plant, the condition and thickness of the soil surface horizon, to examine the erosion layers, gullies, ditches, or other forms of erosion, sometimes pH tests, to observe land use patterns, and soil protection techniques. Data storage and processing satellite images and aerial photographs if present, and any data which taken on the ground. This allows the user who consults the GIS to get an idea of the degradation phenomena observed, The GIS enables users to an access data from each of these sources and analyze changes in compound

concentrations and spatial distributions over time with respect to surrounding environmental data Wafur 2017 (Onwubuya et al. 2015, Wafur 2017).

## RESULT

We have chosen as comparison the state of the soils observed in good conservation conditions and in non-cultivated sites. The many works of surveys carried out by soil scientists in Western Desert, Upper Euphrates between 1990 and 2018 determine for each soil type, what were its characteristics under vegetation natural or under the spontaneous vegetation of old wastelands. The state of degradation observed in 1994 was limited, therefore, the studies must be continue to observed any changes about the soil in any place. If the lands and environment of Western Desert, Upper Euphrates are monitored by remote sensing the next century, it will be possible to draw up a periodic report on the state of degradation, because the application of GIS and remote sensing enable us to study many factors eg. Climate elements, hydrological conditions, geomorphological features with in the area to deduce the agents that are responsible for the increased the degradation and analyze any changes in the soil and spatial distributions over time with respect to surrounding environmental data (Wafur 2010). We can then compare this state of reference established by space images, which itself refers to initial conditions referred to direct identification of degradation. At last, the important question is whether land degradation, can directly and fastly identifiable on

the images or not, without any helping from the fieldworks.(Nodeh, and Aghili 2015).

## CONCLUSION

1. We can says that the space images very useful to define the types and the subtypes of erosion and degradation, and degree of intensity, and the various causes of this degradation. We also calculated the cases of improvement and land conservation.
2. The use of satellite images, combined with the exploitation of a GIS, is an excellent to study the degradation and conservation of lands. On the wide scale of the country within a short time.
3. It can be concluded with good reliability that land is relatively degraded in Western Desert, Upper Euphrates, and that the agricultural potential of the country is still good, although the political turmoil in the country.
4. Operating GIS, which is operational, is also a very practical way of controlling as the database evolves and quickly put it at the disposal of decision-makers and various users.
5. The method used in Western Desert, Upper Euphrates is applicable in the any area of the country, and must use the space images will however have to be according to nature of the land units, and the nature of the units of ground.
6. For documenting the work of interpretation of the images, need visiting the area, to make a necessary reconnaissance and observations the differences between regions.

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