International J. of Engg. Research & Indu. Appls. (IJERIA).
ISSN 0974-1518, Vol.9, No. III (December 2016), pp. 13-22

DESERTIFICATION MONITORING USING REMOTE SENSING AND GIS TECHNIQUES

MUTHANNA MOHAMMED ABDULHAMEED AL BAYATI
Lecturer
Building and Construction Department
University of Technology Baghdad, Iraq.

Abstract

Proliferated in recent years the desertification phenomenon, and the desert areas started expanding at the expense of green areas, which affected the environment. This research focused on studying the desertification and its changes regarding to the time, through using different multi band satellite images for the area of interest in different times and studying the changes appear to the land cover and calculating the areas of each parameter to make the comparison for each environmental parameter (soil, agriculture, and water).

مراقبة التصحر باستخدام تقنيات الاستشعار عن بعد ونظم المعلومات الجغرافية

المدرس مثنى محمد عبد الحميد البياتي
الجامعة التكنولوجية – بغداد – قسم البناء والانشاءات

مستخلص

انتشرت في الأونة الأخيرة ظاهرة التصحر وبدأت المناطق الصحراوية او شبه الصحراوية بالتوسع على حساب المناطق المزروعة مما اثر في البيئة بشكل واضح.

وتركز بحثنا بدراسة هذه الظاهرة ومراقبة التغيرات مع الزمن من خلال استخدام صور فضائية متعددة الاطياف لسنوات مختلفة لمنطقة الدراسة الواقعة الى الغرب من بغداد واجراء المقارنة بين طبقات الغطاء الأرضي وحساب فرق المساحات لكل معلم على حدة لا سيما في العناصر البيية الرئيسية (التربة, النباتات, الماء). وتم عر ض النتائج بشكل جداول ورسوم بيانية.

1. INTRODUCTION

Desertification is wrongly defined as the extension of existing deserts, but can be defined as the land degradation because of human activities in dryland areas(1).

1.1 DESERTIFICATION DEFINITION

We selected the following definition from many definitions of desertification we found, Desertification refers to the persistent degradation of dryland ecosystems by climatic variations and activities of human. It occurs on all continents (except Antarctica) and affects the livelihoods of millions of people, including a large proportion of the poor in drylands.(2)

1.2 DESERTIFICATION CAUSES

Desertification is caused by a combination of factors that change over time and vary by location.

direct factors such as land use patterns and practices and climate-related processes, and indirect factors such as population pressure, socioeconomic and policy factors, and international trade as well as.(2)

Desertification is happened mainly by land degradation, which occurs when the land’s use by human is incongruent with the land's attributes (FAO, 1976).(6)

1.3 DESERTIFICATION AFFECTS

Desertification affects all categories of ecosystem services:

- Services of provisioning like food, forage, and water.
- Services of regulating like climate regulation and water purification.
- Services of cultural like recreation and cultural identity.
- Services of Supporting like soil conservation.

These effects can be quantified directly or indirectly and management approaches are available to prevent, reduce, or reverse these manifestations of desertification. (2)

1.4 MONITORING DESERTIFICATION

Remote sensing has various data sources so it offers the possibility of gaining environmental data, but it cannot replace traditional sources of data for monitoring.(7)

1. PAPER GOAL

This paper aims to monitor the environmental elements (water, soil, and vegetation) using remote sensing and GIS techniques calculating areas of each element and check the differences per specific time.

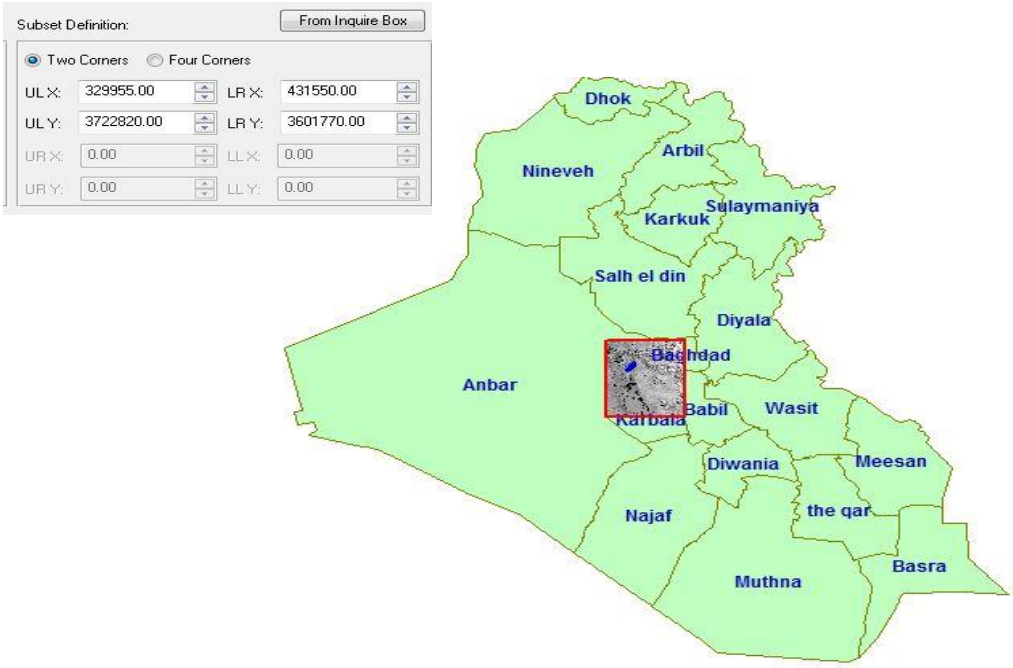
2. CASE STUDY AND AREA OF INTEREST

The area of interest selected carefully to study the main environmental elements, so we selected the area in the mid of Iraq to the west of Baghdad, Euphrates river passes throw the area from the north west to the south east as well as 2 big water bodies to the north Habania reservoir and Razaza reservoir to the south, agricultural and green areas already surrounded the river and water bodies, in other hand desert represent the rest areas.

Therefor the area of interest selected is suitable to match the goals by including the elements should monitored. The area of Interest Located in between the two corners bellow, the coordinates is in Projection UTM-Z38, WGS-84 system.

UL 329955 ; 3722820

LR 431550 ; 3601770



Map (1) – Area of Interest

3. DATA AND TOOLS USED

In this paper we used the following data:-

1- Landsat -7 TM, Image dated 2000, full bands Roa data 30m for bands 1 to 5 and 15m for band 8 (panchromatic), will called before image.

2- Landsat -7 TM, Image dated 2010, 3 Bands processed data and pansharpened to 15m. will called the after image.

Also we used software for image processing and GIS to calculate and analyses the results.

1- ERDAS Imagine V. 14 Used for Image Processing.

2- Geomedia Pro. V. 13 Used for calculations and analyses.

4. METHODOLOGY

We tried to make most of the processes used by previous researches in the same application. Regarding to the importance of the desertification many people worked on in different locations. We reviewed many papers from different scientific research centers and believed the following procedure.

4.1 Radiometric Correction

In the beginning of the work we starting the processing by the following steps to reach to the enhanced images. ATCOR Add-on ERDAS module used for atmospheric correction.

4.2 Sub set the Area of interest

As you know that LANDSAT image dimensions are about 180 x 180 km, to reduce the processing for all the image we subset both images to the same AOI and corners. We made this process two times one in the beginning to reduce all the processed areas and another one after the geometric correction where a traditional shift happened.

Subset made to set the same corners to both images.

Figure (1) bellow explain the shifting in the

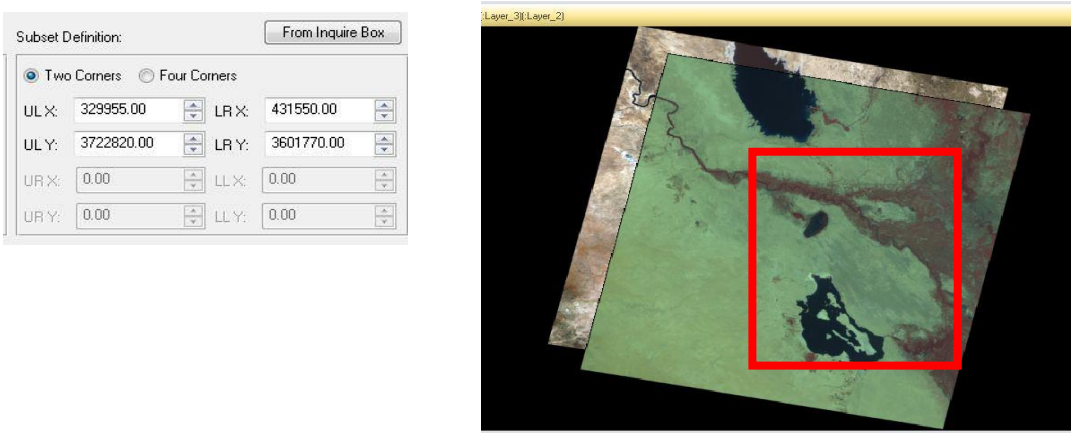


fig (1) – shifting of images in different dates

4.3 Geometric Correction

Regarding to the time between the 2 images we found shift in the features, so we need to make the geometric correction to remove the shift and reach the suitable situation for change detection and classification.

It is important to mention her that in the same time of producing the corrected image we made the resampling to union the pixel size 15m for both images.

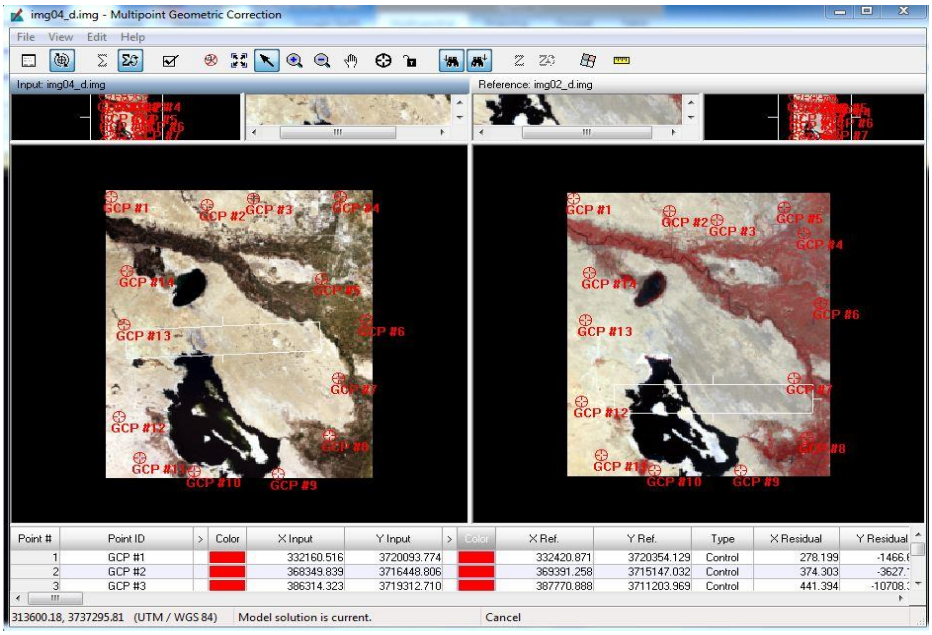


fig (2) – Image geometric correction

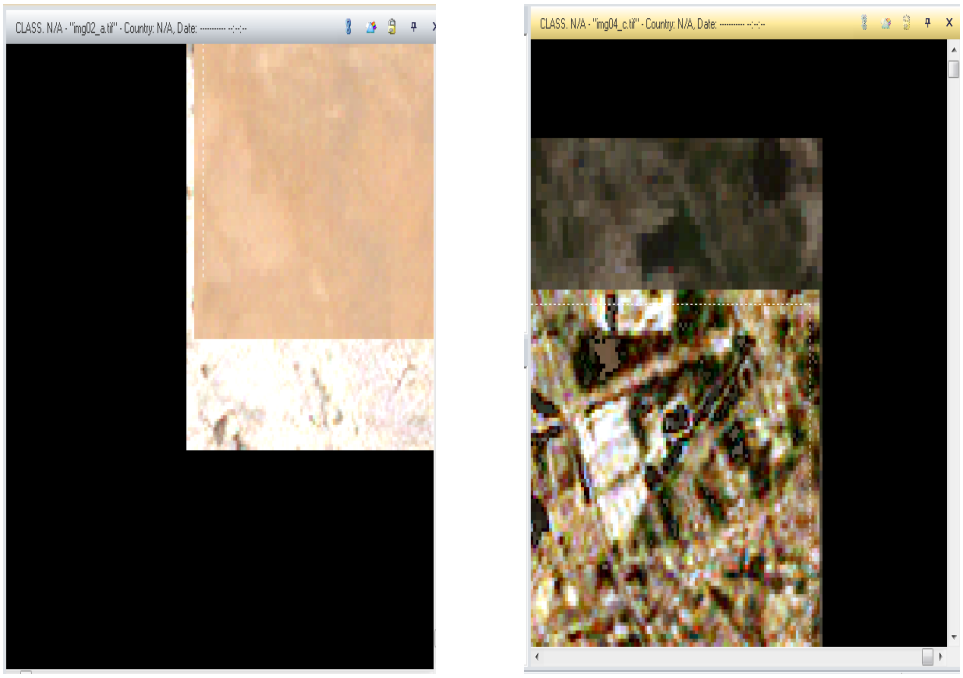


fig (3) – shifting after Image geometric correction

4.4 Change detection and high light changes

Change detection is the most process used in cases like ours when are searching to specify the sites includes the changes and differences between the before image and the after image to the same area of interest.

When we applied the change detection process in ERDAS Imagine,

1- The input were the before and after image.

2- The output will be 2 results the change detection as panchromatic image and the high light which will be as a thematic image mentioned the locations have differences between the before and after images.

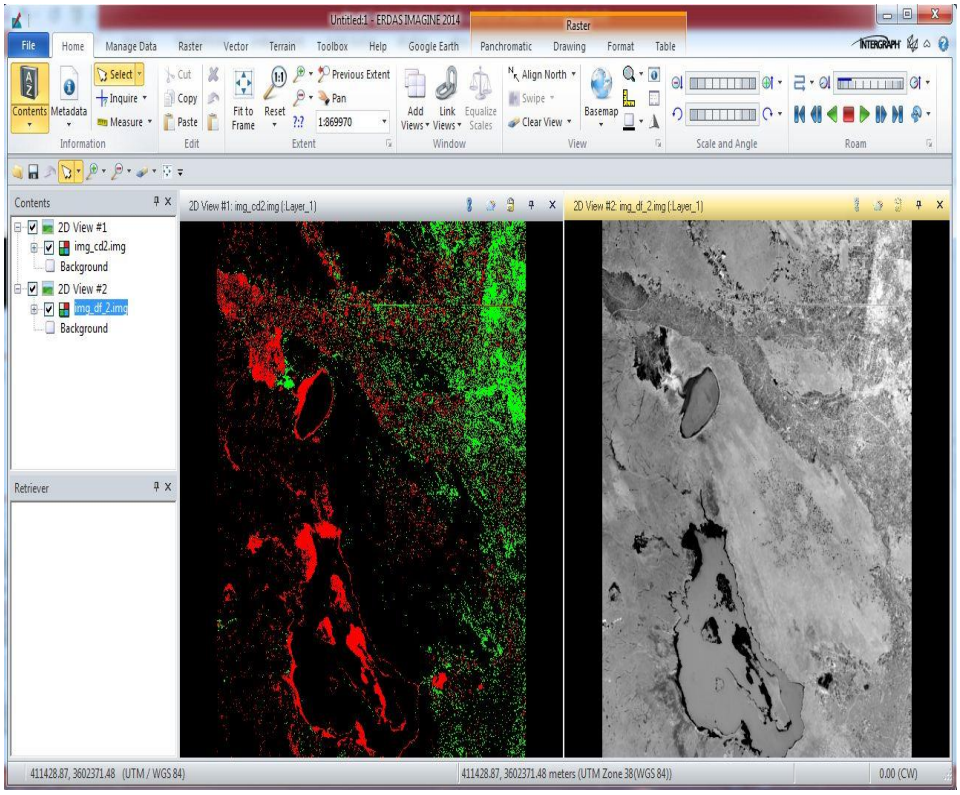


fig (4) – Change Detection

4.5 Classification

Unsupervised classification used to classify both images before and after, from our knowledge and experience to the area of interest we abled to manage the classification to reach to 4 classes required. We specify 8 classes in the beginning then merge them to reach to 4 only (Soil or Deseret, Water Bodies, Green Lands, and Urban). ERDAS Imagine software used in this process.

4.6 Convert data to GIS

ERDAS Imagine is the Satellite Image Processing Software produced by Hexagon which already produced Geomedia GIS software, so we found a link between these two software,

After the unsupervised classification we convert the thematic image or classes to vectors and transfer these vectors to Geomedia.

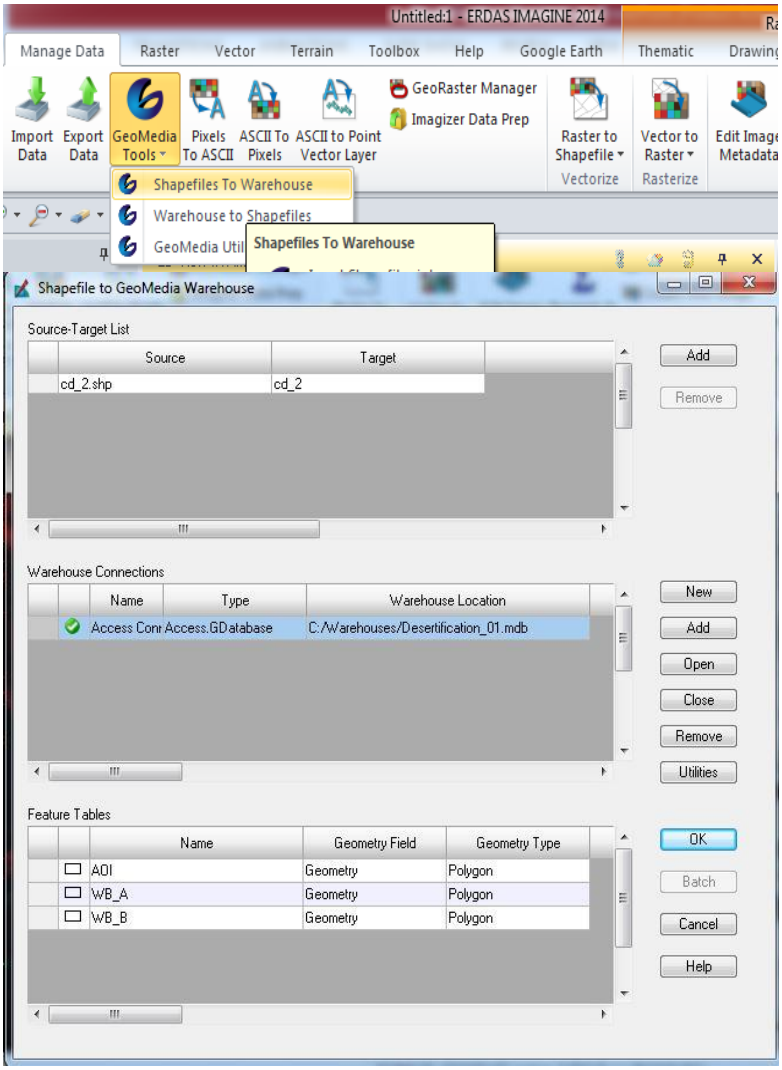


fig (5) – Data Transform From ERDAS to Geomedia

4.7 Thematic Map Production.

In Geomedia GIS software we made the Thematic map of 4 layers represent the main environmental elements (water, Green lands, and Soil(desert)) as well as the urban areas which appear as a class but neglect in the calculations because of the goals of the study.

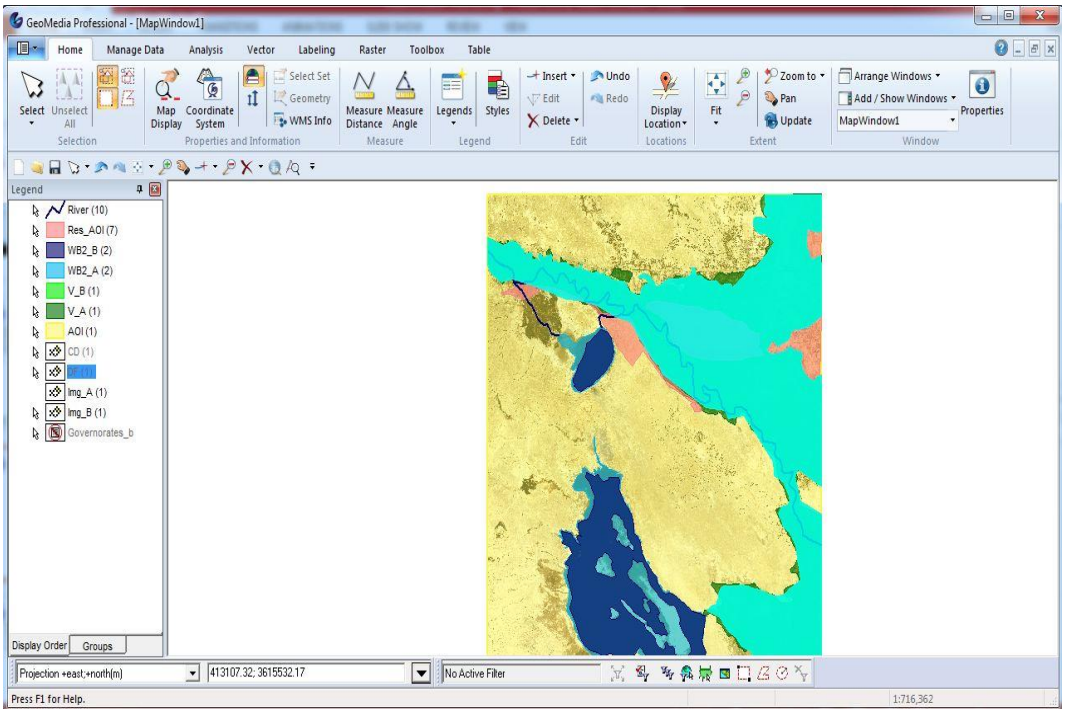


fig (6) – Thematic Map in Geomedia

4.8 Calculate Areas and Produce the Chart.

Table (1) Areas of Classes

Cover	Area km2 2000	Area km2 2010	Delta Area	Differences %
Water	1420.8	1167.6	253.2	17.8
Soil	7412.9	7723.7	310.8	4.2
Vegetation	3466.3	3408.7	57.6	1.66
Total	12300	12300		

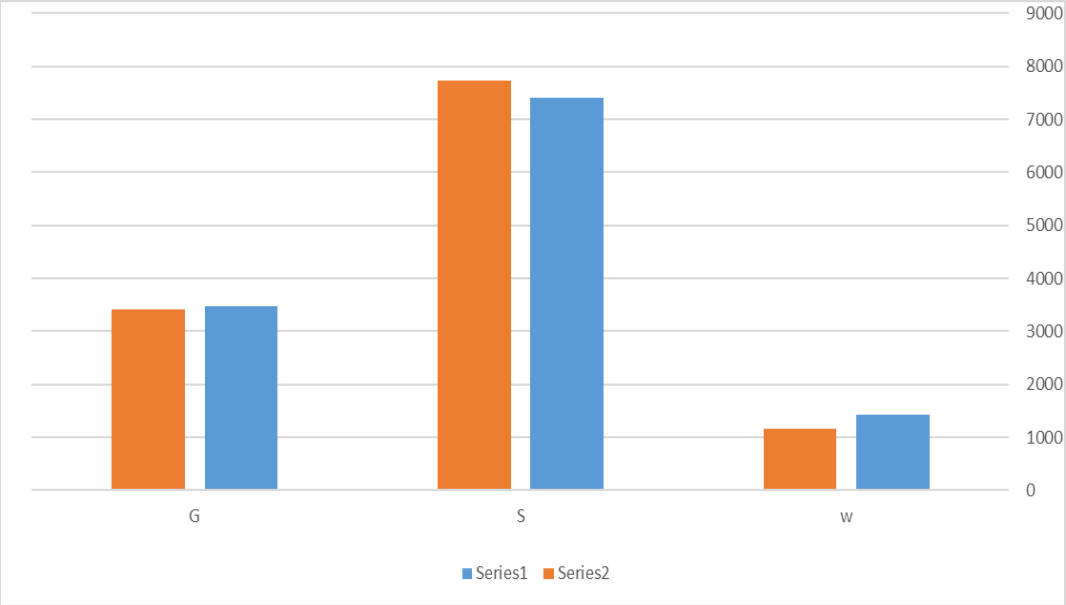


fig (7) – Chart for corresponding areas

CONCLUSION

1. We can monitor and study environmental phenomena using satellite images.
2. We can got good results and fast estimation.
3. The link between ERDAS and Geomedia very important for feeding data base more details from the Image processing to use the capabilities of GIS analysis.
4. We found big difference in water, should be reviewed if it is organized or not.
5. The expansion of desertification to the vegetation.

REFERENCES

[1]. Land Degradation and Desertification, by Directorate-General of Global Affairs, Development and Partnerships.

[2]. Green Facts – Scientific Facts on Desertification.

[3]. Desertification - Concept, Causes and Amelioration, by Jagdish C. Katyal and Paul L.G. Vlek

[4]. Desertification Monitoring Using Remote Sensing Technology, by Ismat M. El Hassan.