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# Use of Geospatial Technology to the study of land covers changes in the region of Errachidia: SE of Morocco

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**Abstract:-** *Errachidia - Tafilalet region located in the southern Atlas of Morocco, is facing enormous difficulties combining scarcity and poor quality of water then long periods of severe drought that have affected recent decades, whose ecological consequences are considerable, as evidenced by the decline in the irrigated area under the action of desertification and rising saline soils.The use of remote sensing and GIS enabled to understand the dynamics of land use. In this paper we have used three imagery satellite Landsat (TM 1987, ETM+ 2001, ETM+2006) for a diachronic analysis, to assess and monitor the change of the palm in the Middle Ziz. We managed to show the levels of evolution in terms of differential use of space, soil degradation, regeneration of the environment, resilience, and finally, the segmentation of the territory. Low rainfall, dry years have a very negative effect on the surface water reserves, agricultural production, but also the movement of sand and silting.*

***Keyword: Dy****namic of Land cover, NDVI, Remote sensing, Silting.*

## 1. Introduction

The region Errachidia -Tafilalet located in the southern Atlas region of Morocco (Fig.1), is facing enormous difficulties combining scarcity and poor water quality result, long periods of severe drought affected who in recent decades. This area knows more than a desertification process that manifests itself in the form of siltation, degradation of vegetative cover, soil salinization, depletion of groundwater, and water and wind erosion. [3] Three unit structural form the landscapes of the region of the North southward: the High basin which corresponds in the High Atlas, the average Basin or the pre-African furrow (Cretaceous basin of Errachidia) of which is a part the zone of study, and the lower basin or oriental Anti Atlas: Ougnat[12].

The central objective is to show the one hand, the potential of remote sensing and GIS for the characterization of the state of land use and its spatiotemporal evolution. On the other hand, to make available to potential users, managers, local politicians and decision makers with reliable information on the state of the environment and natural resources in the region of Errachidia. This study is built around the following axes:

- Diachronic analysis and identification of changes in land use and major components of the environment;
- Production of information layers and maps holders.

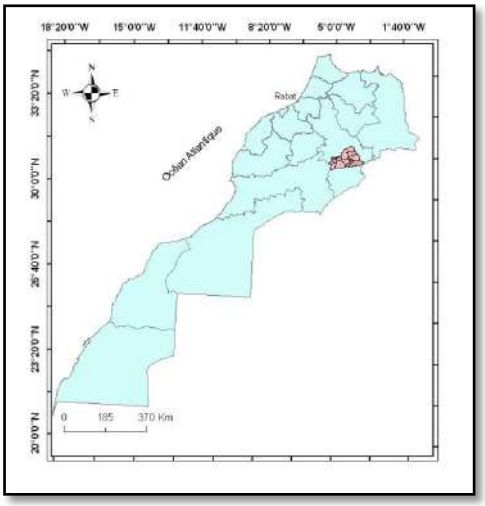


Figure1. Geographical location of the study area

## 2. Materials and methods

The methodology used to extract thematic classes is based essentially on the digital image processing multi temporal Landsat (TM and ETM +), including technical supervised classifications (true semblance max) but on some index (NDVI, Iron index ...). These information layers (thematic classes) have been integrated into a geographic information system (GIS) for spatial analysis (Calculation of areas from counting each class that is equal to the number of pixels that the present).

## 3. Results and discussion

### 3.1. Evolution of water bodies

The study area is continental nature and the main bodies of water are often present dams, sometimes dayas; and are more or less filled with the seasons and years of acquisition of the scenes. The year 1987 is the driest, while 2006 was the wettest year and this has a direct effect on the filling of water bodies. We see a positive trend between the years 1987, 2001 and 2006. The dam Hassan Addakhil shows a water surface more and more (Figure 3). Indeed, the climatic mechanisms and the importance of reliefs are in the Maghreb less favorable to the absence extended and generalized by rains [2]. The behavior spectral some water presents a maximum of reflectance in the blue band to 0.5 µm and almost nobody in the infrared. The turbidity, the transport of materials in suspension and a shallow water, modify its characteristics and the reflectance becomes more important for all the wavelengths In addition, the spectral signature of water is

relatively high in 1987 (fig.4a and 4b), which means that the water was very shallow in this year.

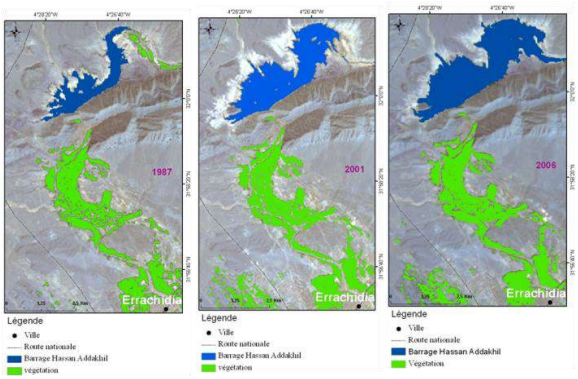


Figure2. Evolution of the Hassan Addakhil dam surface for the years 1987, 2001 and 2006

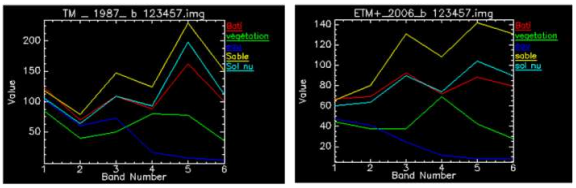


Figure3. Signatures discrete surface elements extracted from the Landsat TM 1987 (a) and ETM + _2006 (b)

### 3.2 Vegetation Index NDVI

The Normalized Difference Vegetation Index (NDVI) is a proven method for the study and mapping of vegetation. This indicates the best known and most used to detect the chlorophyll activity from multi spectral remote sensing data. Several new indications adapted to the behavior of grounds were developed, but Index NDVI (Normalized Difference Vegetation Index), proposed by ROUSSE [14], remains the most used indication (index). NDVI classes show a trend towards an increase in crop production (Fig.5). This increase should be seen in connection with the distribution of precipitation treated years. The year 2006 is the rainiest present the largest chlorophyll activity with a value of NDVI max of about 0.72; however the year 1987, the drier is the one with the lowest activity justified by its max NDVI value that is equal to 0.61. We can conclude that there is a decline in vegetation space, which is already reduced in a desert environment rife with bare soil that feed the bright sands, especially when weather conditions permit. However, when climatic conditions are favorable as in 2006, crop production becomes very interesting. The study showed also, through the images of NDVI, crop production is highly dependent on rainfall. Thus, the year 2006 is the most productive while 1987 is significantly below the other seasons. The study showed also, through the images of NDVI, crop production is highly dependent on rainfall. Thus, the year 2006 is the most productive while 1987 is significantly below the other seasons. The agricultural activity is any time associated directly to the availability of streams and sources, which were since Antiquity used by the population of this zone to exploit economically the water [8].


Figure4. Evolution of the vegetation index for years 1987.2001 and 2006.

### 3.3 Dynamic silting

In the region of study, the geologic outcrops are mainly formed by trainings shalty sandstones which are sensitive to the hydric and wind erosion. The climate of region favorite the training of the deposits important to texture silty -sand [1]. Beside the deposits current of the rivers, in silty-sand dominant, are reshaped by the wind and also contribute to the blocking with sand [11].

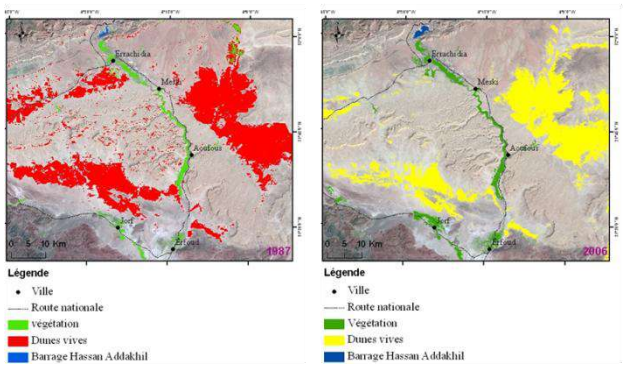


Figure5. Silting location for the years 1987 and 2006.

Mobile sands are a permanent threat to the oases of Tafilalet. The study mapped the evolution of silting from Landsat (TM and ETM +), across the red sands that make up the final product of the soil stripping. The recognition of the sands by the supervised classification was supported by the iron index image that helps locate permanently by their nature very ferric. It was thus demonstrated that the distribution and migration of sand (Fig.6) depend on the moisture level of the year. The year 1987 being the driest in terms of rainfall had a greater migration of red sand, while the year 2006, the wettest was a smaller movement. Supervised classifications of the three images iron index show a regression of areas occupied by sand (fig.6) with a change of -26% between 1987 and 2006. The interpretation of these results shows a negative correlation between the degree moisture and the distribution of red sand. The work of Coude-Gaussen and Rognon [6] show that the silting problems have become very acute in semi-arid and arid countries, especially in North Africa, the phenomenon is growing especially in the south and south-east: in Eastern High Atlas, in the medium and lower Ziz, around Errachidia Goulmima, Erfoud and south in the Tafilalet and Drâa basin.

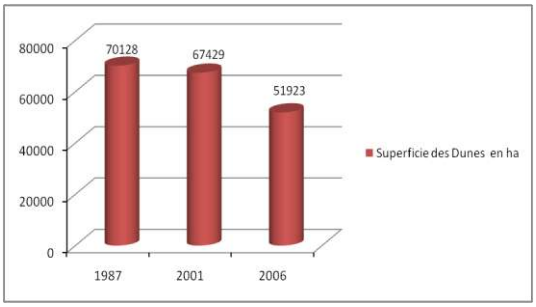


Figure6. Evolution the area of Silting between 1987 and 2006.

Furthermore, the works of BENMOHAMMADI [3]; BENALLA [2]; KABIRI [9] and DESJARDINS [7], showed the fast and catastrophic progress of the desertification and more particularly in the valley of Drâa and the valley of Ziz. Indeed, according to the work of BENMOHAMMADI [3] the blocking with sand in these zones is recent and began since 1970, previously this plague did not exist. It should be noted that the work of LEMSANNI [10] for monitoring desertification in Morocco from NOAA AVHRR images; and DESJARDINS [7] which demonstrated the advance of the dunes in many parts of South-eastern Morocco have used remote sensing data for characterization of desertification. Through these studies the remote sensing tool has proved essential in this kind of research and investigation. So, MARIUS [13] deals with the problem of blocking wind sand and his negative impacts on the mangrove swamps of Senegal; CALLOT [5] the geodynamics of wind sands in the Sahara northwest; TAIBI [15] uses images Landsat MSS of 1977 and TM of 1989 as well as images SAR-ERS of 92 and 93 to realize a diachronic follow-up of three main themes: the dense vegetation and the sandy formations on five sites of south Piedmont of the Saharan Atlas. More recently, BENSAID [4] used the satellite imagery for the study of the blocking wind sand in the wilaya of Naâma (Algeria) in dry area.

## 4. CONCLUSION

Facing the environmental challenges posed by recurrent droughts and population pressure, it is necessary to monitor the available natural resources for their rational and sustainable management. In this context, remote sensing is a powerful tool for acquiring information necessary for monitoring and management of natural resources, to assist in decision making for the sustainable management of these resources. Diachronic analysis based on the use of digital satellite imagery from different periods allow you to enter all of the environmental changes in order to integrate them into a geographic information system in order to better identify changes in a given spatial and temporal context . It appears from this study that the oasis dynamic space, which is very fragile, is strongly linked to climate change. Indeed, the low rainfall, dry years have a very negative effect on the surface water supply, agricultural production, but also on the movement of sand and silt.

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