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Article *in* Advances in Environmental Biology · September 2016

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Advances in Environmental Biology, 10(9) September 2016, Pages: 201-208

AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/AEB/

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Received 17 July 2016; Accepted 28 September 2016; Available online 30 September 2016

ABSTRACT

Background: These forests include mainly M'sila forest in northwestern Algeria, which in recent years, to undergo a sharp decline that threatens its survival. **Objective:** This delicate situation required a short follow-up, medium and long term to better prevent such events, to understand the main mechanisms and propose relevant solutions by understanding the structure and dynamics of vegetation and soil surface conditions. **Methodology:** Analysis of satellite images from the NDVI, allowed us to locate changes in the forest area. **Results and conclusion :** The study showed that the magnitude of changes in land cover between 1987 and 2014, especially a regressive evolution of 30.82% of the space was found.

KEYWORDS: drill msila, regression, satellite images, NDVI, regressive evolution.

INTRODUCTION

Studies on the change in occupation and land use are importance because they allow to know the current trends in deforestation, degradation, desertification and loss of biodiversity in a particular region [10]. There are natural factors such as climate, wind, rain etc., that promote changes in vegetation cover [17]. Nevertheless, in recent decades, human activities are the main trigger of the transformation of ecosystems [20].

It is estimated that forest loss since the beginning of mankind until the present time varies from one third to half of the original surface MCKEE *et al*. [13]. This accelerated loss of forest cover leads to the disappearance of the inherent genetic reserve for indigenous ecosystems. The most obvious consequences are the loss of land use potential for human well-being and loss of habitat in general VELAZQUEZ *et al*. [19].

The study and monitoring of changes that reach the level of forests (fire, deforestation ...) require the use of new techniques for handling space thus modern remote sensing, is now a powerful tool and an essential way.

Studies concerernant tracking changes the characteristics of the vegetation [7,18,12] are based on the normalized vegetation itself index.

To better understand the changes occurring, the classified images of the two dates (1987-2014) crossed pixel by pixel carriers themselves of diachronic information.

The objective of this study is to provide a mapping of the drill Msila, using remote sensing tool and show that it is possible using satellite data of land resources, assess areas changes in these forest massifs and locate changes in forest area .

II - characteristics of the study area:

1) Location of the study area:

M'Sila The forest is located 30 km west of Oran and 7 km from that of Boutlélis Mhamdia [5].

It covers an area of 1080 Ha of plant formation all confused 60% of this area is occupied by the cork oak M'hamdia [14] and includes six C.F.W.O cantons [6].

Administratively, it falls within the territorial jurisdiction of the wilaya of Oran Bouhraoua R.T [5]. It depends on forest conservation of Oran, forest district of Oran and District Boutlélis C.F.W.O [6]. It is limited by the municipalities of Ain El Kerma west, Messerghine east, El Ançor and Andalusian north and south stands Terziza (Fig.1) M'hamdia [14].

2) Orography and Hydrography:

The drill M'Sila is located west of Jebel Murdjadjo BOUDY [4]. It consists of a single massive aka M'Sila whose steep configuration is very rugged especially in its eastern part. However, most of the solid present a softer and less rugged with a flat and without steep slopes (3% lower slopes) contrary to the south where land is very unstable and eroded mainly due to slope failures (upper 25%) Bouhraoua RT [5].

The massive M'Sila is drained by a river system with orientation NE-NO consisting of six wadis (Oued Guedara, Oued N'saris, Dith Wadi, Wadi Djourf Halia, Bensabia and Wadi Wadi Hassan) and one deep ravine flowing in plain Bousfer Bouhraoua [3].

3) Geology and Soil Science:

Northern M'Sila is composed of some shale elements falling within the Jurassic and Cretaceous established at Middle Miocene TINTHOIN (1948). The south is occupied by the hard dolomitic limestones of Jurassic Superior Bouhraoua (2003). Other soils developed on marly shales of Upper Cretaceous, Eocene and Miocene marl, soft limestone and Pliocene or Quaternary sands G. Aubert and MONJAUZE A. [2].

On the soil level, the forest M'Sila consists of siliceous clayey soil texture of the poor from the decomposition of schists and quartzites néocomiens and disintegration sandy Pliocene sandstone TINTHOIN. According to S. LOVE, four types of soils exist in this forest: the red soils of quartz formation, red soils decarbonated on calcareous sandstone, tirsifiés red soils and polycyclic soils.

4) Climate:

Oran in the growing mode is conditioned by drought. The latter can last long enough in the time making him suffer the plant formations and generate the trigger fires that are deadly blow to these plants.

To achieve a synthesis climate on our study area, we used climate data (as from original documents) of the meteorological station of the port of Oran (an out of area, but is close to the area of study).

Climate data essentially rainfall and temperatures are characterized by fluctuation in global regressive tendency for precipitation and temperatures for scalable. These facts are decisive factors in the dynamics of natural ecosystems.

a) Rainfall:

One of the original features of the climate in Oran is expressed by the irregularity of rainfall throughout the year: abundant in autumn and winter and spring and sometimes almost zero in summer G. Aubert and A. MONJAUZE.

a) Annual distribution of rainfall:

Precipitation is the main source of water required for production of biomass, characterized by three main parameters: volume, intensity and frequency vary by day, month and also by years Guyot [9].

Generally used the annual average rainfall to characterize the amount of rainfall in a given place. The unit of measurement is the millimeter of rain height, which corresponds to a water volume of 1 liter per square meter.

The average rainfall height is relatively quite low in the region. She rarely exceeds 500 mm per year. The average recorded between (1987-2013) is of the order of 388 461 mm and this does not favor the developement of plant species in our forest, especially the cork oak that requires installment rainfall between 600-1200 mm / year.

The minimum rainfall is observed in 1999 with a layer of water 260 mm while the maximum of about 590 mm were noted in 2000. The shape of the curve, however, shows two peaks in 1991 (580 mm) 2000 (590 mm).

b) Temperatures:

Temperature is an important ecological factor and vital to the vegetation.

It represents a limiting factor of prime importance in the Mediterranean climate because it controls all the metabolic processes and conditions thereby sharingof all the areas and communities of living beings in the biosphere RAMADE [15].

b1) Average monthly and annual temperatures (T ° C):

From this table, we see that the annual average temperatures are in the range of 18.02 C for the period (1987-2013). January remains generally the coldest month for both periods (11.6 ° C). The hottest month is rated by cons in August with 26.2 °.

III – Methodology:

To meet the objectives set, a specific methodology allowing late to study the detection of changes in land use following the completion of two land cover maps from 1987 and 2014 requiring multispectral image selection and mulitidates, geometric correction, radiometric and even atmospheric images TM and OLI.

For the realization and design of the land cover map of Msila drill 1987 and 2014, a visual interpretation with the land use map produced by the BNEDER and also with field contact data desmissions were collected during sampling (Spring 2014) and also on the comparison of the colored composition of the same year.

1) Selection The satellite images:

Two Landsat satellite images are used in our étude.Landsat TM 25/04/1987, and Landsat 8 Oli of 04/11/2014 with a resolution of 30 m.

The pre-treatment phase was to perform geometric correction of satellite images of the study area to ensure the overlay with existing maps and georeferenced beings.

Then we made a division of images by selecting the parts corresponding to the same portion of space from the geographical coordinates of our study area.

2) The color composition:

This combination, called 'false color infrared is widely used in remote sensing because it is perfectly suited to the study of vegetation. It relies on the vegetation properties which reflects very strongly the near IR radiation. It has also the same characteristics as the old infrared aerial photographs used for long, initially for military purposes, then by forest. On the colored composition, vegetation appears in shades of red depending on the species, but also the environmental conditions.

Both images at the same season of the maximum peak of production of vegetation (month of April).

A colored composition in which the searched topics are most apparent was developed during the processing of the image that allowed to view channels in green, red and near infrared by assigning blue colors respectively, red and green (RGB).

The series of images was systematically corrected radio metrically and atmospherically based on data with satellite images, to make them comparable and calculate the various radiometric indices.

3) Calculation of Vegetation Index Normalized Difference (NDVI):

Before making our treatments unsupervised classification, a comparison was made between the average index of NDVI obtained on both dates, calculated on the study area.

4) Development of the soil cover map from 1987 and 2014:

a- Image Classification: However, some difficulties appear for the precise delineation of the various plant areas MAJOR *et al* [11]. The technique of unsupervised classification was used in order to have an overview of the geography of the land use units. The images generated by the classification served as validation documents to confirm the observations made on the colored compositions.

To realize the soil cover map from 1987 and 2014, we processed images composed by (NDVI) by applying an unsupervised classification by mobile centers for late two final maps of surface states which contribute more or least basic knowledge about the study area.

The interpretation of classes was made by comparing the index values for each date compared to field contact data and also the image of the colored composition.

Many studies have emphasized the importance of calculating the indices for the characterization of surface conditions particularly in arid regions. [3,8,16]

b- Preparation of the map changes:

Obtaining the map changes in surface conditions from both Landsat: TM OLI 1987 and 2014, through a geographic information system (GIS).

Both ground cover maps derived from clustering under ENVI 5.1, images are in raster mode and have summers converted to vector mode and then processed by the MapInfo 8.0 software is a geographic information system.

RESULTS AND DISCUSSION

In order to show the evolution of each land use class over time, we used a series of set transformations; the relationship between the class on two different dates, we can extract the "stable" areas, "regression" and "progression" of this class. It is considered that t1 represents the set of pixels of the date 1 and t2 is the set of pixels for the date 2.

1) The map of the forest at the time "t1":

Using remote sensing tool allowed us to make a classification of the plant cover in order to differentiate between dense woodland and maquis and rangelands. This classification identifies four classes depending on the type of occupation and density.

The interpretation of this map shows that forest coverage in 1987 was very important and dense class cork oak forests and sometimes associate with the Aleppo pine dominates the geographical area of the forest of M'sila. The clear scrub cis and mastic covers small areas. The path represented by the tracks and decided by fires occupy significant areas in relation to the total forest area of M'sila.

"Figure 1" clearly shows the distribution of classes with Overall Accuracy = 83.7936% and Kappa coefficient = 0.6889.

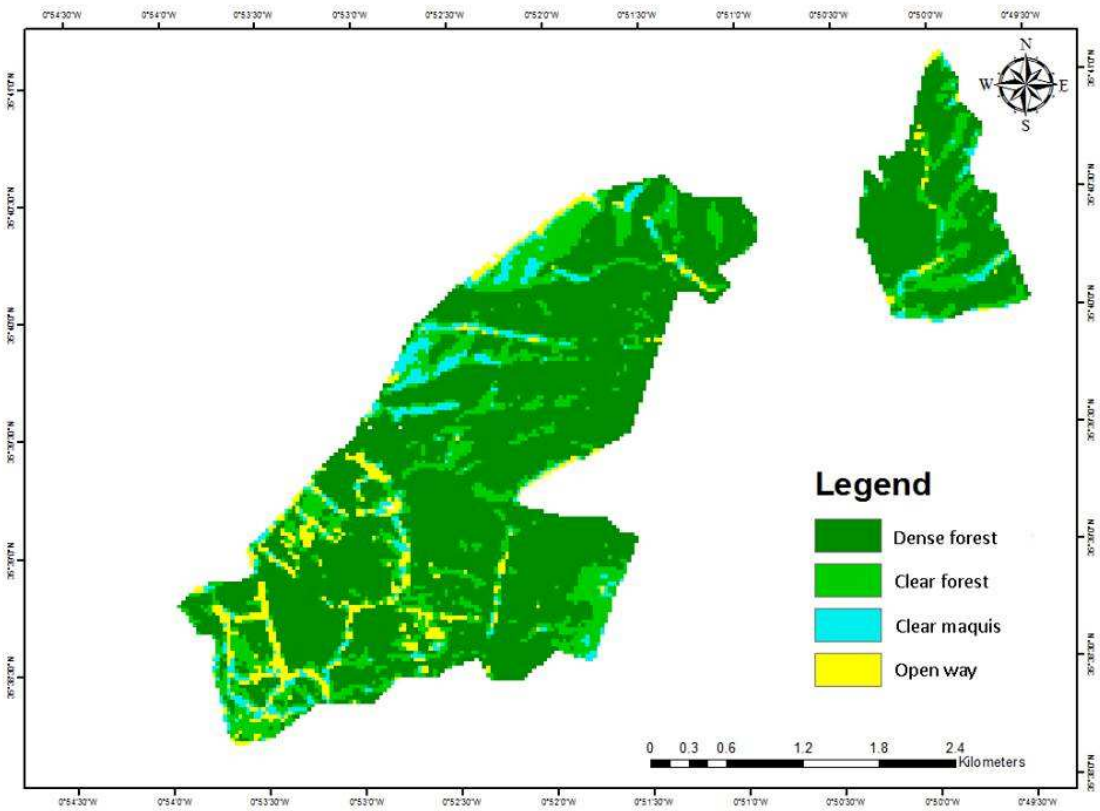

Fig. 1 : Image classification Landsat 5 TM since 1987 (t1)

2) The map of the forest at the time "t2":

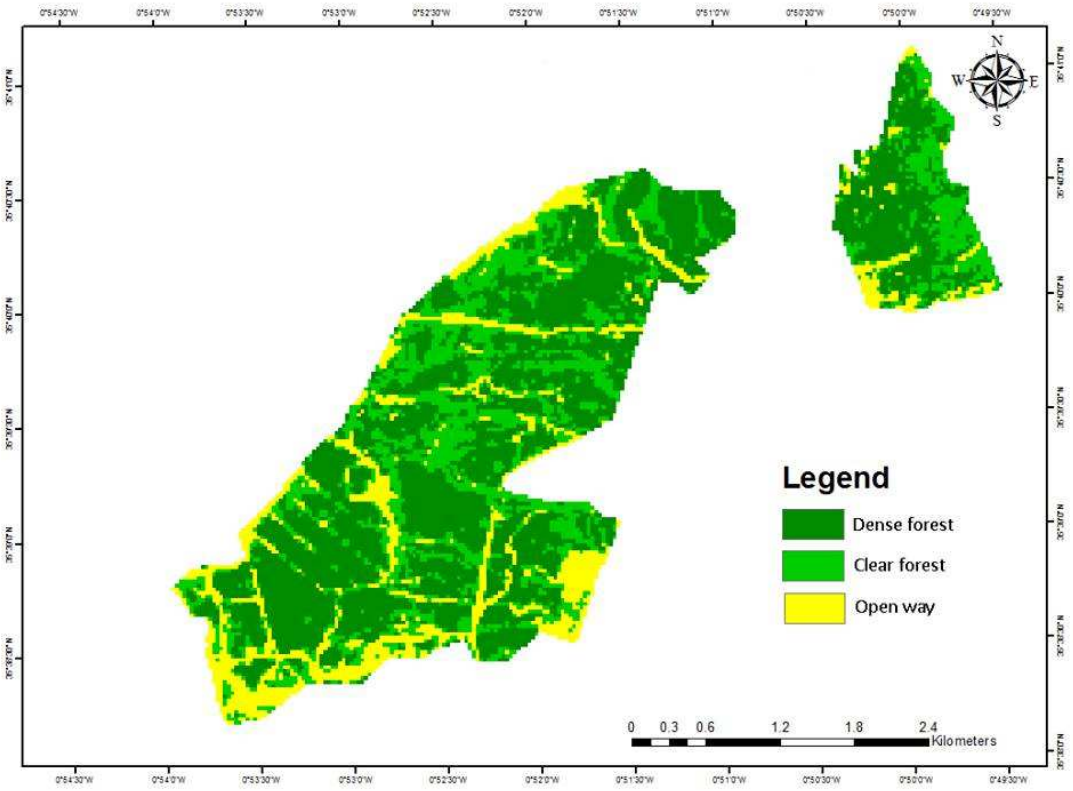

Fig. 2: Image classification Landsat 5 TM since 2014(t2)

The classification of Landsat 8 accentuated Oli 2014 showed a deterioration in the dense forest replaced by clear and clear scrub forests to rangeland and other side there is a progression of woodland to dense forest and the clear scrub evolved into woodland.

The forest degradation observed on t2 map was compared with the result image of vegetation index "NDVI" which shows a low reflectance of vegetation cover. This comparison justifies the importance of forest degradation. And the confusion matrix The "Figure 2" shows the accuracy of the classification adopted with; Overall Accuracy = 79.4186% and Kappa coefficient = 0.6559.

3) Map of forest changes M'sila:

The map changes between 1987 and 2014 shown in Figure 3, is made from the crossing of these layers from different classifications. Indeed, the cross between two periods of combining arithmetically the values of the cell to cell themes. This allows us to quantify the changes in land use occurred between these dates. Both thematic maps generated by crossing from layers of unsupervised classifications 1987 and 2014 are encoded output and the types of changes are grouped according to their relevance. This led us to reclassify our two thematic maps in several classes.

The study of the dynamics of land uses is based on three cases. It is of "no change" which includes all occupations that have not changed between two dates. Then we have the term "regressive change or conversion or degradation" which are units of land uses have undergone conversions between dates and at the end we have the term "increase or progression" which includes classes having progressed in terms of area of occupation.

The interpretation of the cross image has provided a very detailed mapping of forest areas in the forest of M'sila and at the same time draw up a classification according to their degree of change.

The SIG and used also helped organize all the data and results as layers of information in the database available equipped it facilitates us the identification and location information known types of change or on other information concerning land use.

The analysis of the map (Figure 3), produced by crossing the floor to use maps of 1987 and 2014, shows a dynamic in the various thematic classes. It is found that over 60% of the study area did not undergo changes. Tandit that among the land units that have been modified, it is degraded surfaces that have experienced an increase of 9.2% is 98, 43 ha justified by reforestation and the phenomenon enrésinement in reality the geographical area of cork oak, grows of natural and introduced coniferous species such as Aleppo pine, which

have resulted in long-term occupation of the ecological niche of cork oak. It is therefore gradually replace hunt in his area.

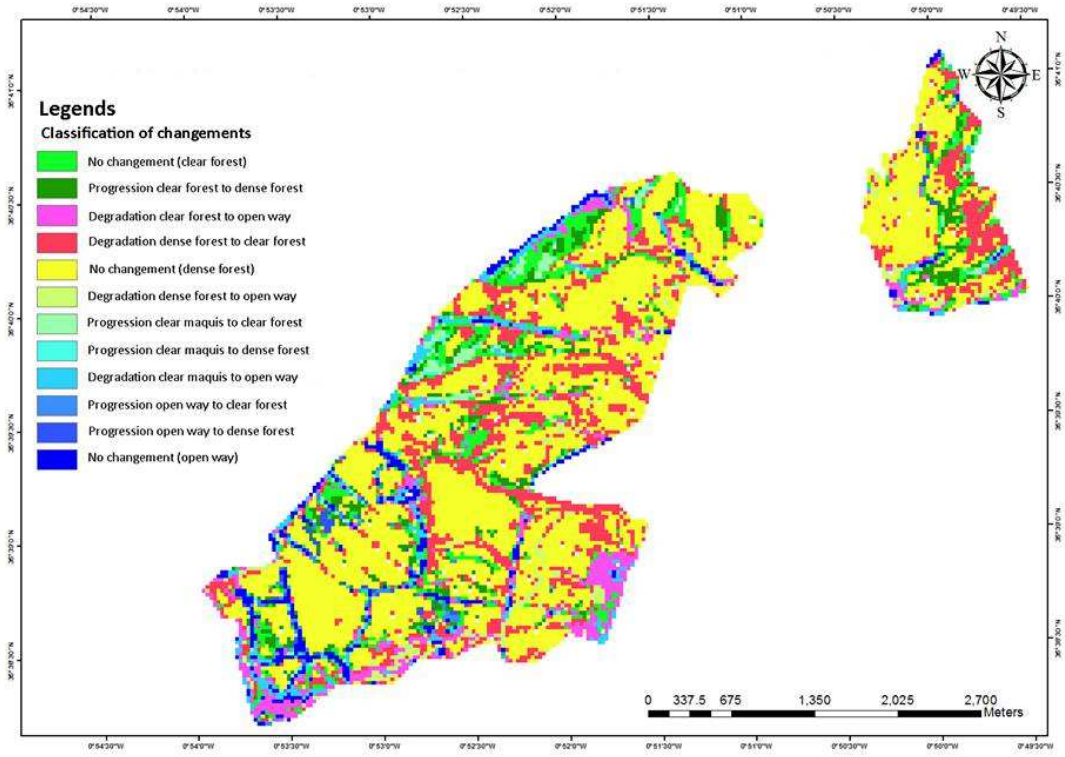

Fig. 3: Map of M'sila forest changes since the period study

Moreover, we find that the forest area has been degraded is the most affected with 328.22 hectares or 30.82% of the study area divided between clear forests and regression course, retraining in culture and in eradication downright bare soil.

The causes of the degradation of this forest ecosystem are multiple is due;

- The spatial and temporal variability of rainfall and scarcity of rains, adding that a prolonged drought, which had dramatic repercussions on the forest, as well as raising the frequency of winds that worsens increasingly the situation accelerating the decline of the phenomenon.

-The several unfavorable soil conditions and soil conditions are unfavorable and that seem to be involved in this process and are:

On the outskirts, soil texture, favoring the loss of water from rain (already insufficient 400 mm) deep infiltration, which strongly modifies the reserves of these profitable in soil water for the trees. These are then exposed to more severe stress especially when they occur at the time of the leaves (spring). Soil texture and is a significant predisposing factor for these stands.

Finally, the presence of limestone in this forest is due to the geological nature of the region, we ask the question about the reasons which have led policymakers to plant oak species liege calcifuge in Oran.

-The inappropriate forestry practices The silvicultural problem that is related to the lack of maintenance, by brushing and cleaning especially well-goers stands.

These stands abandoned favored the development of lush vegetation facilitating the spread of fires.

-A These problems are man's action as illegal logging (wood and cork), tourism (200,000 tourists / year), fire (during the period 1987 to 2013, 287 ha been devastated by fire (16 fires / year) (Photo 2), inconsiderate clearings and a large herd course.

-The Grazing pressure, which significantly increased in some areas in recent decades has destroyed and all possibilities of natural regeneration by sowing following the consumption of acorns fell to the ground and young plants from their land output (Photo 1).

Add to this the overgrowth phenomenon considered one of the important factors directly involved in the weakening and wasting of cork oak.

increasing the population of the region where the overexploitation of land

Factors biotic order are represented by insect attacks and other plant pathogenic fungi

-among The devastating actions of forests, there should be noted the development and financed development operations (achieving the tracks and Tournieres) but resulted in an alteration of forest ecosystems as shown (Photo3).

Conclusion:

Following this study, the diachronic study of the drill Msila during the past 27 years have led to an overall vision of the evolution of land use and obtaining a set of maps and vegetation index, which in turn helped us to see the changes reached in the middle, copiously regressive than progressive.

The anthropozoogenic pressures, the spatiotemporal variability of rainfall and prolonged drought have driven, during the period 1987-2014, a change in the vegetation negatively.

Faced with this situation that the direct conséquance is the disappearance of plant and animal species, it is desirable that this drill reconstitution stratigies are implemented by gestionaires to involve the people in decision dicisions with respect to any related activity has the forest management.

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