

Impact of Human Factor on the Desertification Process in the M'Cif Region, Msila, Algeria

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Abstract

This research revolves around the anthropic factors and their role in the expansion of desertification in the region M'cif in the state of Msila (Algeria) because this problem is one of the most dangerous environmental phenomena in arid and semi-arid areas. Thus, the study area is located in a dry climate and is subject to the emergence of desertification on its lands. The study aims at identifying the anthropic factors that impact the emergence and aggravation of the problem of desertification, including population density, the power of the legal regime, grazing, and irrigation methods that leave vast tracts of agricultural land unproductive.

Key words: facteurs humains, desertification, M'cif region; Algeria.

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Introduction

Desertification affects 25% of the lands worldwide. In this line, more than 100 countries and around 900 million people suffer negative socio-economic impacts of this phenomenon (DMI, 1995). The latter represents a serious threat for the ecosystem equilibrium and a danger for the development of civilizations (Thiombiano., 2000, Diana., K. Davis., 2005, Stringer., 2008). It is an environmental and socio-economic problem faced by the inhabitants of the dry regions internationally (Asma Ali Abahussain., 2002; Awad Othman Abu Sawar, 2008). Currently, it is considered a major environmental problem of the 21st century (La Banque Mondiale., 2002, Diana., K. Davis., 2005).

The fight against this issue is a major challenge for all the affected developing countries such as Algeria because the loss of the natural resources is an economic loss and an obstacle in front of the future development; in addition to the social consequences. In Algeria, there are around 200 million acres of Sahara, 12 million acres are affected by the hydric erosion and 20 million acres are affected by desertification (steppic arid and semi arid zone). Desertification concerns mainly the steppe of the arid and semi-arid regions that had always been the adequate space for the extensive cattle ranching (Eddisi, 1997).

Therefore, the zone under study suffers this problem due to the continuous pressure on the natural resources resulting from the demographic growth, the pressure on the agricultural lands and their use, the bad irrigation practices, the overgrazing, lack of awareness about the gravity of the issue, and the absence of plans that stop the problem. Consequently, we chose to study this topic aiming at finding some solutions.

Materials and Method

The study zone

The region of M'cif is part of the Daira of Khobana that has a surface of 591 Km². It is bordered on the North by the municipalities of Ouled Mahdi and Souamaa, on the East by the municipality of Aekazil, on the West by the municipality of Khobana, and on the South by the municipality of Houamed (Fig. 1). The distance between the center of the municipality and the center of the Wilaya is 150 Km. As for the distances between it and the other municipalities, they are 35 km to Khobana, 75 Km to Houamed, 220 Km to Aekazil, 130 Km to Ouled Mahdi, and 140 Km to Souamia.

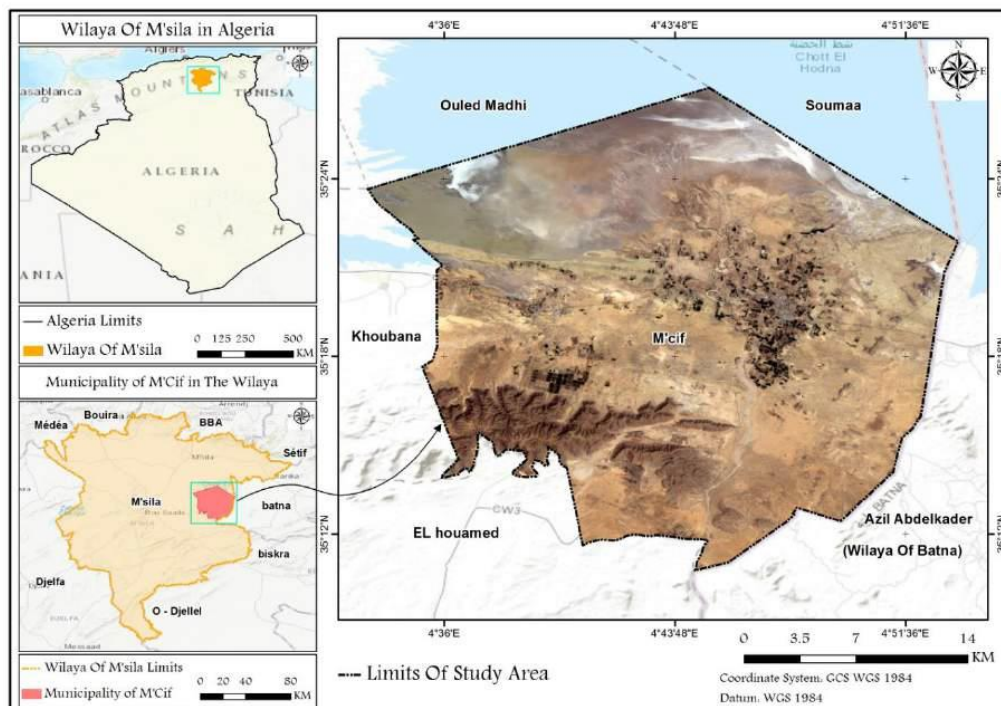


Fig. 1: Geographic location of the study area. (M'cif, Msila, Algeria).

The study region is located in the arid bioclimatic stage that is characterized with a dry season most of the time. The precipitations are weak with an annual average between 150 to 180 mm distributed irregularly throughout the year. The heat is excessive during summer with an insufficient and variable precipitation during the year. Generally speaking, the monthly precipitations are weak and present a summer deficit starting from May.

Materials and Methods

The methodology we use relies on the satellite, topographic data; in addition to measures and observations carried out on the field. These data are analyzed and interpreted for the cartography of the states of the surface of the region of M'cif. We followed different steps to make a map of the lands occupation.

Throughout the study, we mainly used:

The choice of the satellite image: In order to study the evolution of the states of the surface of M'cif region, we analyzed six multi-spectral bands (3 in the visible and 3 in the infrared) for each of the 2 dates of the scene p193r038.

Supervised classifications: The lands occupation on the study zone is very heterogeneous and the passage between the different classes is according to the density of the cover and the size of the individuals. If numerous classes may be discriminated, we decided to work on 6 major cases to make the classification. Some of them have been regrouped with prior analyses:

- 1) Agriculture; 2) Grassland; 3) deteriorated Grassland ; 4) sebkha ; 5) sand dunes; 6) urban area .
- 2)

Results and discussion

A. The changes of the surface states

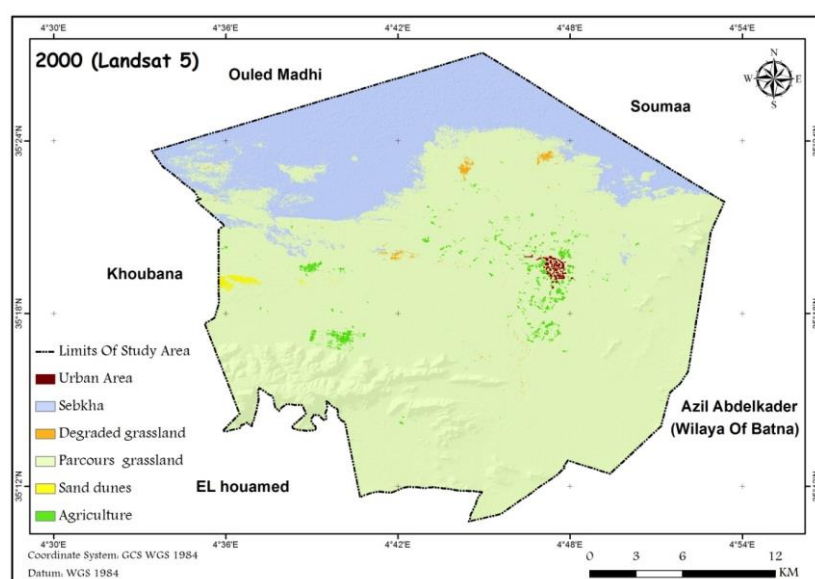


Fig. 2: The lands occupation in the study zone (M'cif, Msila, Algeria) in 2000.

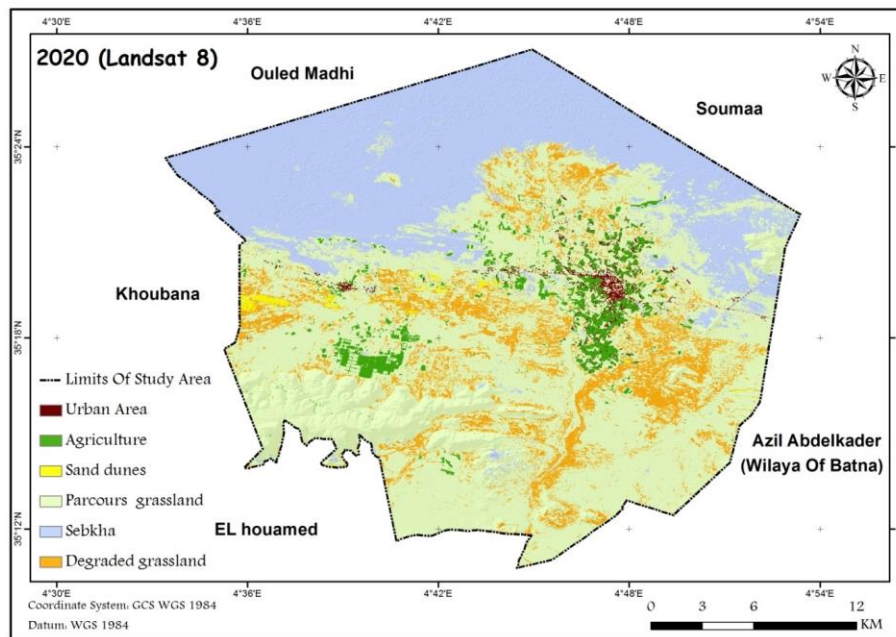


Fig. 3: The lands occupation in the study zone (M'cif, Msila, Algeria) in 2020.

The maps of the lands occupation resulting from the classification of the satellite images allowed the calculation of the surfaces of the different lands occupation units (Fig. 2 &3) represented in table 01. The following maps are issued from the automatic superposition made between the information layers; each one describes a situation. We must note that the change was made in all the units. Some increased while others decreased.

From the reading of maps 2 and 3 and the table, we see an evolution of the deteriorated grassland with + 10.29% dynamics. Moreover, we see an evolution of the sand dunes between 2000 and 2020 in the under study zone with + 0.36 % dynamics. These sand formations designate a state that is sensitive to the desertification because we notice them later after the real dunes which show the continuity of the sand dunes.

B. The dynamics of the lands occupation (2000 and 2020)

Table 01: the dynamics of the lands occupation units and the changes recorded between 2000 and 2020 in the region of M'cif.

	2000 (Km ²)	2000 (%)	2020 (Km ²)	2020 (%)	global Dynamics / Total municipality
Agriculture	4,87	0.82	21	3.55	+ 2.73
Grassland	450.04	76.12	319.79	54.09	- 22.11
Deteriorated Grassland	1.22	0.20	62,05	10.49	+ 10.29
Sand dunes	1.06	0.17	3,17	0.53	+ 0.36
urban area	2.06	0.34	3,21	0.54	+ 0.2

Source: Results and classifications of the satellite images (2000 and 2020) by *ENVI 5.1*.

We shall detail the changes in the lands occupation of each class separately. The evolution statistics confirm what would have been observed visually (Table 1).

Interpretation of the results

Evolution of the urban area

The urban area occupies a surface of 3.21 Km² which is 0.54% of the global surface in 2020. It shows a regular increase with time (table 1) with different rates between 0.34% and 0.54% in 2000 and 2020, respectively. This increase is due to the evolution of the current population of the municipality according to the census of 2000 and of 2020 as shown in table 2:

Table 02: The density and evolution of the population of M'cif region between 2000 and 2020.

Year	2000	1998	2008	2012	2019	2020
Number of inhabitants	7775	10743	12301	14023	15978	16 278
Density of Inhabitants /Km2	13.15	18.17	20.80	23.71	27.02	27.53

Source: annual statistics of the Wilaya of Msila (2021).

Table 02 shows that the density of the population in the region of the study increased during the whole study period. The population increased from 13.15 inhabitants Km² in 2000 to 27.53 inhabitants Km² in 2020. This landmark has a relatively small surface. The density may give an idea about the anthropic pressure on the resources (mainly the large scale exploitation of the space). However, it cannot alone explain this pressure. Thus, we must have a sufficient number of explicative criteria and link them to understand the impact on the landscapes.

The decrease of the demographic growth of the study zone has many reasons mainly the lack of certain needs, qualifications, and infrastructure. This pushed the inhabitants to move to other zones such as the city of Bousaada. The zone under study is 100% rural and has an unemployment rate of 17.94%. Indeed, the desertification may also develop in the less inhabited zones or the developing zones with less than 16 inhabitants per Km². In addition, the weak rural density and the extensive agriculture may harm the environment. On the other hand, we must reach a certain density of population to target intensification (Gendreau, 1996., Bedrani., 1998).

Evolution of the agriculture

Agriculture occupied a surface of 4.87 Km² which gives 0.82% of the total surface in 2000. Table 1 shows an increase with time to a rate of 3.55% in 2020. This increase is mainly due to the agricultural projects in the region of M'cif. The productions and surfaces declared by the agricultural services show that the levels of performance are weak. In this line, the arboriculture in the study zone is insignificant but not negligible. We must note that the hot climate of the region cannot accept some

rustic species such as the apricot, almond, pomegranate, apple, olives, fig, etc.

We must remember the changes that happen in the agro-pastoral zone and the trend to look for the economic equilibrium. Nevertheless, we must signal that the arboreal approach is part of the frame of the ecological equilibrium because the plantation of the fruitful trees aims at fighting desertification.

Evolution of the grassland and the deteriorated grassland

The maps of the lands occupation in 2000 and 2020 (Fig 2 and 3) made by the satellite images show that 76.12% of the total surface of the study region contains grassland; 1.22 Km² , , which is equivalent to 0.20% of them were deteriorated in 2000 while in 2020 we notice a regression in grassland to 54.09% and a progression of the deteriorated grassland to 29.68%. These numbers show the pastoral character of the study region. In addition, these results show an instable situation due to the degradation of the natural milieu that can be attributed to the anthropic and animalistic activities and the climatic factors that show irregular precipitations and an arid nature.

Indeed, the study region is marked with a pastoral activity that makes a continuous pressure on the resources of the region. The overgrazing is considered an important factor in the degradation of the steppes in North Africa. This pressure is not limited to the steppes because the overgrazing in the forests is widespread in the region. This is confirmed by the overgrazing grassland in the forests and the existence of the camping.

Overgrazing

The study region suffers a high overgrazing rate because it is estimated that there are 2 acres for each sheep in the pastoral zone while there must be 6 acres for each sheep. The overgrazing intensity was estimated taking into consideration the animals per surface during the overgrazing period. According to Heitschmidt & Stuth (1991), the overgrazing intensity is calculated according to the following equation:

Number of animals of overgrazing/ grazed surface

This equation has been evaluated with success to estimate the rate of the loading as a reference to evaluate the durability of the grazing (Kairis et al., 2015).

The application of this equation allows us to get the following results:

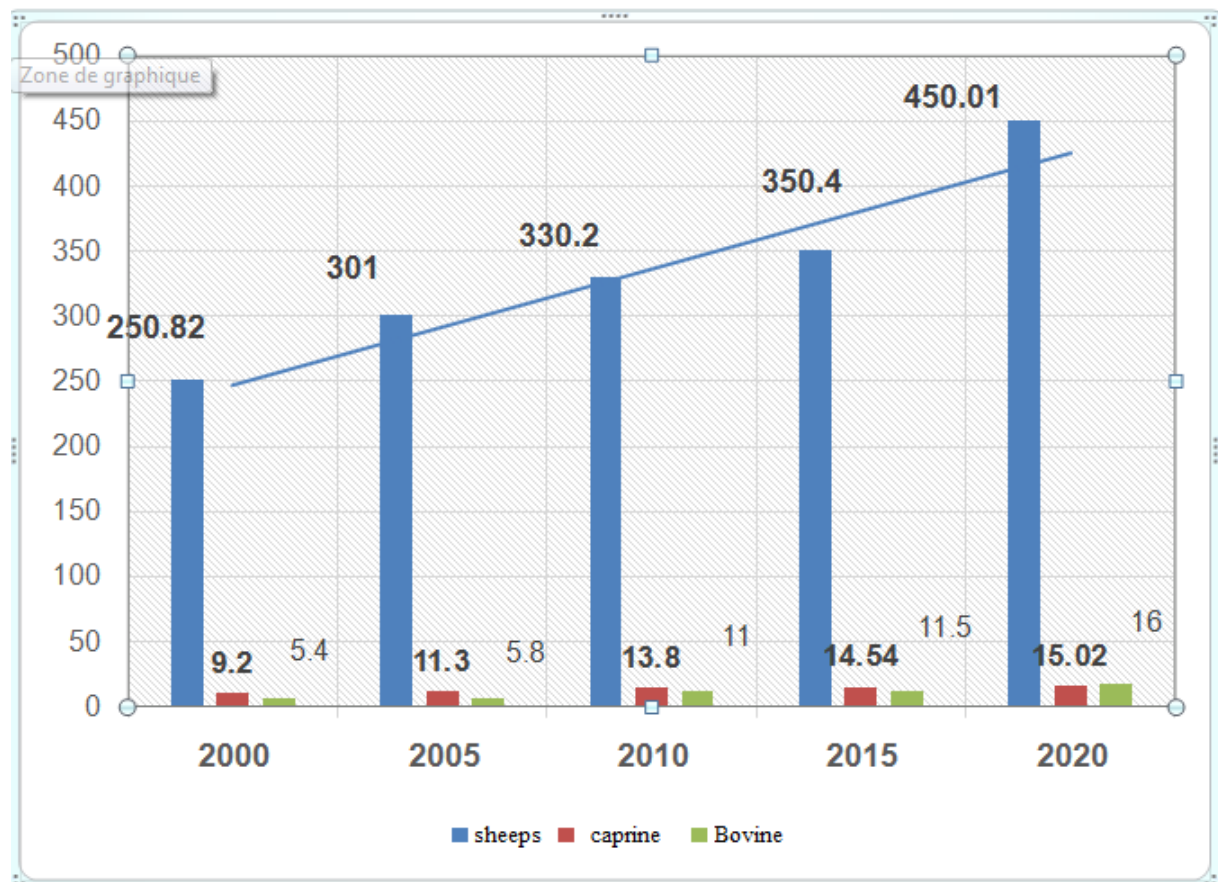


Figure 04: grazing intensity in the M'cif region during 2000 and 2020.

The total intensity of the grazing increased with a significant manner between 2000 and 2020 from 250.82 in 2000 to 450.01 in 2020; it is almost the double. In return, the number of the cattles increased importantly during the study period.

Evolution of the sand dunes

From maps 2 and 3, we see an evolution of the sand dunes between 2000 and 2020 in the study region with dynamics of + 0.36 %. These sand formations designate a state that is sensitive to the desertification because we notice them later after the real dunes which show the continuity of the sand dunes. This confirms the results of the silting of the tracks of the study zone which is the anthropic factor that stays always determining at many levels (Haddouche, et al., 2007).

According to some inhabitants of the region, it suffers many moving sands that invade the inhabitants, the state institutions, and the roads. The sand reaches even the ceilings of the houses. Moreover, sand covers the plantations and harms the water conducts which causes losses because it needs workers to remove the sand what takes much time and money. Some inhabitants moved to M'cif downtown or other zones leaving their agricultural lands (rural exodus).

The pressure of the legal system of the lands

The inadequate laws and regulations on the access to the estate and the protection and exploitation of the lands and natural resources prefer a mineral use of the lands and the search for a short-term benefit without long-term precautions (Andre et Jose, 1996, Diana. K. Davis, 2005).

Table 03: The judicial state of the agricultural lands in the study region.

Judicial state	APFA	Private	Individuals	Total
Number of the agricultural exploitations	54	78	23	155
Percentage (%)	34.84	50.32	14.84	100

Source: Our study.

The majority of these exploitations is private or belongs to the Association of Exploitation of the Agricultural Estate Property APFA. The latter is made up of private exploitations created thanks to the process of lands privatization as provided for in Law 83/18. The average surface of the agricultural exploitations in the study region is 8.6 acres. In this line, Berchiche (2000) noted that the social fabric and its organization in the steppe correspond to a tribal organization that relies on the family head rather than the administrative authorities. This is the case of our study in M'cif.

The inadequate use of the irrigation technology

The bad practices in irrigation cause an increase of the salinity and dries out the water conducts that supply the big lakes (Sharma, 1998). Due to the arid climate, the available water resources are limited to the groundwater.

Table 04: Number and characteristics of the groundwater resources in M'cif during 2000-2020.

hydic resources	Number	
	2000	2020
drillings	3	507
Wells	8	10
Total	11	515

Source : DSA, 2021.

According to DSA, the drillings in the region represents the main water source for the exploitations. There are around 100 illicit drillings meant for agriculture and are made up of groundwater and confined groundwater. Their depths are generally variable from 10 to 200 m.

The supply of drinking water takes place through the exploitation of the drilling. However, the number is still insufficient for the needs of the local population.

In our study, we notice that the farmers and the cattle ranchers of M'cif use much irrigation mainly through drip-to-drip with a rate of 39%, the gravity irrigation with 27%, and the aspersion with 17%. Most of the investigated parts had their irrigation materials thanks to the different state programs that aim at the national development of agriculture in various regions including the steppic zones. Irrigation caused the problem of the salt rise. Irrigation depends on electricity. However, the studied zone suffers the electrical interruptions that lead to the death of the plants and, hence, the expansion of desertification. In addition, most of the exploitations suffer many problems in the irrigation system including the plugging, monitoring their functioning, and the costs of the materials.

Conclusion

From this study, we notice the degradation of the lands in M'cif due to the direct relation between the anthropisation of the zone (population density and the overgrazing ...) that increases the climatic or natural problems such as drought and aridity. The combination of the natural and anthropic factors and the deserted surfaces lead us to make the following notes:

- The increase of the population, the cattles, and the pressure of the judicial system of the lands in the studied zone are the main anthropic factors that influence desertification.
- The main cause of desertification in M'cif is the irrational and intensive economic activity.
- The policies that encourage the agriculture in the lands of grassland that cannot support viable ecosystems contribute to the desertification.
- The weakness of the precipitations, the high temperatures, and the violent winds determine a strong aridity that has a role in the evolution of the desertification.
- It is clear that in this zone the recrudescence of the desertification is much more linked to the increase of the anthropic pressure than the pejoration of the bad climatic conditions.

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