

ANALYSIS OF ANTHROPOGENIC IMPACTS ON THE ACHACH FOREST DEGRADATION IN CENTRAL PLATEAU – MOROCCO

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Abstract- *The gradual decline of the Achach forest cover is at the heart of regional and national environmental issues. Public policy wishes to develop a participatory approach involving local populations. Thus, a better understanding of how local management should be is required. This article examines the analysis of human impacts on the Achach forest degradation. Surveys conducted in the field and consultation of minutes evolution during 24 years ago (1987 to 2011) showed a large exploitation of the Achach forest by local population, through transfers of firewood and leaf fodder for livestock. 1500 reports were established by the forest guards during this period and 43 152 trees were cut down, while the number of reports related to the overgrazing were about 1 824 with 161 532 trees and associated plants were damaged in this area.*

Keywords - degradation, impact, anthropogenic, logging offenses, overgrazing, central plateau, Morocco.

I. INTRODUCTION

The forest provides production functions (wood products: wood, firewood and non-timber products: mushrooms, honey, medicinal plants) and environmental (soil protection, erosion control, combating siltation of dams, carbon sequestration...). In Morocco mountain areas of the central plateau have strong ecological constraints: very open landscapes, degraded forest and arid climate. Rural logging, embodied in samples of leaf fodder, firewood and building, is essential to the life of the local population. The Moroccan forest area estimated to 5 814 000 hectares, loses about 31 000 ha [1] each year. This degradation poses serious environmental problems for both the ecological and economic roles of the forest. Whatever, the economical subsistence of mountain populations in Morocco is based on pastoralism activity. This operation is regulated by customary institutions [2]. Data analysis of grazing distribution at national scale shows that grazing pressure is relatively low in 9% of the national territory, while it's excessive in 26% of the territory, with a potential of exceeding by 2 to 5 times depending on the area[3]. The Achach forest area covered by several natural forest plants (cork-oak, holmoak, Tetraclinis, oleaster, and other secondary plants) and artificial plantations (Pinus, Eucalyptus, Atriplex, Lycieum, Accacia, Cactus ...) provides diversified production for local population. The diachronic study was based on using images from multiple (TM 1987 and TM 2011) which was used to map the evolution of forest settlements using remote sensing and GIS. The results show that the green oak and Tetraclinis are species that have experienced significant regression respectively 64.58% ie 27.14% compared to their original areas in 1987 [4].

In this area several enclave spaces with an area more than 3 000 ha characterize the general features of this environment. These enclaves are often inhabited by a population that is adjacent to this space and in constant contact with the forest. The extensive rearing provides most of its power through the exploitation of the forest by the users. So, The level and intensity of this pressure should be closely approached in order to identify the main factors with direct effect on this land degradation and to propose some recommendations regarding to the development aspect. So, the aim of this research study is to analyze the various anthropogenic factors responsible for the regressive evolution of the Achach forest.

II. MATERIALS AND METHODS

II.1. Presentation of the study area

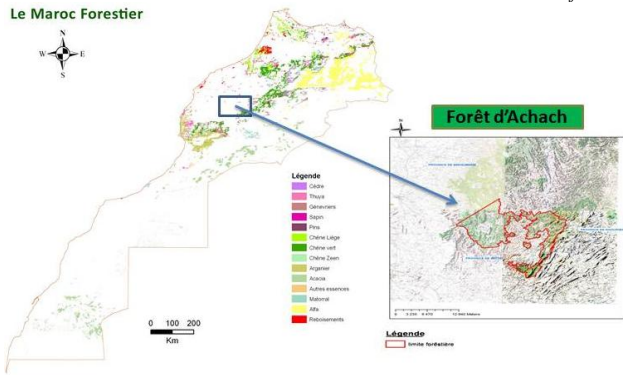
The Achach forest is bounded on the north by the M'dakra forest, on the south-west by the Oued Zemrine, in the east by the Gnadiz forest, in the north and northeast by the forest of Oued Tifssasine.

The area is located on the bioclimatic semi arid temperature. The average annual rainfall ranging from 350 to 450mm (Sidi Sbaa station and El Kkhatouat station).

Indeed, 70% of the relief is formed by mountains. The remain area consists of plateau and valleys. The soil is dominated by Lahrache (33%) and Dendoune (77%). Plants encountered in this area are dominated by Tetraclinis, holm-oak and cork-oak. [4].

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II.2. Socioeconomic data

At the socio-economic level, the Achach forest covers the rural communities of Ouled M'hammed and M'Garto. The right holders are two tribes which consist of three fractions: Ouled hmama Ouled Abdallah who are the users of the Achach forest.

CR Mgarto: The illiteracy rate, up to 76% among women in 2004 and 50% among men. A sharp increase in rural housing (68 to 90%) Was observed in 10 years. The employment rate in M'Garto was around 13.7% among women in 2004 and 61% among men[5].

CR Oulad Mhamed: The data provided by the General Census reveal that illiteracy at the rural community of Oulad MHamed has known a setback during the period 1994-2004 among both men and women. It was 82.3% among men and 95.48% among women in 1994, but in 2004, data are respectively 57.2 and 79.04%[5].

II.3. The practices of the local population

The study of the changing demographics of the population using the forest shows that the total population in the Achach forest 19671 inhabitants in 2004 [5]. If this large population maintains its forest practices related to the surrounding wooded area, it would seriously jeopardize its survival

The energy consumption is essentially based on wood fuels. All households within the study area use firewood for heating in their homes during the cold period (winter).

Illegal practices put additional pressure on the forest area. These destructive practices include cutting down live wood for energy in winter and offense routes during periods of drought.

II.4. Agriculture

Agriculture is the backbone of self-sufficiency of the overall rural activity that add up farming and other practices, especially the practice of forestry.

The primary objective of farming is to satisfy the needs of the household in basic foodstuffs, including cereals (durum wheat and soft wheat especially). The performance, dependent on mechanization, fertilizers use and crop rotation that are practiced, is more than satisfactory.

II.5. Grazing and its impact on the forest

Breeding livestock represents an activity of paramount importance in the operation of farming and the management of the production system that is in its design and approach the integration of all components of the natural environment in

the production process.

The herd that moves in the region is numerous and includes, in the case of the Achach forest about 60 548 UPB. It should also be noted that 51% of farmers in The Achach forest own more than 50 UPB. This number is higher than what is usually considered "familiar": 40 heads of sheep[6].

The breeding practiced in the region is traditional with a supply of supplementary food in the drought period. The herd spends 6 months of the year (winter and spring) in the forest, so that the breeding activity remains heavily dependent on the forest area.

The annual needs of livestock grazing in the forest can be estimated at 10 153 820 UF in the Achach forest[6].

II.6. Prospections and measurement

From the visits we made in the field and after meeting the local foresters and consulting the existing documents at the headquarters of the provincial Department of Water and Forests and Desertification Control of Settat in Morocco,

To understand and analyze the anthropic factors responsible for the degradation of the Achach forest, we studied the evolution of (PV) offenses recorded by the forest officials in the two rural municipalities during the years 1987-2011 (24 years).

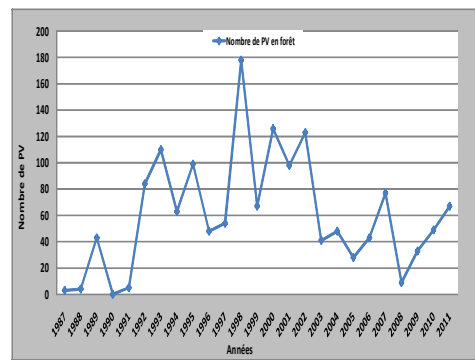
III. RESULTS AND DISCUSSION

When we consulted the Counting books which contained the offenses recorded by forest officials of the provincial Department of Water and Forests and Desertification Control of Settat , we were able to study and analyze the number of offenses of cutting live wood and grazing as well as the number of trees cut down illegally and the damaged and mutilated plants in a 24-year period (1987-2011) and we were also able to classify the data in the following graphs:

III.1. Offenses of cutting live wood

Table and Fig 1: Evolution of the number of offenses of cutting live wood between 1987 and 2011 in the Achach forest :

Année	Nombre de PV en forêt
1987	0
1988	41
1989	43
1990	0
1991	41
1992	44
1993	114
1994	63
1995	58
1996	48
1997	54
1998	178
1999	67
2000	124
2001	38
2002	123
2003	42
2004	46
2005	28
2006	43
2007	71
2008	44
2009	33
2010	46
2011	67
Total	1500



• From a quantitative point of view, the number of reports (PV) prepared by the officials managing this forest about the offenses of cutting down live wood for 24 years (1987/2011), has continued to increase over the years, with the exception of the periods (1987 - 1991), (2003 - 2011) when the number of reports (PV) declined, noting that 1990 recorded no offenses (Table and graph 1). Only in the period of 1992 to

2002 where we observed a strong pressure on the forest. 178 reports are noted in 1998.

- It should be noted that in a total of 1500 reports (PV) prepared during the period (1987-2011), more than 40% of reports (PV) were recorded only during the five years of observation (1998-2002). This confirms that the intensity of the impact of the population on the forest environment was amplified during this period, while the first five years (1987-1991) only 4% of offenses were recorded, which explains that logging has not started with intensity until 1992.

- The average number of reports (PV) established during this comment period is 63.

DISCUSSION:

The demographic component is undoubtedly the main factor in the degradation of the Achach forest. Indeed, the growing needs of the local population, especially financial resources, have resulted in the deforestation and clearing of large areas of the forest.

- The natural Achach forest has for a long time known a high pressure illustrated in illegal logging. This wood is turned by the local population into charcoal which is to be sold mainly in the markets of the neighboring regions.

- It should be noticed that compared with the community of Mgarto, people in the Douars belonging to the rural community of Oulad Mhammed tend to harm the forest and forest resources in general more. Because of poverty, difficult conditions, lack of basic infrastructures and above all the illiteracy of the people.

- On the scale of this zone, forest formations are under great anthropogenic pressure to different degrees depending on the species and cantons of the forest.

- The cutting down of wood, especially oak, tetraclinis and oleaster is practiced by the residents of the forest in winter which is usually marked by a strong demand for fuel wood and energy

- It should be noted that logging is practiced most often in the form of collective and organized offenses using all the means to enable them to track and watch every movement of forestry staff. • In response to these offenses, forestry staff, though handicapped by the lack of human and material resources, continues to deploy considerable efforts in surveillance, repression and control without being able to stop this regressive dynamic of the forest. Consequently, and in order to address this alarming situation which threatens the sustainability of natural resources and population stability, a collaborative and participatory approach to the development and conservation of forests and the improvement of living standards of the local residents is essential.

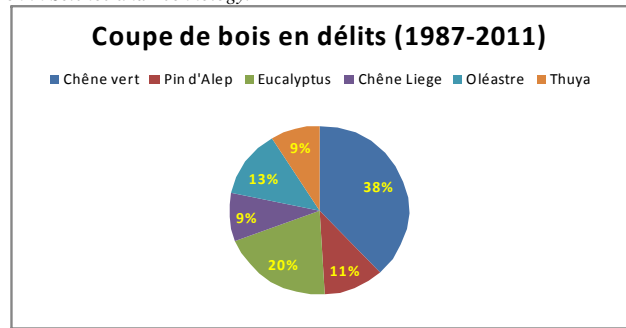
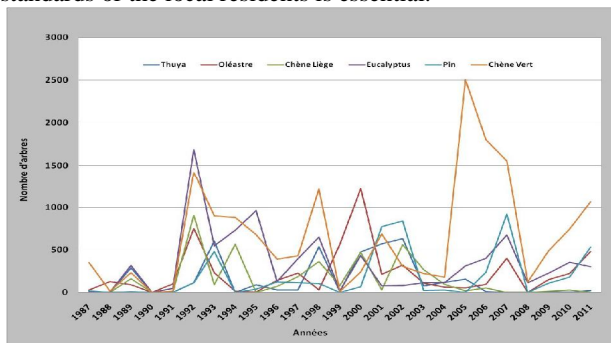


Fig 2: Evolution of the number of trees per species cut down illegally between 2011 1987et in the Achach forest.

- From a quantitative point of view, the number of trees per species cut down illegally recorded by this massive forest manager for 24 years (1987/2011), has continued to increase over the years, except for 1990 which has known no tree cutting (Table and graph 2). These are the periods (1992-1995), (2000-2002) and (2005-2007) which experienced a strong pressure on the forest, reaching a peak of a number of total trees cut down (all species) equal to 4988 in 1992.

- It should be noted that a total of 43152 trees cut down during the period (1987-2011), more than 27% of the trees were cut down only during the observation period (1992-1995), 19% of the trees were cut down during the observation period (2000-2002) and 21% during the period (2005-2007). This confirms that the intensity of the impact of the population on the forest environment was amplified during these periods.

- The natural species which were cut down are green oak for a total of 16438 (38%) with a peak of 2504 in 2005, oleaster for a total of 5632 (13%) with a peak of 1222 in 2000, the cork for a total of 3952 (9%) with a peak of 903 in 1992 and tetraclinis for a total of 3750 (9%) with a peak of 630 in 2002. By contrast, artificial species planted by foresters are eucalyptus with a total of 8682 (20%) with a peak of 1688 in 1992 and pinus for a total of 4698 (11%) with a peak of 918 in 2007.

- The average annual number of trees illegally cut down during this period of observation (1987-2011) is 1798.

Discussion:

- The oak is the species most attacked as it is used to make coal of good quality which is sold quickly at higher prices than other species in the market.

- Other species are also used for construction and domestic use of firewood.

- The phenomenon of sharp wood cutting has grown for more than forty years, irreversibly connected to population growth and the poverty of the people.

- Deforestation by cutting wood and clearing conjugated to overgrazing, erosion and pest attacks leading to significant losses in forest resources and a considerable annual shortfall.

III.2. Overgrazing for 24 years

Table and Fig 3: Curve showing the evolution of offensive overgrazing during the 24 years (1987/2011) in the 2 CR:

Années	PV en forêt
1987	83
1988	77
1989	74
1990	50
1991	118
1992	67
1993	84
1994	56
1995	130
1996	71
1997	100
1998	85
1999	153
2000	80
2001	102
2002	146
2003	21
2004	76
2005	57
2006	5
2007	34
2008	16
2009	23
2010	25
2011	16
Total	1824

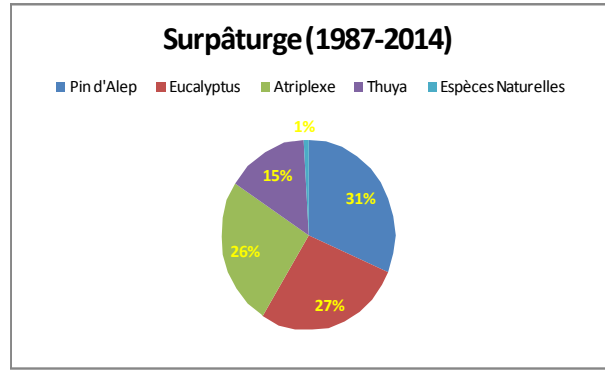
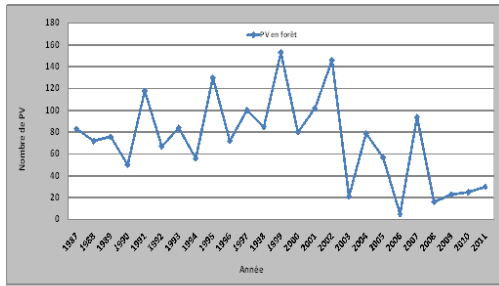
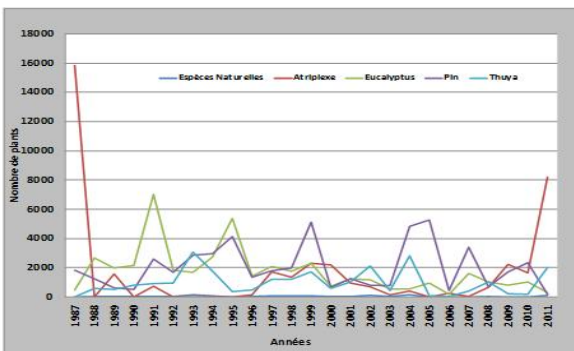


Fig 4: Evolution of the number of trees per species damaged by overgrazing between 1987et 2011 in the forest of Achach:

- From a quantitative point of view, the number of reports (PV) established by this massive forest managers for 24 years (1987/2011), has continued to increase over the years, except for the period (2008 - 2011) and the two years 2003 and 2006, where the number of reports(PV) declined. We should point out that the year 2006 saw only five offenses (Table and graph 2). The period from 1991 to 2002 saw a strong pressure on the forest by grazing reaching a peak number of reported offenses equal to 153 in 1999. The same period knew an increase in exclosure cases.
 - Notice that in a total of 1824 reports (PV) prepared during the period (1987-2011), more than 48% of them have been recorded only during the eight years of observation (1995-2002). This confirms that the intensity of the impact of grazing on the forest environment was amplified during this period. By contrast, the last four years (2008-2011) represent only 5% of offenses, which shows that humans and livestock have decreased their pressure on the deferred grazing and the forest in recent years.
 - The average number of reports established during this comment period is 76
- Discussion:
- overgrazing is a major constraint for the sustainability of the forest;
 - The feed units within the forest and the exclosure (reserves) are food and energy much greater in value than areas outside forests.
 - The reforestation areas made by the Provincial Administration for Water and Forests and Desertification Control of Settat know overgrazing and even invasions by herds of the local population, especially in summer and just after planting these perimeters.
 - Establishment of mining exploitaion in the forest due to the need to meet growing needs, without being able to ensure the preservation of the resource over the long term.



- From a quantitative point of view, the number of trees and plants by species damaged by overgrazing is very important in this period of 24years(1987-2011) according to this massive forest manager .The number varies along the years from a number of plants of 940 in 2006 to 18175 in 1987 .These are the years 1987, 1991, 1995, 1999, 2004 and 2011 which experienced a strong pressure on the forest with respective numbers of plants damaged 18175, 11278, 9886, 11531, 8740 and 10776.
- It should be noted that in a total of 161532 trees and plants damaged by overgrazing during the period (1987-2011), more than 11% of the trees were mutilated during 1987, while in all the years that follow the percentage never exceeds 7%. This confirms that the intensity of the impact of population on the forest environment and reforestation areas was amplified during these years.
- The artificial species planted by foresters are heavily damaged namely: the Aleppo pine for a total of 50714 (31%) with a peak of 5258 in 2005, Eucalyptus for a total of 44060 (27%) with a peak of 7032 in 1991, Atriplexe a total of 41101 (26%) with a peak of 15847 in 1987 and Thuya for a total of 24377 (15%) with a peak of 2822 in 2004. By contrast ,the number of damaged native species (Holm oak, cork oak, oLEASTER and secondary species) rarely exceeds a total of 1289 (1%) with a peak of 161 in 1993.
- The average annual number of trees and plants damaged by grazing during the observation period (1987-2011) is 6730.

DISCUSSION:

- The artificial plantations established by the Moroccan Administration for Water and Forests in this area are mostly based on Aleppo pine and Eucalyptus.This (reforestation work)is installed in degraded areas of the Achach forest, followed by Thuja (restoration work) and Atriplex (sylvopastoral amelioration work)which is experiencing a strong pressure by the cattle of the local population.
- In the various perimeters, planting begins in December and ends in March.Success is excellent and held until summer. However, after summer,perimeters often know significant failures which are caused mainly by grazing practiced by the local population especially in August and September. Some boundaries are invaded and destroyed by livestock often at night, affecting both young and old plantations .In the latter , grazed plants are often mutilated and remain stunted.

- It should also be noted that this situation is aggravated by the hot weather and the "Chergui" (very hot eastern wind) waves and also by technical constraints, namely the delay in land preparation and the planting of plants which often affect their vitality.
- The effectiveness of installing fences with barbed wires made by forest agents around the perimeters to prevent livestock access remains low and does not appear to significantly reduce the importance of illegal grazing. The residents of the forest usually proceed to the partial destruction of the fences to allow access of the herds to the perimeters. In addition, stealing of the barbed wires is a common practice in several places.
- In this process, the most destructive factor is related to the permanent presence of the herd belonging to the existing population in the forest. This permanent presence in the forest is indeed an economical source which the population cannot do without, especially in this area where livestock is the backbone of the resources of the local community.

III.3. The problem of grazing and the struggle strategy

The problem of grazing is very difficult in the area, given the high density of the local population of the forest: a dozen enclaves are indeed inside the forest; the solution of this problem requires the involvement and commitment of stakeholders: authorities, politicians and justice; the strategy should focus on three areas:

- Campaigns to seize the repeatedly found animals grazing in the perimeters.
- Report the offenders and transmit them to justice.
- Sensibilization of the forest users about the compensation of being prevented from grazing.
- Improvement of living conditions of the local population

III.4. Consequences of the degradation of the Achach forest:

Since the Dahir of 20 September 1976 related to the participation of rural communities in the development of the forestry sector [7], the payment of forest income in the account of the communities is an important resource for most of them. The regression of the forest in the communities of Mgarto and Oulad Mhammed will have a negative impact on their economies.

The Achach forest has a diverse flora, however, this biodiversity is currently compromised by the extent of clearing, overgrazing and the various abuses to which it is subjected. Another consequence of the degradation of the natural environment is the destruction and fragmentation of the favorite wildlife habitats.

Soil degradation causes partial or total loss of the quantitative or qualitative productivity, or both, resulting in phenomena such as the wind or water erosion, salinization, water logging, loss of nutrients, deteriorating soil structure, desertification and pollution [8].

In our study area, erosion is already an apparent reality. Indeed, all forms of erosion are present with different intensity levels.

VI. CONCLUSION

During this study, all analyzed data showed that the degradation of the Achach forest is not a new phenomenon. The action of man on the natural environment was already

evident at the beginning of the century, but it has become most serious in recent years because of a combination of several factors:

- To satisfy their basic needs, people therefore tend to expect more from nature, which leads to the breakdown of social and ecological balances issuing from former land use and natural resources. The greediness of people has also led to the use of clearing, the cuts of trees, overgrazing, ... etc.
- The analysis of forestry disputes shows very hostile behavior of the local population towards the forest resources in the area.
- Factors related to forest bad management of this massive and global forest policy are also factors that further aggravate the degradation of the forest.

The combination of all these factors has resulted in the fact that the Achach forest is nowadays in a deteriorated condition, which will surely have ecological and socio-economic impacts on the region. Hence, the need for large-scale operations for its maintenance and rehabilitation. It is especially important to try to find viable solutions focusing on solving the ecological, socio-economic and technical problems.

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