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Effects of drought and anthropism on vegetation and soil elements in the station of Tadmit (Wilaya of Djelfa, Algeria)

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SUMMARY – Vegetation of the high steppic plains of the southern algiers region has always been used by human occupation. The harsh climatic context, characterized by long periods of drought and an ovine livestock in constant growth lead us to devote particular attention to the biodiversity of those living environments. The diachronic study made in Tadmit (50 km South of the district of Djelfa) about the specific recording, led us to notice what follow: the floristic recording of Tadmit is not reduced in time but fluctuates, this depends on the pasture intensity, the annual rainfall and especially on the protection area of the following two years from January 2004. The specific recording of the station undergoes significant changes from one period to another; those changes in the floristic list concern nearly 50% of the initial flora that could disappear or be replaced by new species. Finally, the alfa steppe is in a marked decline and is substituted by new facies privileged by the overgrazing, stranding or clearance.

Key words: Overgrazing, diachronic study, protection area, climate.

RESUME – *"Effets de la sécheresse et de l'activité de l'homme sur les éléments de la végétation et du sol dans la station de Tadmit (Wilaya de Djelfa, Algérie)". La végétation des hautes plaines steppiques sud-algéroises a depuis toujours été sollicitée par l'activité de l'homme ; le contexte climatique rude, caractérisé par de longues périodes de sécheresse et un cheptel ovin en constant accroissement, accélère la dégradation de ces milieux. L'étude diachronique menée dans la station de Tadmit (50 km au sud de la commune de Djelfa) sur l'évolution de la richesse spécifique, nous a permis de faire les constatations suivantes : la richesse floristique de la station de Tadmit ne subit pas une diminution continue dans le temps mais elle fluctue ; cette variation dépend de l'intensité du pâturage, de la pluviosité annuelle et surtout de la mise en défens de deux années consécutives entreprise en janvier 2004. La composition de la richesse spécifique de la station subit des changements très significatifs d'une période d'observation à l'autre ; ce remaniement dans la liste floristique touche près de 50% de la flore initiale qui peut disparaître ou être remplacée par de nouvelles espèces. Enfin la surface de la nappe alfatière dans la station de Tadmit est en nette régression, remplacée par de nouveaux faciès favorisés par le surpâturage, l'ensablement ou les défrichements.*

Mots-clés : *Surpâturage, étude diachronique, mise en défens, climat.*

Introduction

The station of Tadmit was the subject of several phytoecological studies Djebaïli (1970), Tazaïrt (1989). In our present work we compare our results made in 2006 in the same station, in order to measure the progression of vegetation through its floristic composition, pasture share species, evolution of vegetation cartographied in 1988 and its area. The latter will be studied in comparison to the soil occupation map, Tazaïrt (1989) to ours.

Methodology

Climate and bioclimate

Climate data were taken from Seltzer (1946) for a period from 1913 to 1938, from Dubief (1950) for 1926 to 1950 and from ONM (Office National de la Météorologie) for 1971 to 2006 for our station and some bordering to ours (Djelfa & Laghouat). Climatic succession from 1919 to 2006 leads us to settle the tendency of the mean annual rainfall.

Anthropic actions

We settle the evolution and the tendency of the ovine size for the Wilaya of Djelfa by the mobile mean method.

Vegetation sampling

50 phytoecological samples were made in the station of Tadmit. We have compared our results to those of Djebaïli and Tazaïrt by counting the variation ratio and similitude index of Sorensen (1948) for the following parameters: (i) floristic richness; (ii) pastoral species.

Physionomy comparison of some interesting facies were made. For the latter, we have compared soil occupation map of Tazaïrt (1986) to ours (2006).

Variation ratio: ([(b - a) / a] x 100)

Similitude index of Sorensen (1948); in Kadi-Hanifi (1998): (2 c / (a + b)), with: (i) number of species for the previous year; (ii) number of species for the next year; (iii) number of common species between the two periods of observation.

Results and discussion

Climatic synthesis

The station of Tadmit, with an area of 1520 ha, is situated in arid bioclimate with cold winter, it belongs to semi-continental Mediterranean climate fairly contrasted.

Climate tendency

The bioclimate of the three stations through different periods led us to settle the fluctuations of different climatic parameters (Table 1). Those fluctuations characterize the Mediterranean climate, but don't belong to a global climatic change.

Table 1. Climatic and bioclimatic parameters (Benseghir, 2008)

		Zeltzer (1913-1938) 25 years	Dubief (1926-1950) 24 years	O.N.M (1971-2006) 36 years
Annual rainfall (mm)	Djelfa	308	329.20	324.30
	Tadmit	267.28	273.90	242.30
	Laghouat	167	171.50	143
Season rainfall	Djelfa	W.A.S.Su†	W.S.A.Su	S.W.A.Su
	Tadmit	–	A.S.W.Su	
	Laghouat	A.S.W.Su	A.S.W.Su	A.S.W.Su
m (°C)	Djelfa January	–0.80	–	January: 0.002
	Tadmit	–	–	January: 0.72
	Laghouat	January 2.30	January : 1.90	January: 2.9
Drought period	Djelfa	half May to half October (5 month)	–	Half May to half October (5 month)
	Tadmit	–	–	Half March to half November (7 month)
	Laghouat	January to December (12 month)	Half February to end November (9 month and half)	January to December (12 month)

† W: Winter, S: Spring, Su: Summer, A: Autumn.

The annual rainfall mean of the stations of Djelfa and Tadmit don't seem to have significant changes (Fig. 1); the following figure see evidence the irregularity of annual rainfall in both stations but doesn't demonstrate downward tendencies. There is no significant difference in annual rainfall mean between the first half and the second half of the twentieth century. If we try to find a cause to desertification, it would be not from climatic matter.

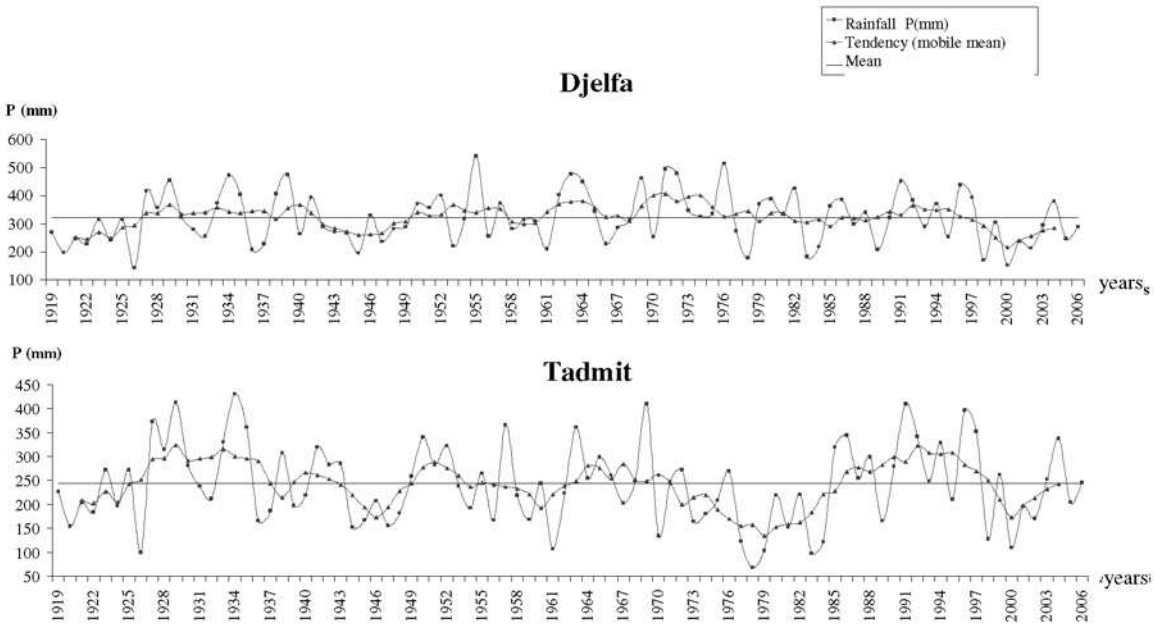

Fig. 1. Annual rainfall withe tendencies (Benseghir, 2008).

Anthropism

A continual demography increasing of the wilaya of Djelfa (Fig. 1) and its livestock entailed an increasing of natural resources exploitation (Figs. 2 and 3).

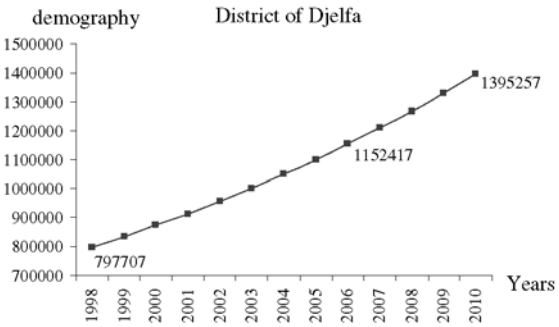

Fig. 2. Demography evolution of Wilaya of Djelfa. Source of data: Statistics National Office.

Diachronic study

We noticed fluctuations of floristic richness and not a continual decrease.

Between 1970 and 1989 we notice a decrease of 26% (Table 2). This regression is due to a lack of annual rainfall (Fig. 4), but rainfall only can't explain this decrease because the 4 previous years to 1989 were very rainy and contribute to reload water stock in soil.

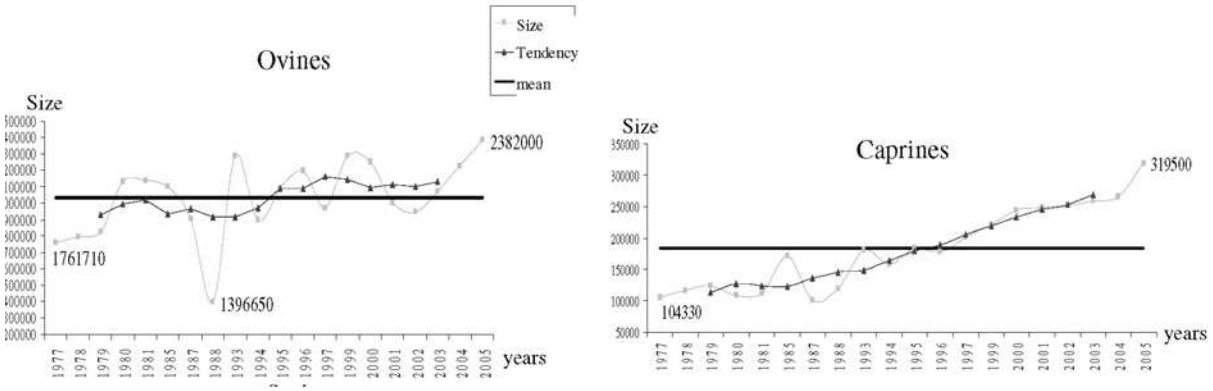

Fig. 3. Evolution size of ovines and caprines of the wilaya of Djelfa. Source of data D.P.A.T. (1994, 1996, 2004), and Agriculture Ministry.

Between 1989 and 2006 we recorded a very important increase of the floristic richness (48%). This growth can not be related to only rainfall, because of the average mean annual rainfall of 2006. Furthermore, if we compare 2006 specific richness to 1970, we noticed increasing of 10%, even if annual rainfall of 1969[1] is higher than of 2006. The increasing of specific richness in our station is due to a protected area put during two years consecutively from 2004 to 2005.

Table 2. Variation ratio of the floristic richness

Species number 1970	Species number 1989	Species number 2006	Variation ratio 1970/1989	Variation ratio 1989/2006 (%)	Variation ratio 1970/2006 (%) (%)
131		97	144	-26	48 10

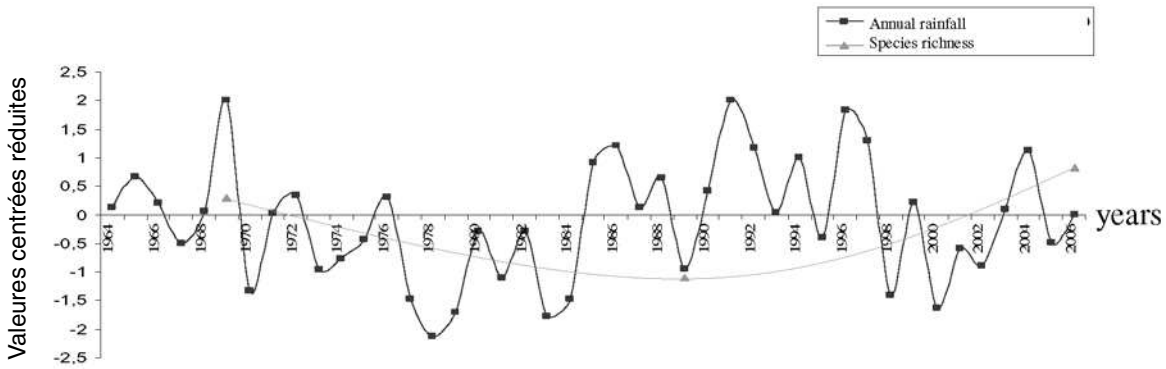

Fig. 4. Evolution of the floristic richness with the annual rainfall for Tadmit station (Benseghir, 2008).

In calculating the Similitude Index from a period to another, we noticed that each time half of initial floristic composition is lacking, this means that by 2006, 50% of species didn't exist by 1970. Were those latter good pastured ones? In comparing pastured species, every time, 60% of the species of Tadmit were good pastured ones. At least, we can't insure that pasture in Tadmit is in good state because for this, the recover of well pastured species must be higher than the less.

[1] The floristic sampling was done in 1969.

The comparison between two pastoral maps (1989 and 2006), lead us to notice that areas of steppes of *Stipa tenacissima* which covers a rich floristic composition in pastured species is in decrease. First, new species weakly pastured are adding to those steppes, when overgrazing tend to be longer, those, take over *Stipa tenacissima* to make new kind of steppes with a very weak pasture degree as steppes of *Atractylis serratuloïdes* or of *Lygeum spartum*. We notice the same phenomenon in steppes of *Artemisia herba-alba* that are replaced by steppes of *Astragalus armatus* or *Lygeum spartum*.

Conclusion

Overgrazing is the leading cause of richness floristic decrease in the station of Tadmit, and then the main factor that could have a close relation to it.

As we've seen it before, lack of rainfall has not a direct influence on specific richness. It seems that there's no decrease of annual rainfall from the first half to the second half of the XXth century and periods of drought are commonly seen in Mediterranean climate.

Vegetation in Tadmit regenerate very nicely after a period of protection, but the original floristic composition is not completely found because replaced by new species; this new composition is rather interesting in a pastoral way because of the stable proportion of the well pastured species in the three periods of study.

The fact that the well pastured species should be more important than the other is answered by comparing both soil occupation maps in Tadmit. The latter shows that an important pastoral area is in decrease by steppes containing species less appreciated by livestock.

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