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Natural Vegetation Cover Dynamic under Climatic Drought and Human Disturbance in the Matmata Mountains, Southern Tunisia

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Abstract: This study deals with the assessment of the effects of climatic drought and human disturbance on the natural vegetation cover in the arid zone of Tunisia (Matmata Mountains). Plant cover and density were assessed and monitored during two seasons (fall 2005 and spring 2006) using the quadrat-point method in four sites (stations) which differ by their disturbance degree. Main results show that the plant cover is mainly influenced by the human activities. The highest plant density was recorded during the spring.

Keywords: Climatic drought, Desertification, Human disturbance, Plant density, Vegetation cover

1. Introduction

Desertification has been considered, since few decades, the principal environmental problem in the arid zone of Tunisia (Le Houérou, 1995, 2001). This zone is characterised by recurrent climatic droughts aggravated by the extension of various human activities such as overgrazing and annual cropping (Ouled Belgacem *et al*., 2006). The drought results from the variability and unpredictability of rains and the succession. The impact of climatic drought is more intense in the ecosystems subjected to human disturbance (Teague *et al*., 2004). This study aims at monitoring and assessment of some ecological indicators (total vegetation cover, plant density) under climatic drought and human disturbance in the Matmata Mountains of southern Tunisia.

2. Materials and Methods

The plant cover and total plant density were monitored and assessed during two seasons (fall 2005 and spring 2006). The annual rainfall was about 176 and 238 mm in the nearer meteorological stations (Matmata and Dkhilet Toujane respectively) of our studied sites. This study carries by the use of the quadrat-point method (Daget and Poissonnet, 1971) in four sites (stations) which differ by their location, altitude, soil substratum and disturbance degree. The first site is characterised by loamy substratum with high density of *Stipa tenacissima* L., *Rosmarinus officinalis* L., and *Genista microcephala* Coss. The second site is dominated by *Stipa tenacissima* on loamy substratum. The third site is dominated by *Stipa tenacissima* and *Rosmarinus officinalis* on gypsum substratum. The fourth site is dominated by *Stipa tenacissima* and *Gymnocarpos decander* Forsk on calcaro-gypsum substratum. The main studied indicators are: i) the total vegetation cover (TVC), determined as TVC = (n/N)*100, with n: number of points where the vegetation is present and N: total number of sampled points, ii) the total plant density (D_t) and the density of the old and young plants (desiccated or alive). The plant density is measured in ten 20 m^2 area sampling units. The obtained data was analysed by several statistical tests (One-way ANOVA, Tukey LSD test and dependant t test) using the SPSS 11.5 software (SPSS Inc, 2002).

3. Results and Discussion

As shown by the **Figure 1**, the plant cover (TVC) is significantly different between the four studied stations. Plant cover is also affected by drought. The difference between the dry and the rainy season is significant ($p < 0.05$). This difference is explained by the abundance of annual plants when the climatic conditions are appropriate.

The mean total plant density (D_t) determined in the four studied stations (**Fig. 2**) shows that this descriptor varies highly between stations and seasons. The evolution of plant density in station 1 gives a more reliable idea on the tendency of establishment or the disappearance of the plant species and permits to evaluate the aptitude of regeneration of the ecosystem (Floret, 1988). When plant density is important, the soil particles are fixed and enhance water infiltration which provokes seed emergency and plant development.

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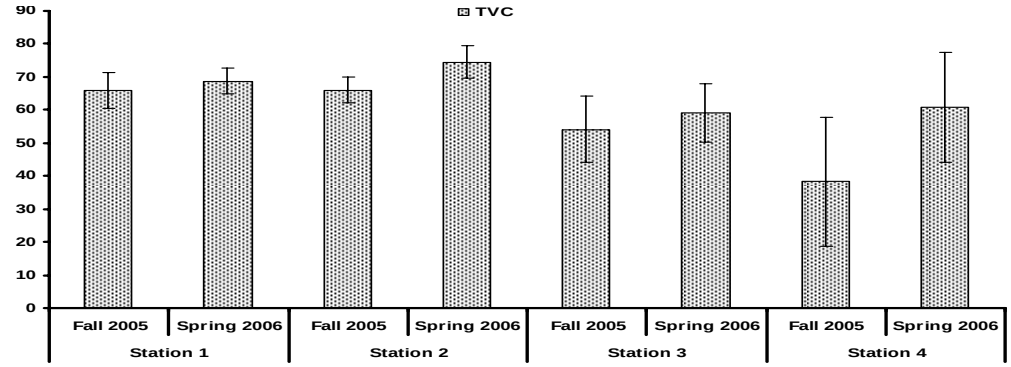

Fig. 1. Total vegetation cover (TVC %) during the fall (2005) and the spring (2006) seasons in the four studied stations.

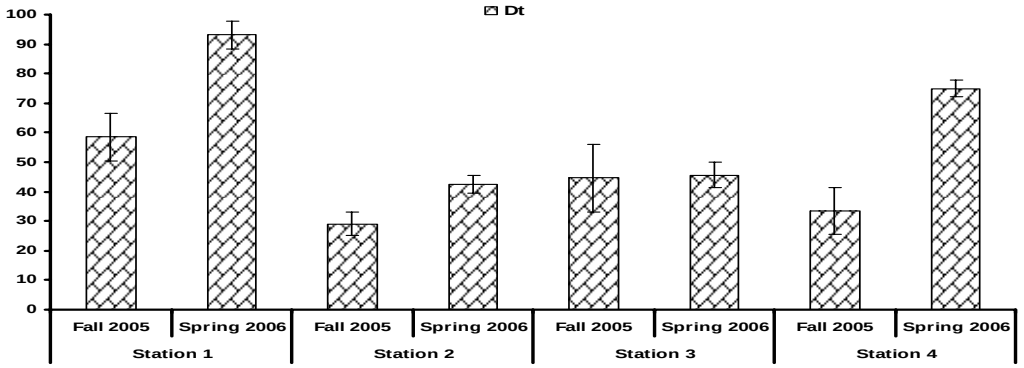

Fig. 2. Variation of total plant density (Dt in plant m^{-2}) during the fall (2005) and the spring (2006) seasons in the four studied stations.

Table 1. Variation of plant density in the four studied stations (in plant m^{-2}) (DY: dried young plant; GY: Green young plant; DA: dried adult plant; GA: green adult).

	Station 1		Station 2		Station 3		Station 4	
	Fall 2005	Spring 2006	Fall 2005	Spring 2006	Fall 2005	Spring 2006	Fall 2005	Spring 2006
GY	3.48±0.95	78.11±3.56	0.83±0.12	81.97±2.97	0.85±0.05	62.2±4.21	1.77±0.75	45.95±2.61
GA	11.47±0.13	13.69±1.47	1.44±0.38	0.84±0.09	2.05±0.53	0.86±0.11	1.93±0.07	1.92±0.26
DY	0.01±0.002	0.01±0.001	0.01±0.006	0	0	0	0.01±0.007	0.07±0.01
DA	1.48±0.07	1.28±0.12	1.12±0.03	0.95±0.02	1.41±0.31	1.18±0.18	1.2±0.01	1.14±0.09

Table 1 shows that the highest density of the dead tufts was recorded for the adult one (DA) during the two seasons for all stations. Green tufts of adult or young plants dominate in spring. All these results show that the ecosystems of the Matmata Mountains are more resilient and conserve a higher regeneration capacity after drought periods (Ben Salem *et al.*, 2007).

4. Conclusion

The climatic drought and human disturbance effects on the natural vegetation cover in the four studied stations of the Matmata mountains are determined following many indicators. The main results are: i) the plant cover is influenced by climatic drought, ii) in the two seasons the establishment of plants is more important in station 1 and iii) the majority of the old and vigorous plants seem to be more vulnerable to drought than the young individuals.

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