

## Monitoring Desertification at Oued Mird Observatory

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### Abstract

Monitoring activities in Oued Mird observatory coincidentally met with a severe drought period. Surveyed descriptors have shown a regressive evolution because of the scarcity of rain and the increasing rural population needs. Data analysis has shown an easy regeneration of *Acacia raddiana* species when environmental conditions are favorable. In general, the ecosystem evolves in a positive way during rainy cycles. But, in the surroundings of populated areas, mutilations and short cuts of *Acacia raddiana* trees, completely crippled bushes and sometimes pulled and eradicated species like *Stipagrostis pungens* are noticed. Livestock also causes important damage. The scarcity and irregularity of water resources, combined to insufficient knowledge of suitable agricultural techniques, do not permit durability of the existing production systems.

### Résumé

Les activités de surveillance dans l'observatoire de l'Oued Mird ont coïncidé avec une période (99-03) de sécheresse sévère. Les descripteurs étudiés ont montré une évolution régressive en raison de la rareté de la pluie et des besoins croissants de la population. L'analyse des données a montré une régénération facile d'*Acacia raddiana* quand les conditions environnementales sont favorables. En général, l'écosystème évolue dans un sens positif durant les cycles pluvieux. Mais, aux alentours des douars, des mutilations et des coupes rases d'arbres d'*Acacia raddiana*, des touffes d'arbustes complètement éradiquées et des espèces arrachées et extirpées comme *Stipagrostis pungens* sont notées. Le bétail cause également d'importants dégâts. La rareté et l'irrégularité des ressources en eau, combinées à la connaissance insuffisante de techniques culturelles appropriées, ne permettent pas la durabilité des systèmes de production existants.

### Introduction

In Morocco, the Long Term Ecological Monitoring Network (ROSELT/OSS) certified three observatories (ROSELT/OSS, 1995); they are located in the provinces of Ouarzazate and Zagora. They correspond to three different situations and represent the main kind of land use found in semi arid and arid zones of Morocco. In a concise manner the three observatories can be characterized as follows.

- Oued Mird observatory is part of the 154 Biologic and Ecological Interest Sites (SIBE), it offers a very beautiful *Acacia raddiana* ecosystem.
- Issougui observatory is a pastoral zone of about 120 000 ha, exploited by the tribe of Aït Zekri, it constitutes a pastoral unit well delimited sociologically.
- Fezouata observatory is a complex of oasis and valley. It has a big dunes fixing program undertaken since 1980. It is a suitable site for studying the oasis system.

In the following topics, main results from ROSELT/OSS activities at Oued Mird observatory are presented.

## Materials and methods

Oued Mird Observatory covers an area of 75 000 ha, it is located in the province of Zagora at the borderline between Morocco and Algeria and has been subject to regular follow-up.

The following descriptors have been regularly surveyed: The mode of rain, wind and the ETP; Surface soil evolution; Threatened and/or rare plant species; The surface cover of different plant stands; *Acacia raddiana* ecosystem dynamics; Phytomass and fodder units' production; Rare and threatened animal species; The animal populations dynamics; Variation of the water table level; The dynamics of installment or abandonment of farms; Variation of the cattle number; Nature and importance of the agricultural investments; Emigration and extra agricultural incomes; Localization of nomads and their displacements.

## Results

Data analysis from four surrounding climatic stations show that the high variability of rain in Oued Mird observatory as in the whole arid zone results from the fact that, an important part of the yearly rain occurs within a small number of rain events, and the occurrence of these events is very uncertain, and the irregularity is especially high as the number of events is small. As shown on figure 1, 1999-2003 is considered as a dry period

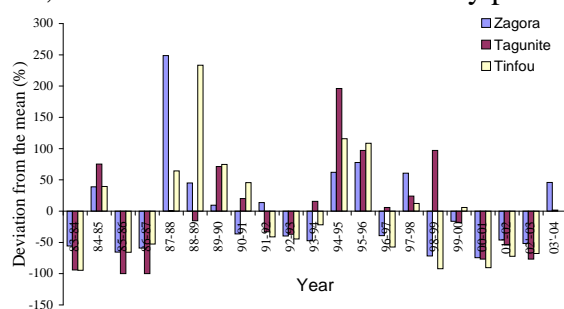


Figure 1. Yearly rainfall deviation from normal at surrounding climatic stations

Measurement of the piezometric level shows that the water table level follows the general altitudinal difference of natural land level. The observatory is endowed of a vulnerable shallow groundwater with regard to climatic variations and rechargeable due to flooding (Yassin et al; 2003). The number of wells nearly doubled from 1999 to 2004 (148 to 228 wells), whereas the pumped volume only increased by 50%, the cumulated drought years has had a direct impact on the water table level.

Vegetation monitoring studies distinguished four great plant formations taking into account the presence and density of *Acacia raddiana*. Within each formation, vegetation groups have been distinguished (Aafi & Taleb 2001). The flora is composed of 83 taxa with one rare and endemic (*Lavandula mairei*), three presumed rare (*Pennisetum dichotomum*, *Brocchia cinerea* and *Pennisetum dichotomum*) and one very rare and endemic (*Heliotropium undulatum* ssp. *antiatlanticum*) (Fennane M. & Ibn Tattou M. 1998).

This specific richness has undergone a progressive reduction during the agricultural years of 00/01 to 02/03 (figure 2); it has been reduced by 40% because of some therophytes disappearance. Vegetation cover has undergone the same evolution (figure 3); it is mainly the areas near agglomerations and on the nomadic passage zones that received most impact. The quantity of water fallen in 2003-2004 was at the origin of a spectacular vegetation response, it allowed an important development of the herbaceous stratum and installation of several new species (15 species) among which a species is suspected to be rare (*Pulicaria tensed*).

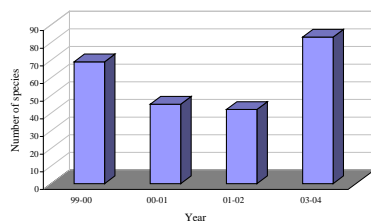


Figure 2. Variation of flora richness

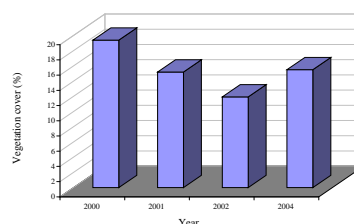


Figure 3. Variation of vegetation cover

Within vegetation groups distinguished, a soil profile was described and soil samples have been analyzed. The analyses and descriptions made have shown that, in general, Oued Mird soils are shallow calcareous with alluvial or colluvial accumulations. They are marked by water and wind erosion. Seasonal soil monitoring conducted on the upper 10 cm came with a clear texture variation according to wind dynamics.

Soil surface characteristics are measured on the linear vegetation measurement transects. The vegetation groups distinguished have a differentiated distribution of the soil surface constituents. It is a function of the muddy micro-water flow that plugs the inter-aggregates macro-porosity. After the rare storms, the plasmic film formed from micro-sheet flow turns into a crust (Casenave & Valentin 1989) that disappears under sand deposits during the months of April and May or gets disrupted by livestock stamping.

Oued Mird observatory undergoes a fauna follow up as well. Fauna monitoring shows that the specific richness varies distinctly from one class to another; the birds are better represented with a total of 68 observed species (figure 4), followed by Mammals and Reptiles with 12 observed species for each of the groups; and finally the Amphibians are only represented by four species. Spatial distribution of birds varies according to inhabitat type (figure 5).

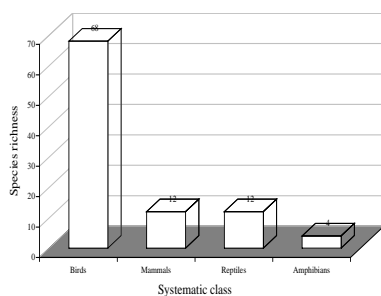


Figure 4. Fauna richness

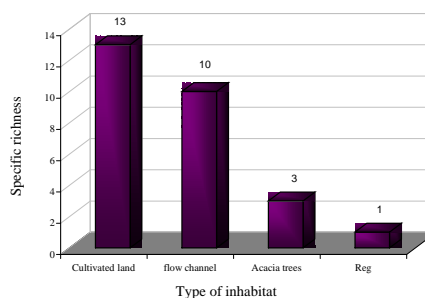


Figure 5. Distribution of bird species by inhabitat type

The socioeconomic data collected show that, the observatory is part of the pre-Saharan vast pasturelands used historically by nomads from different ethnic groups. The former nomads of the Aït Isfouls tribe currently use it as agriculture land. More than 1500 inhabitants belonging to 162 families are installed along Oued Mird and practice a subsidizing irrigated agriculture. Figure 6 shows that despite of drought, settlement rhythm did not know any reduction.

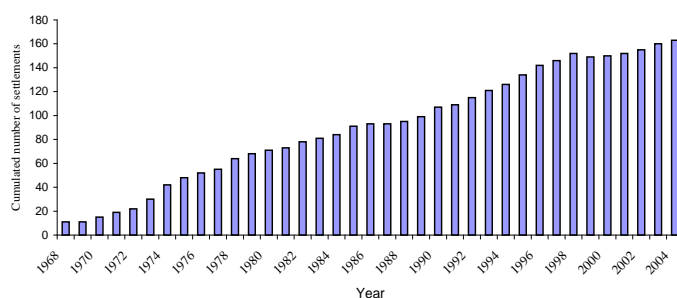


Figure 6. Rural settlement evolution

In general, the fodder contribution from the farms covers less than 35% of the energy needs of livestock. The bovine raising is very weakly represented because of the very limited practice of fodder cultures. In parallel to this type of on farm livestock rising, we notice the emergence of a new type of livestock rising using better ovine races like Dman and Draa caprine races which are from the Draa palms oases.

### Discussion

The aim of monitoring Oued Mird observatory is to provide reliable information on the scope of desertification and its ecological, agro-ecological and socio-economic consequences. In an attempt to integrate the information collected, a GIS integration model (yassin et al 1986) overlapping geology, vegetation and ground cover maps has been applied. It has shown a variation of the areas vulnerable to water erosion according to variation of the vegetation and soil surface cover. A second integrating model called Local Environmental Information System (LEIS) (D'Herbès et al 1997) is being applied to make a state of desertification and future prognostics

### Conclusion

Ecological monitoring is viewed as an important initiative that can be valorized within the assessment system of the National Action Plan to Combat Desertification (NAP/CCD). ROSELT/OSS observatories subscribe, certainly, to a large space network with dominant regional preoccupations, nevertheless the data and indices they produce can be of a national interest and can help in conceiving a national environment monitoring network integrated to the NAP/CCD assessing system.

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