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in

Kyriazopoulos A.P. (ed.), López-Francos A. (ed.), Porqueddu C. (ed.), Sklavou P. (ed.). Ecosystem services and socio-economic benefits of Mediterranean grasslands

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 114

2016
pages 267-270

Effect of grazing intensity on rangeland productivity in Northern Libyan area of Syrt

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Abstract. Urbanization and irrigation plans that took place in Libya during the last decades have started also to concentrate livestock rearing, consequently for the first time it would now be possible to restrict overgrazing in some areas of the rangeland. Rangeland rehabilitation after long overgrazing by wild animals and nomadic herds should take a start from a preliminary investigation of the present productivity and the effects of grazing limitations. A trial has been done in 2009 in the Syrt rangeland few months before the start of the war, in order to compare forage productivity of the grazed rangeland with that of areas where grazing was avoided. The trial was managed thanks to agreements of the Italian Agronomic Institute for Overseas (Ministry of Foreign Affairs), University of Florence, and University of Syrt now destroyed. The results have shown a very little productivity of the native vegetation, but also the possibility to rise it considerably if grazing can be suspended for a period of time. Further investigation would be needed soon as the area will be secured again for national and international operators. However our results show also that the little productivity of the rangeland cannot be enough to give better lives to rural people and suggest that herding and rangeland uses should be linked to other sectors of the national economy and integrated in a modern scenario.

Keywords. Rangeland productivity – Grazing intensity – Overgrazing – Rehabilitation.

Effet de l'intensité de pâturage sur la productivité des terres de parcours dans la région de Syrte, au nord de la Libye

Résumé. *L'urbanisation et les plans d'irrigation qui ont eu lieu en Libye au cours des dernières décennies ont commencé aussi à concentrer l'élevage, par conséquent et pour la première fois, il sera maintenant possible de restreindre le surpâturage dans certaines zones de pâturages. La réadaptation des parcours après un long surpâturage par les animaux sauvages et les troupeaux nomades, devrait démarrer suite à une enquête préliminaire sur la productivité actuelle et les effets des limitations de broutage. Un essai a été réalisé en 2009 dans les parcours de Syrte quelques mois avant le début de la guerre, afin de comparer la productivité fourragère des parcours pâturés avec celle des régions où le broutage a été évité. Le processus a été géré grâce aux accords de l'Institut Agronomique pour l'Outre-mer d'Italie (ministère des Affaires étrangères), de l'Université de Florence et de l'Université de Syrte maintenant détruite. Les résultats ont montré une très faible productivité de la végétation indigène, mais aussi la possibilité de l'augmenter considérablement si le pâturage était suspendu pour une période de temps. Une enquête plus poussée serait nécessaire dès que le secteur sera de nouveau sécurisé pour les opérateurs nationaux et internationaux. Cependant, nos résultats montrent également que la faible productivité des pâturages ne peut pas être suffisante pour donner une vie meilleure à la population rurale et suggèrent que l'élevage et l'utilisation des pâturages doivent être liés à d'autres secteurs de l'économie nationale et intégrés dans un scénario moderne.*

Mots-clés. *Productivité des terres de parcours – Intensité du pâturage – Surpâturage – Réadaptation.*

I – Introduction

The Libyan Government during the period of Gheddafi conducted a policy of agricultural development supported by the construction of the Great Man made River that would serve 180,000 ha using fossil water. This project was integrated into a wider project of sedentarization and urbanization. The development of intensive irrigated agriculture has already brought a reduced human and livestock pressure on the predesertic environment, but also gradual

abandonment of the heritage of rangeland people. Grazing was locally conducted with too low or too high stocking rates, with uncontrolled herds. This caused progressive loss of productivity, increasing percentage of bare soil and biodiversity loss (Pardini *et al.,* 2009). For these reasons we did a preliminary investigation on vegetation productivity and soil cover of the local rangeland in view of changes for its sustainable management. The purpose of the research has been to identify some good management practices that can favour vegetation recover and consequently higher biomass production and soil cover, reducing contemporarily soil erosion.

This research investigated biomass availability at the end of the growing period in the rangeland in Shabiyat of Misurata (area of Bani Walid) and Syrt (areas of Sultan and Al-Gardabia), in representative areas of the transitional region between the narrow strip of coastal vegetation which also includes the new farms irrigated by GMMR project, and the great inland Sahara desert. The area has very poor natural vegetation, characterized by grasses and small shrubs, often with low palatability and nutritional value, the unfavourable condition of the vegetation are due primarily to the harsh physical environment but also to decades of excessive human pressure on the rangeland.

The following research was done within the project “Centre for applied research in animal growing and forage cropping in the Shabiyah of Syrt”, which was assigned by the Directorate General for Development Cooperation of the Italian Ministry of Foreign Affairs to Istituto Agronomico per l’Oltremare of Florence, with Shabiyah of Syrt, local partner, and in collaboration with the School of Agriculture of the University of Florence, and Al Tahadi University of Syrt.

II – Materials and methods

A preliminary investigation and the choice of the sampling areas has been done in February, all data have been collected at the end of March 2009. February - March is the only short period with some rain and plant growth. The quantity of biomass reduces rapidly in the following months due to grazing, drying, and enhanced drought. The livestock grazes in mixed groups of mainly sheep and goat, sometimes also with few dromedaries. The livestock is conducted by shepherds in different parts of the rangeland according to annual planning, so that there is always a part grazed and another normally not grazed and left to periodical rest. Grazing control is sometimes facilitated with fencing.

Three areas of the coastal rangeland of Syrt have been investigated (Bani Walid, As Sultan, Al Gardabya). Each of the three areas had three sub-areas. Each sub-area had one area that normally is grazed and one nearby area that normally is not grazed, for a total 18 sub-areas. Three sampling areas were controlled into each sub-area for a total of 54 sampling areas. Grazing or not grazing is just controlled by shepherds, even if in some areas there is fencing. The following measurements have been done in each area and sub-area:

Soil cover. Linear analysis. Three lines in each of the three sub-areas in grazed and not grazed areas, for a total of 54 lines. Each line 100 m, with analysis points each 1 metre. We considered any plant present as “covered” and every spot without plants as “bare soil”. Consequently the calculation of bare soil percentage has been analytical.

Biomass. Grass mowing and shrubs defoliation in 5 m^2 inside the 54 sampling areas. After mowing and green weighting, samples of 500 grams have been collected, oven dried and weighted again to know the percentage of dry matter.

Rangeland carrying capacity. This calculation has been done by the Ponderal Contribution method (Pardini *et al*., 2002) that integrates biomass measurements and calculations, with esteems of the forage value. The method however has been simplified introducing a coefficient of forage value = 0.4 as it was calculated for the same area in a different study (Pardini *et al.,*

2016). The data of biomass and the coefficient were input in the program Ranger 3.0 (Pardini *et al*, 2011).

III – Results and discussion

1. Soil cover

The soil covered by vegetation was not much (43.3% in the average of all areas and sub-areas), however considering that this is an arid rangeland the cover has been good (Table 1). The difference of grazed and not grazed areas has been notable, only 35.8% of the soil was covered by vegetation in the grazed areas, in comparison to 50.7% in the ungrazed. This difference is important and confirms the utility of resting periods for the vegetation.

Table 1. Percentage of soil covered by vegetation in the three areas investigated

Area	Soil covered by vegetation (%)		
	Grazed	Not grazed	Average
Bani Walid	42.1 a	57.3 a	49.7
As Sultan (Alhnioa)	34.6 b	48.4 b	41.5
Al Gardabya	30.7 b	46.5 b	38.6
Average	35.8	50.7	43.3

Data with different letters in columns are significantly different at P=0.05, ANOVA by Sistat.

2. Biomass available

The quantity of biomass in the rangeland (Table 2) has been very little in all the three areas and in the average (1.13 t ha^{-1}), this quantity will remain almost unchanged through the whole year due to rapid drought, however this small quantity is normal in a predesertic area.

In the three not grazed areas was recorded the highest production in all cases and in the average (1.38 t ha^{-1} in not grazed areas, and only 0.88 t ha^{-1} in grazed areas). This suggests that even an annual period of rest is enough to restore vegetation conditions and productivity. Plants in the not grazed areas were more frequent and bigger than in the grazed areas where clearly some were eaten and also killed before reaching a large size.

Table 2. Biomass in the three areas investigated

Area	Biomass DM (t ha^{-1})		
	Grazed	Not grazed	Average
Bani Walid	0.36 b	0.80 c	0.58
As Sultan (Alhnioa)	1.24 a	1.46 b	1.35
Al Gardabya	1.04 a	1.86 a	1.45
Average	0.88	1.38	1.13

Data with different letters in columns are significantly different at P=0.05, ANOVA by Sistat.

3. Rangeland carrying capacity

The annual carrying capacity per hectare, calculated on the biomass cumulated at the end of March and corrected with Forage Quality coefficient = 0.4, has been within 0.051 and 0.127 Livestock Units (500 kg livestock). Even if the biomass was cumulated only up to the end of

March, this is the data that must be considered because any further production will be extremely little after this period and, on the contrary, livestock will keep on grazing all through the year. The carrying capacity resulted 1.57 times higher in the not grazed areas (0.077 LU per ha per year in the average of three areas) than in grazed areas (0.12 LU in the average).

Conclusions

The biomass availability in the arid rangeland analyzed is very low and will be impossible to rise it conveniently unless there is irrigation, that of course shall not be applied. The productivity of vegetation has been higher in the not grazed than in the grazed areas, thanks to lower percentage of bare soil and because plants were bigger than in other parts.

In conclusion, this preliminary research has shown very poor biomass availability, although higher in not grazed areas. Consequently, we advise longer resting periods for the grazing sectors and a better control on herd movements.

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