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Effect of herd mobility on the species composition and productivity of plant communities in the northern Mediterranean region of Morocco

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Abstract. The study was conducted in two pasture areas in the Moroccan Rif mountains (Akoumi and Bettara) exclusively used by goat's herds to assess biomass production and botanical composition of major species. To measure plant biomass we used the method of the reference module. Breeders use pasture throughout the year, except on rainy days where they resort to limbing. The shrub, mainly *Erica arborea* and *Arbutus unedo,* is the main diet used by goats. In Bettara, breeders are becoming sedentary, where the pastures are overgrazed and dominated by unpalatable plant species, and biomass production is estimated to 934 kg DM/ha. In Akoumi, where breeders are still transhumant, plant biomass largely exceeds that of Bettara (2256 kg DM/ha). A seasonal movement alleviates anthropozoic pressure on pastoral land and allows restoration of palatable species. In fact due to climate change, silvopastoral resources will be less available and of lower quality, mobility of herds is a necessary adaptation strategy to insure sustainability of pastoral resources.

Keywords. Pasture – Rif – Biomass – Mobility – Adaptation.

Effet de la mobilité des caprins sur la composition et la production des espèces végétales dans la région Méditerranéenne au nord du Maroc

Résumé. *Cette étude a été menée dans deux sites de pastoraux dans les montagnes Rifaines (Akoumi et Bettara), exclusivement utilisés par les troupeaux caprins, afin d'évaluer la production en biomasse et la composition botanique des principales espèces pastorales. Pour mesurer la biomasse végétale la méthode du module de référence a été utilisée. Les éleveurs utilisent les pâturages tout au long de l'année, sauf les jours pluvieux où ils ont recours à l'ébranchage. Les arbustes, principalement Erica arborea et Arbutus unedo sont les principaux sources alimentaires utilisés par les caprins. A Bettara, les éleveurs sont de plus en plus sédentaires, ce qui explique la surexploitation des pâturages. Ces espaces sont dominés par des espèces végétales non appétibles et la production de biomasse y est estimée à 934 kg MS/ha. A Akoumi, les éleveurs gardent leur tradition de transhumance, ce qui explique que la biomasse végétale dépasse largement celle observé à Bettara (2256 kg MS/ha). Le déplacement saisonnier allège la pression humaine et animale sur les terres pastorales et permet donc la restauration des espèces les plus appétibles. En fait, en raison du changement climatique les ressources sylvopastorales seront moins disponibles et de qualité inférieure, de ce fait pour assurer la durabilité des espaces pastorales, il faut adopter une stratégie de mobilité des animaux afin de restituer les ressources pastorales et fourragères.*

Mots-clés. *Pâturage – Rif – Biomasse – Mobilité – Adaptation.*

I – Introduction

Moroccan Mediterranean forests are increasingly under pressure due to uncontrolled goat grazing. This traditional system, inheriting to Rif society, is becoming vulnerable due to reduced

forage and pastoral production (FAO, 2009). This vulnerability may increase further in response to climate change variability and population growth.

Mobility, as an ecological rationality in arid and semi-arid lands, is a response of herders to unexpected variability in pasture production and/or animal nutritional needs. It relies on herder's knowledge and local institutions in decisions making. It's part of the society's culture. Herd mobility under traditional land use systems is mainly based on a comprehensive knowledge of rangelands, where the stocking rates vary with land potential seasons (Oba, 2011).

However, breeder's sedentarization is becoming a widespread practice, especially among poor pastoral households especially in Rif Mountains.

This study was carried out in two contrasting pastures of the Moroccan Rif mountains (Akoumi and Bettara) exclusively used by goat's herds to assess the effect of herd mobility on biomass production and botanical composition.

II – Material and methods

The area of study is part of the valley of Oued Laou which is located between the provinces of Tetouan and Chefchaouen north of Morocco. The climate is Mediterranean type, with mean min and max temperatures of 3°C and 41°C respectively. Total annual precipitation is 500 mm. Oued Laou valley, a dominantly forest area, is occupied up to 30% by agriculture.

The study concerned two sites: Akoumi and Bettara. These are forest rangelands exploited mostly by goat breeders. In both sites, the species composition and productivity of plant communities were realized by assessing vegetation qualitatively and quantitatively.

For qualitative evaluation of vegetation we studied the floristic diversity of the forest grazing area. A herbarium was collected to determine the floristic composition.

For quantitative evaluation and in order to control spatial heterogeneity, we used the stratification method as proposed by Qarro (1996), Kouraimi (1997), Chebli and Mrabet (2010). In each site we identified the number of quadrats needed to control heterogeneity of silvopastoral area (3 in Akoumi and 4 in Bettara). The size of the quadrats adopted for measurement of biomass is 2 m x 5 m for shrubs strata and 1 m x 1 m for herbaceous strata. Plant biomass was measured using non-destructive method known as the reference module.

Measurements were conducted during eight months period. Quantitative evaluation was performed during May, which correspondent to vegetative peak (Qarro 1996, Kouraimi 1997, Chebli and Mrabet, 2010). Flora composition was determined during April, May and June 2011. Several surveys were conducted during the study period to gather information on modalities of pastures grazing and to complete database on species characterization.

III – Results and discussion

The area of study is characterized by a relatively rugged topography. The vegetation structure is mainly shrub-dominated.

1. Botanical composition

In Akoumi and Bettara, 125 plant species were determined. The most dominant species, which constitute the staple diet of goats in the valley of Oued Laou, are presented in the Table 1.

Table 1 expresses the floristic control between Akoumi and Bettara sites. In Akoumi sites, palatable species are relatively more abundant and diversified while in Bettara site the qualitative evaluation shows the abundance of unpalatable species. This differences in flora can

be explained by high population pressure in Bettara and the dominantly transhumant population in Akoumi. In other term, biodiversity in Bettara sites is under intense degradation compare to Akoumi site. Especially, we observed species with low pastoral interest invading Bettara site, such as *Daphne gnidium* and *Arisarum vulgare*.

Table 1. Principal botanical composition of palatable and unpalatable flora in the Oued Laou valley

Plant	Akoumi	Bettara
Palatable species		
Arbutus unedo	++	+
Cistus crispus	+++	+
Cistus monspeliensis	++	+
Erica arborea	+++	+
Quercus canariensis	+	+
Quercus suber	++	+
Lavandula stoechas	++	+
Pistacia lentiscus	+	+
Zizyphus Lotus	-	++
Unpalatable species		
Anagallis arvensis	-	+
Arisarum vulgare	+	++
Coriaria myrtifolia	-	+
Daphne gnidium	+	++
Ranunculus sardous	-	+
Urginea maritima	-	+

+ + + Species very abundant.
++ Moderately abundant species.
+ Weakly abundant species.
- Absent species.

According to observations and surveys conducted with breeders, plant species that dominate the valley and who constitute over 50% of the forage species are *Erica arborea, Cistus crispus Arbustus unedo, Lavendula stoeches* and *Cistus monspeliensis*. These species are mostly abundant in Akoumi site.

2. Biomass production

Biomass production has mainly concerned the Biomass of palatable species in the two silvopastoral area of Oued Laou Valley.

A. Akoumi site

The Akoumi pasture is located at 35°24' N 5°17' W and between 450 to 755 meters above sea level. This pasture is characterized by dense vegetation mainly dominated by shrub strata. The pastoral feed offer is very high compared to surrounding areas. The site is used by breeders of Akoumi village which has a goat herd of 350 heads.

Grazing occurs throughout the year, from 9 am until 5 pm, with a reduced frequency during winter (2-3 hours per day). From survey's data, goat breeders in this site are practicing mobility in order to maintain natural regeneration of vegetation. This local strategy has helped to conserve palatable species.

Biomass production of palatable species is important; it's estimated at 2259.52 kg DM per hectare, consisting mainly of *Cistus crispus* (49%) and *Erica arborea* (45%).

B. Bettara site

This pasture is located at 35°33' N 5°27' W. This is a much degraded scrubland with vegetation consisting mainly of shrub strata and tree in poor state.

It is operated by four breeders who own a goat herd estimated at 348 heads. Grazing is practiced throughout the year except during rainy days where breeders use delimbing. The grazing time does not exceed 6 hours a day. The herd mobility is very low and breeders are becoming sedentary. The pastures are overgrazed and dominated by unpalatable plant species (Table 1).

The site is under degradation spiral where low pastoral (unpalatable) species are dominating (*Asphodelus microcarpus* and thorny species)

Biomass production of palatable species is estimated to 934.04 kg DM per hectare, which is low for a silvopastoral area. It is composed mainly of *Arbutus unedo* (36%), *Zizyphus Lotus* (35%) and *Quercus canariensis* (26%).

IV – Conclusion

The pastures in the Oued Laou valley remain a large area for forest grazing. Biomass production varies greatly from an area to another. *Erica arborea* and *Arbutus unedo* are species most consumed by goats. In Bettara, breeders are becoming sedentary, where the pastures are overgrazed and dominated by unpalatable plant species, and biomass production does not exceed 934 kg DM/ha. In Akoumi, where breeders are still transhumant, plant biomass largely exceeds that of Bettara (2256 kg DM/ha).

A seasonal herd movement alleviates anthropozoic pressure on pastoral land and allows restoration of palatable species. In order to reduce further vegetation degradation in Rif Mountain and to adapt to climate change, a strategy based on herd mobility should be central to silvopastoral management.

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