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Mediterranean pastures management by local cattle breeds for the valorization of typical products and for the development of nature tourism

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SUMMARY – A trial was established in a private farm of Tuscan Maremma, that had recently set up an organic meat production system. The farm was grazed by Chianina cattle from the end of winter to autumn, and the animals were supplemented with alfalfa hay during summer, and maize silage during winter. Grazing impact on pastures was assessed from botanical composition and specific contribution, herbaceous species biodiversity, herbage height, seasonal and total annual forage production. The pastures distant from the stable and farm buildings were under-grazed, and consequently, their botanical composition became worse due to the overspreading of tall grasses and shrub encroachment. Until now pasture productivity remained almost unchanged, however the few animals used were not sufficient to maintain the current pasture resources. Consequently, the present number of reared animals (59 Livestock Units) is not enough in comparison with the calculated pasture carrying capacity (1.13 LU in the year average) and suggests the reduction of pasture area, at the same time managing forest reintroduction. Forage productivity was good (7.6 t DM/ha in native pastures, 8.1 in sown firebreaks and 10.0 in sown pastures) and this suggests concentrating management efforts in the most productive areas. Land care will contribute to developing naturalistic activities, especially by equipping resting areas and trekking paths and organization of tourist services. In some farms of the region this is already used to generate incomes.

Keywords: Multiple uses of the territory, farm resource differentiation, cattle local breed.

RESUME – *"Gestion des pâturages méditerranéens par l'élevage local pour valoriser des produits typiques et pour le développement des activités naturalistes". L'expérimentation a été conduite dans une exploitation agricole de la Maremma toscane qui a récemment mis en œuvre un système de production biologique de viande. Les animaux, de race Chianina, séjournaient au pâturage pendant toute la période fin hiver - automne. Le complément était assuré par du foin de* Medicago sativa *et de l'ensilage de maïs, respectivement en été et en hiver. Le nombre des animaux (59 UGB) était inférieur à la charge potentielle. La productivité était élevée (7,6 t MS/ha dans la pâture, 8,1 dans les coupures de combustible améliorées et 10,0 dans les pâtures semés avec des espèces fourragères). Les observations conduites suggèrent la réduction de la surface pâturée, la réintroduction de la forêt et la concentration des efforts sur les surfaces les plus productives. L'entretien du paysage peut contribuer au développement des activités naturalistes.*

Mots-clés : *Usage multiple du territoire, diversification des ressources, élevage local.*

Introduction

The number of livestock reared on Italian pastures has reduced notably during the past 20-30 years, especially in the Northern and Central parts of the peninsula (Staglianò *et al.,* 2000; Talamucci *et al*., 1996; Talamucci and Pardini, 1996). The same problem affects other European countries (Rigueiro-Rodríguez *et al*., 1999; Rochon and Goby, 1999; Spatz and Papacristou, 1999). Pasture management is regionally diversified although it is frequently sub-optimal. Unfortunately, pastures are very sensitive to management changes because they often derive from different ecosystems and their biological equilibrium is artificially maintained.

Reduced pasture utilization decreases productivity and biodiversity. Shrub encroachment and transitory degraded stages of forest develop before a new tree stand is grown again. Biomass accumulation due to scarce forage intake increases fire hazards. Moreover, transitional stages of vegetation are not beautiful and reduce tourist presence in the area. Pasture management is therefore necessary even when forage has partially lost economic importance. Unfortunately, high costs often cause land abandonment and lack of environmental risks control or effort fragmentation.

Common solutions suggest increasing pasture productivity by sowing and oversowing, fertilization, introduction of new cultivars. Unfortunately, farmers have little interest in carrying out these actions if they have very few animals. Preventive evaluation of the effective vocation of each pasture land is preferable to direct management efforts to conserve pasture, especially in tourism areas, or to lead forest new introduction. Pastures have nowadays regained importance for their biological, recreational and cultural functions and they generate important incomes through services related to their flora and fauna. Many farms already organize trekking and horseback rides in pastoral areas. These uses require the construction of organized lookouts, resting areas, pick-nick places, information boards, and can be integrated into further diversification actions of the national economy on a farm and territory scale.

This trial has evaluated the possibility of conserving a diversified and multi-purpose pastoral system by minimal management with animal grazing, considering also farm income diversification through nature tourism (Talamucci *et al.*, 1997; Pardini *et al.*, 2002).

Materials and methods

A trial has been conducted on a private farm of coastal Tuscany. Climate is Mediterranean with annual rainfall of 680 mm and an average temperature of 14.6°C. Summer rainfall is 95 mm only and this limits the vegetation productivity. Winter is excessively cold to maintain sufficient forage production.

Local cattle and horse breeds are reared. Rotational grazing comprises native pastures (97 ha, 12% of grazing area), pastures sown with subterranean clover *(Trifolium subterraneum*, 20 ha, 2.4%), firebreaks sown with subterranean clover (*Trifolium bracycalycinum*, 60 ha, 7%) and a thinned-out oak forest (*Quercus cerris* and *Q. pubescens*, 630 ha, 78%). The number of grazing animals has been reduced from 269 livestock units (LU) in 1990 to 59 LU in 2002; nowadays it comprises 44 cattle and 15 horses only and it is equivalent to an animal stocking rate of 0.3 LU per hectare, considering only pasture and firebreak areas. The farm has started a nature tourism initiative which generates additional income to that coming from the animal product market.

This article presents the results of the study of pastoral system organization and productivity and of tourists' opinions of the area. The following measurements were taken:

(i) Pastoral system organization (interview with the manager).

(ii) Productivity and quality of the grazed areas:

- Forage dry matter production (biomass into exclusion cages, cut and weighed each month. Shrub leaves in the forest were considered only up to a height of 1.5 meters).
- Forage dry matter intake by the animals (difference between production into cages and residual forage after grazing out of the cages).
- Botanical composition (linear analysis in each grazed typology, data were used also to calculate Shannon's biodiversity index).

(iii) Pasture carrying capacity [ponderal contribution method, which measures forage production, analyses botanic composition, estimates specific palatability and chemical composition also in relation to the vegetative phase, and takes into account environmental parameters of climate type, slope, slope orientation, presence of rocks and bare soil (Pardini *et al.*, 1999; Pardini *et al.*, 2000)].

(iv) Tourists' opinions of the area (interviews with 60 customers, questions comprised landscape beauty estimation and suggestions for improvement).

Results and discussion

Pastoral system organization (Fig. 1)

Cattle can graze native and sown pastures from February to mid June (143 days) and again from

the end of September to the end of November (61 days). Grazing is not allowed in areas reserved for hay production until harvest at the end of spring. Animals are moved to firebreaks when vegetation growth is over (mid June), but also to reduce fuel biomass. In the same period cattle enter spontaneously into the thinned forest seeking green grass and shadow, animals graze in the firebreak area and in the forest for 107 days, forage in the forest is not enough and they are also supplemented with hay from sown meadows of the farm. The same happens in winter when animals stay in the forest for 54 days. Areas that are not or are insufficiently grazed due to the use of few animals are mown yearly and mechanically cleared from encroaching shrubs every 4 to 8 years.

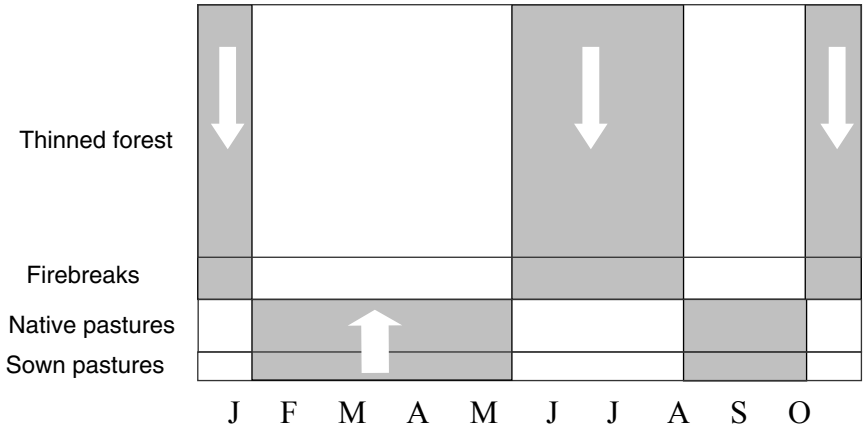

Fig. 1. Proportion of areas of each vegetation type (left), grazing period (grey), forage harvesting (upward arrows) and hay distribution to animals (downward arrows).

Forage production and residuals after grazing (Table 1)

Forage availability was very low in the forest (0.6 t DM/ha), the main component being shrub leaves. Forage production is however better distributed seasonally than in the other three resources and animals find green grasses also in summer. The highest production was found in sown pasture (10.0 t DM/ha).

The highest amount of residual forage after grazing was found in native pastures (5.1 t DM/ha), probably because of the good productivity and worse palatability than in sown pastures. The presence of many residuals, which become dry and highly inflammable in summer, is an added cost to the manager who has to mow to reduce fuel biomass. However, the mown grass dries on the ground where it also remains; consequently the utility of mowing is lower than that of animal intake.

The highest percentage of forage utilization was found in sown pasture (55%), probably due to the good palatability of the clovers. The utilization rate was good in the thinned forest (50%) even if the palatability of native species is not very high, because the availability of forage is scarce and it remains green in summer when grass is dried in any other resource.

Table 1. Forage production (t DM/ha), residual forage after grazing (t DM/ha) and percentage of utilization in 2002

	Production (2002)	Residual (2002)	% Utilization
Thinned forest	0.6^{c}	0.3^{c}	50.0^{b}
Sown firebreaks	8.1^{b}	4.4^{b}	45.7^{c}
Native pastures	7.6^{b}	5.1^{a}	32.9^{d}
Sown pastures	10.0^{a}	4.5^{b}	55.0^{a}

Values with different letters are significantly different at P = 0.05.

Botanical composition and biodiversity index (Table 2)

Seventy five plant species of the four resources were recorded. This number is not too low, since some unpalatable species are spreading. Shrubby species spread especially in the forest (*Juniperus communis, Erica scoparia, Erica arborea, Cistus salvifolius, Sarotamnus scoparius, Spartium junceum*). Vigorous perennial grasses have spread in pastures and firebreaks taking the place of legumes (*Festuca arundinacea, Bromus inermis, Lolium multiflorum*). These observations were made by comparing with previous trials in the same area (Pardini *et al*., 2002), and suggest that there is a trend to new colonization by pre-forest vegetation and a reduction in forage quality.

The highest biodiversity index was found in the non-sown resources (native pasture, 1.71 in the average of the year; thinned forest, 1.41). Sown pasture and firebreaks showed the greatest seasonal changes, with biodiversity increasing in summer when the sown clover is dead.

In general, the indices found are not very good for pastures and higher indices are common in the literature. This is due to the spread of cosmopolitan species (especially tall grasses) and shrub encroachment caused by reduced management. However, the rapid increase in the number of plant species in summer in the sown pastures means that the soil maintains a rich seed bank that can be used to increase the biodiversity again if the nature conservative management will be continued to develop further nature tourism.

Table 2. Seasonal variations in Shannon's biodiversity index in the four resources of the system in 2002

	Shannon index (2002)				
	Winter	Spring	Summer	Autumn	Year average
Thinned forest	1.34	1.48	1.53	1.30	1.41 b
Sown firebreaks	0.93	0.78	1.74	1.10	1.14 c
Native pastures	1.82	1.80	1.60	1.62	1.71 a
Sown pastures	0.56	0.39	1.66	0.73	0.84 d

Pasture carrying capacity

Calculation of the pasture carrying capacity has been done for pastures and firebreaks (Table 3). It was not calculated for the forest because of the very low productivity, which makes this resource actually more important for shadow in summer and shelter in winter than for forage availability. Consequently, the data refer to an area of 177 ha that does not comprise the wood. The animal stocking rate in this area is 0.3 LU per ha, lower than the current pasture carrying capacity in spring and autumn, lower than in winter, and higher than in summer (in fact during the hot season animals also receive hay).

Table 3. Pasture carrying capacity and difference from the current animal stocking rate (LU per ha) in the average of pastures and firebreaks

	Calculated pasture carrying capacity (LU per ha)	Difference from the current animal stocking rate (LU per ha)
Spring	1.91	+ 1.61
Summer	0.28	- 0.02
Autumn	1.60	+ 1.30
Winter	0.73	+ 0.43
Year average	1.13	+ 0.84

On a theoretical annual average the pasture carrying capacity is much higher (1.13) than the current animal stocking rate. This suggests that more animals can be reared in the same area, or that mechanical management is necessary to maintain the pasture, or some of the pasture land can be driven to a new forest stand.

Tourist opinions

All customers expressed appreciation of the site's beauty, however, a list of possible interventions to improve the farms' tourist services was obtained through interviews with a group of farm visitors. Tourists expressed the following preferences:

(i) 100% would appreciate equipment in resting areas (tables, benches, rubbish bins, barbecues, lookout platforms supplied with information boards).

(ii) 100% expressed interest for higher education of the guides on ecological-pastoral-forestry topics.

(iii) 80% would appreciate the setting up of trekking paths or bridle paths, including lookout platforms, rubbish bins, information boards showing species names of plants and their ecological meaning.

(iv) 76% wanted the flocks to be visible in appropriate areas near the paths.

(v) 50% would appreciate simplifications of some passages from sector to sector: removal of gates and substitution with cattle grids.

(vi) Finally, 87% of the customers expressed their willingness to pay more for better services as listed above and also to pay an added value to buy natural animal foods directly *on the farm*.

Conclusions

There are few animals on the farm and grazing areas are largely underutilized by animals.

Mechanical control is necessary to avoid shrub encroachment. However, management of firebreaks in steep slopes and in the forest is possible only by hand but it is very expensive.

Animal grazing should always be preferred, and planning of the areas where to concentrate pasture management is necessary if there is a low number of animals.

The adoption of a double grazing-mechanical control on vegetation is considered technically possible and economically convenient for many farms of the area and, it can be theoretically proposed for any area where nature tourism is already a consistent reality.

Pasture areas and pasture quality will be reduced if management is not applied or further reduced and, as a consequence, future land abandonment is possible. Consequently, long term planning of pasture and forest management is suggested, and the money to allow the necessary actions can be obtained from nature tourism. The development of territory cultural uses can also contribute to improve land care education that, unfortunately, is not always considered a priority.

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