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Environmental improvement and conservation of useful pastures for wild herbivores in a Regional Park on the Apennines mountains

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ABSTRACT: In order to investigate some effects of the environmental management with faunistic purpose on pastures located on the Apennines mountains, in open areas subjected to bracken fern (*Pteridium aquilinum*) infestation, samples of vegetation were taken for three years on an open area in the Regional Park of “Laghi di Suviana e Brasimone” (BO). Experimental samples, taken before and after the agronomical works, showed the effects of the pasture improvement on botanical composition, richness and biodiversity. The agronomical pasture management produced a considerable decrease in bracken density and an increase on biodiversity, and the final average value of the Pastoral Value index was quadruplicate. These results confirmed the effectiveness of the actions carried out and the importance of maintaining a continuous programme of pasture management through annual clearing of vegetation.

Key words: Apennines pasture, wild herbivores, bracken fern, biodiversity.

INTRODUCTION – Bracken fern (*Pteridium aquilinum*) infestation has been a problem for grasslands in many parts of the world for some time (Pakeman and Marrs, 1992). The spread of bracken fern is dangerous for biodiversity conservation (Ouden, 2000), and it renders unavailable for wild fauna the pastures of the infested open areas. This problem is increasing in Italy too, in particular in abandoned agricultural lands on mountain areas. This work examined the effectiveness of several agronomical management systems against intrusive vegetation in open areas in the Regional Park of “Laghi di Suviana e Brasimone” (BO), in particular relating to the infestation by bracken fern growing over open areas once used as pastures by wild ungulates. Preserving a correct ratio of pasture areas and wood surfaces is important to consent a better management of wild ungulates and to decrease their damages to the local crops (Danilkin, 1996, Perco, 2001). It is therefore important to identify sustainable systems of management and conservation of open areas, specially in protected areas (parks, oasis, etc.), where to conserve the biodiversity, to emphasize the ecotonal belt (very important to draw in animals) and to improve the faunistic handling represent a primary aims.

MATERIAL AND METHODS – The trial site called “Lamaccia” is an open area located in the Regional Park of “Laghi di Suviana e Brasimone”, it is 2.5 hectares wide at an altitude of about 1100 meters a.s.l. The area is considered representative of the environment and vegetation conditions of the other open areas in the Park. Samples of erbaeous vegetation were taken during summer for three consecutive years, from 2004 to 2006. During this period a useful pasture was established and maintained to reduce the bracken infestation. The agronomical management system was constituted by the cutting of the fern in the first year, followed by ploughing and sowing of a sward mixture of species, selected to obtain a good pasture for herbivores (30% *Bromus inermis*, 30% *Dactylis glomerata*, 25% *Festuca ovina*, 10% *Trifolium pratense*, 5% *Lotus corniculatus*). In the following years, the meadow was cut to maintain the introduced vegetation. The bracken fern cover was recorded in according to Braun-Blaunquet method (1932). The quality of pastures was evaluated studying the ground cover and the botanical composition. For each species the botanical specific contribution (SC) was estimated, that is the percentage of the species in the total of the vegetation. Then, the Pastoral Value (PV) of the area was calculated, using the formula:

$$PV = \Sigma (SC_i \cdot SI_i) / 5$$

where *SI* is a specific index regarding the forage value of each species in the pasture (Cavallero *et al.*, 2002). The *PV* value can range from 0 to 100. Moreover, the floristic richness was evaluated using the Shannon index:

$$H' = - \Sigma p_i \ln p_i$$

where *p_i* is the percentage of the specific frequency in decimal fraction (Massa and Ingegnoli, 1999). The Shannon index expresses the richness and the evenness of the species in the canopy. In order to evaluate the environmental effects of the management techniques on the botanical composition of the ground cover, the different pastoral value and the Shannon index (calculated for each years), were analysed by the following linear model: $Y_{ij} = \mu + A_i + E_{ij}$, where μ = mean; A = year (i = 1, 2, 3,); E =error (SAS, 2003).

RESULTS AND CONCLUSIONS – The bracken infestation before the agronomical managements was described using vegetation samples taken in July 2004. The abundance of the bracken cover resulted about 70% of all the open area surface (18200m² on 26000 total). The results of vegetation composition sampling showed a scarce number of species of particular interest to herbivores. An improvement on the floristic composition, a decrease in number in species of low quality, and an increase in number of botanical families of fodder interest have been observed after the agronomical managements, in confirmation of the positive outcome of the sward mixture used (Figure 1). During the third year, *Bromis inermis*, *Dactylis glomerata*, *Festuca ovina* and *Holcus mollis* were the species with a higher SC for grasses; *Trifolium repens*, *Trifolium pratense*, *Lotus coniculatus* and *Lathyrus pratensis* for legumes. The most present species belonging to other families were: *Achillea millefolium*, with a very good specific index and so certainly attracting the herbivores, *Viola tricolor*, *Veronica chamaedris*, *Stellaria graminea*, *Cirsium eriophorus*, *Rumex acetosella*.

Figure 1. Trend of the specific contribution of the different botanical families.

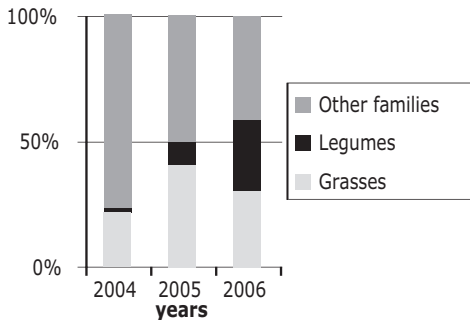
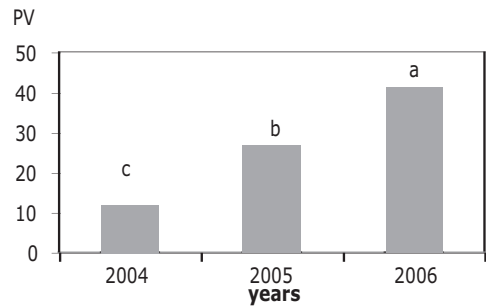


Figure 2. Trend of the Pastoral Value.



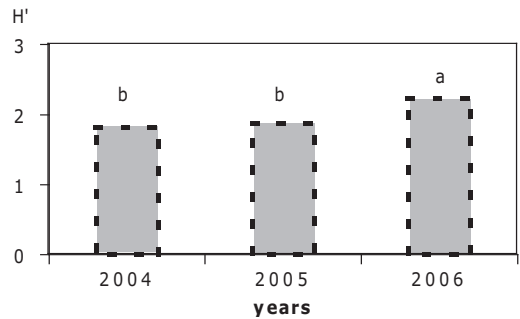
a, b, c = *P*<0,05.

The analysis of pasture permitted to highlight the gradual but remarkable increase of the Pastoral Value (Figure 2), negatively affected, before the agronomical works, both by the fern cover and by the low presence of legumes. The increase of *PV* is attributed to the positive effects of the cuts on the pasture. Table 1 summarizes the features of the ground cover at the end of the study. *PV* is attested to remarkable values, describing a trend in line with the summer climatic characteristics, usually critical in July and August. The specific contribute of spontaneous species (*CS spont*), is higher than the mixture one (*CS mix*), and this suggests the positive outcome of the managements and the naturalization of the pastures. It's also interesting to notice the good distribution in frequency of the botanical species (*SCG*=Grasses, *SCL*= Legumes, *SCO*= Other botanical families). The increased species number, shown by the Shannon index, expresses a floristic variety of definite interest for wild fauna (Figure 3). The high number of species can still augment by the grazing, in fact the wild herbivorous ungulate species can influence a diversity in canopy species (Coughenour, 1991).

Table 1. Seasonal variation of Pastoral Value. a, b= P<0,05.

2006	June	July	August	September
PV	41.20	35.34	35.90	44.79
SC mix %	21.46	9.21	9.94	9.20
SC spont %	78.54	90.79	90.06	90.80
SC G %	35.78	29.91	30.91	25.49
SC L %	31.15	28.38	23.91	33.37
SC O %	33.08	41.71	45.17	41.14

Figure 3. Variation of Shannon index (H').



The Park of “Laghi di Suviana e Brasimone” represents a very important reproduction area for the population of red deer (*Cervus elaphus*) on the Tosco-Emiliano Apennines mountains. This land is particularly used by this species in summer and autumn, months when the food resources are most important in relation to the higher nutritional needs, connected firstly to the lactation and later to the mating season. Therefore, a correct conservation of the open areas can mean an important resource for the ecosystem, establishing and representing a food draw for wild animals, with positive outcomes on the faunistic management and on the decrease of damages to crops caused by the wild fauna in the surrounding agricultural areas.

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