Effects of different establishment techniques on pasture improvements for wild animals in the Italian Apennine Mountains

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Abstract

The propagation of invasive species and their impact on land use pose difficult research questions as a result of the complex relationship between the ecological nature of the infestation and the animal responses to it. Infestation is often a result of land abandonment, which encourages progressive plant growth over green areas, with a consequent reduction in biodiversity. Bracken fern (*Pteridium aquilinum*) is one of the most invasive weeds whose presence reduces the qualitative value of the pastures it encroaches on. This study, carried out in a Regional Park in the central Apennine mountains (Italy), examined the effectiveness of different agronomical management systems against bracken fern infestation and their effects on botanical biodiversity and on the potential reutilisation of open areas as pastures for wild animals. The results highlighted interesting differences between areas managed with different environmental improvements, in particular concerning the specific contribution of the most important botanical families, the pastoral value of the canopies, and their floristic richness.

Keywords: ungulates, pastoral value, biodiversity, botanical composition

Introduction

The constant and remarkable reduction of pastoral activity and agricultural practices has caused deep changes in the natural herbaceous vegetation, concerning both floristic composition and the proportion among different species. From a macroscopic point of view this causes a quick colonisation of areas once used as pastures by invasive vegetation and a reduction of floristic richness and biodiversity (Tucker and Evans, 1997). *Pteridium aquilinum* is certainly a species with high competitive skills and which is able to colonise abandoned areas. This invasive species has a high covering action (Pakeman and Marrs, 1992; Le Duc *et al.*, 2000) which inhibits the establishment and growth of herbaceous vegetation, particularly of species with high forage values, causing a reduction of the pastoral value. The aim of this study is to test the real efficacy of some agronomical practices on areas once grazed and now utilised only by wild animals and thus initially characterised by a massive invasion of bracken fern. The defence of such open areas, especially inside parks, is necessary for the preservation of botanical and landscape biodiversity, besides playing an attractive role for wild animals.

Material and methods

The area of study is located inside the Regional Park of ‘Laghi di Suviana e Brasimone’, in the northern Italian Apennines, at about 1,100 m a.s.l. The area is 2.5 ha wide, with
a massive presence of invasive vegetation (41% *Pteridium aquilinum*) and it was divided into two distinct sectors that were treated with two types of agronomical management. Inside the first area (P), all invasive vegetation was cut up with mechanical intervention by means of a tractor, then ploughing to a minimum depth of 15 cm was performed, whereas the second area (H) was treated only with superficial harrowing. In both cases agronomical interventions were followed by the sowing of the following mixture: *Bromus inermis* (30%), *Dactylis glomerata* (30%), *Festuca ovina* (25%), *Trifolium pratense* (10%), and *Lotus corniculatus* (5%). In the two following years the sward was cut once a year to maintain the new vegetation. Data collection concerned botanical composition recorded in the summer months from 2006 to 2008 (8 samples per year), using linear analysis according to Daget and Poissonet (1969). This survey permitted the determination of the specific contribution (SC) of each species within the total of recognised vegetation, by means of which the pastoral value (PV) was calculated (Cavallero et al., 2002). Furthermore, biodiversity was estimated by the Shannon-Wiener index (Maugurran, 2004) in order to identify possible differences between treatments. The data were analysed with ANOVA, using Tukey’s test to compare the averages.

**Results and discussion**

The comparison between the two areas highlights, in each annual survey, a smaller specific contribution of bracken fern in the ploughed area in comparison to harrowed plots, pointing out the greater efficacy of deeper soil tillage in containing invasive vegetation (Table 1). Moreover, the smaller shading action of *Pteridium aquilinum* favours the growth of heliophilous species in these areas, which is usually characterised by a higher forage value, in particular those belonging to the *Leguminosae* family. Grasses and other species are not affected in any remarkable way by the establishment technique.

Table 1. Specific contribution for grasses, legumes, other species and bracken fern in each area for years of trial

<table>
<thead>
<tr>
<th>Family or species</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gramineae</strong></td>
<td>15.7</td>
<td>24.3</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Leguminosae</strong></td>
<td>19.0</td>
<td>39.6</td>
<td>*</td>
</tr>
<tr>
<td>Other families</td>
<td>43.5</td>
<td>35.7</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Pteridium aquilinum</strong></td>
<td>21.8</td>
<td>0.4</td>
<td>*</td>
</tr>
</tbody>
</table>

Significantly different *P < 0.01; ns – not significant

The better qualitative and quantitative characteristics of the canopies present in the P areas produced a remarkable effect on the pastoral value observed in each year (Figure 1). Furthermore, a decreasing trend in the quality of the canopy is observed in both areas after sowing. This is especially due to the colonisation of spontaneous vegetation belonging to botanical families with poor or no pastoral value interest.

With regard to biodiversity, the ploughed area during the whole period of assessment definitely has a higher Shannon-Wiener index (H’) value and it is characterised by an increasing trend (Figure 2). On the contrary, the harrowed area shows a reduction of the same index with time. Such a tendency is certainly due to the different capacity for suc-
cess of the forage species mixture, which tends to have a decreasing importance in the coenoses in the harrowed sector, and to the high occurrence of bracken fern, which is still the dominant species in the H plot.

Conclusions

The results highlight the importance and efficacy of the sward establishment methods used to reduce *Pteridium aquilinum*, even if deeper soil tillage seems to be more effective in terms of the reduction of this invasive species, and it allows a more proper establishment and growth of other species, with a consequent improvement in the biodiversity and forage quality of the canopy. Harrowing could be employed in the event of the reduced availability of money, as it produces improvement effects in comparison to no interventions at all, as reported by Cervasion et al. (2008), even if these effects have a reduced time duration and need continued cuts to maintain and preserve the results obtained. This work confirms the importance of the restoration of open areas to maintain biodiversity and to play an attractive role for wild animals.

References