An eco-pastoral index for evaluating Pyrenean mountain grasslands

Gómez-García, D.[1], García-González, R.[1], Marinas, A.[1], and Aldezabal, A.[2]
[1]*Instituto Pirenaico de Ecología (CSIC). Jaca, Spain*
[2]*Dep. Biología Vegetal y Ecología, Univ. País Vasco. Bilboa, Spain*

Abstract

A method for calculating the eco-pastoral value of grasslands in the Spanish Pyrenees is explained. The index takes into account different attributes which refer to both ecological and pastoral value. This eco-pastoral index is intended to serve as a tool for the management of grassland resources. As an example, the index has been calculated for five Pyrenean plant communities. As a general rule, extensive pastures which are widely used by livestock show a lower ecological index. However, those of high ecological value do not generate much pastoral interest.

Keywords: nature conservation, ecological assessment, grazing management, forage quality

Introduction

The need to adapt the management of mountain areas, and thus ensure their conservation, demands changes in evaluation criteria of pastoral surfaces. To this end, a method of pasture assessment is presented which takes into account ecological and nutritional variables in order to collect available information and provide managers and technicians with the means for managing and conserving pastures. Some ecological valuations have been developed in other environments (Cirujano *et al.*, 1992), but no ecological valuation of mountain pastures has been carried out to date. With regard to forage value, the most commonly-used indices (Daget and Poissonet, 1971) tend to lack objectivity. The index presented in this study is backed up by quantified measurements of the parameters to be analysed, particularly with regard to the preferences of herbivores, which are of great importance in the pastoral valuation.

Materials and Methods

The Pyrenean grasslands have been defined from phytosociological units, considering alliance as a unit. The level of association has only been taken into account when communities present great structural variability. The eco-pastoral index is defined according to the following equation:

Eco-pastoral index = ecological value (Ve) + pastoral value(Vp)

In order to calculate the ecological value (Ve) of each community, a "standard relevé" has been elaborated from all the relevés obtained from bibliographic and our own data. This "standard relevé" summarises the floristic composition and the frequency (f) of each species. In his turn, Ve = Vf + Vc where Vf is the floristic value and Vc is the value of the plant community. The floristic value of the community (Vf) has been calculated as a mean of the sum of the floristic value of each species (Vsp) multiplied by its frequency (f), or in other words $Vf = 1/n$ Vsp x f (n = nº of species of each community in the "standard relevé").

The floristic value of each species (Vsp) and the value of the community (Vc), has been calculated from the following parameters: distribution area in Europe; distribution area in the Iberian Peninsula, degree of species abundance and community diversity, on a numerical scale from 0 to 5. The values obtained in the communities studied ranged from 3 to 10 (a more detailed explanation can be found in Gómez *et al.*, 2001).

With regard to pastoral value (Vp), it has often been stated that the principal factors for determining the nutritional value of a pasture are abundance, quality and herbivore preference. The equation for defining the pastoral value of a community is as follows:

$$Vp = B[(N + P)D] (1 + S)$$

B is a measurement of the abundance of the community in terms of annual production; N and P refer to the concentration of nitrogen and phosphorus in the pasture and represent an estimate of the protein and mineral value; D is the digestibility of dry matter and S is a measurement of the selectivity or preference of a species of herbivore for that type of pasture. S must include a relationship between

availability and use in the pasture community and thus we propose the use of the Jacobs index (Krebs, 1989) in our assessment. This index varies from –1 (total rejection), to 0 (non-selection) and +1 (total preference). Thus, the pastoral value is 0 when a community is not used in any way. As preferences can change depending on the species of herbivore, a pastoral index must be calculated for each animal species in multi-specific pastoral systems. If N, P and D are expressed in kg kg^{-1} and B in g m^{-2}, normal values vary from 0 to 10.

Results

As an example, the eco-pastoral value has been calculated for the following grassland communities: *Bromion erecti* (BE), *Festucion eskiae* (FE), *F. gautieri* (FG), *Nardion strictae* (NS) and *Primulion intricatae* (PI) in the Goriz summer pastures of the Ordesa National Park. The ecological value obtained for these pastures was: BE = 3.6, FE = 7.4, FG = 7.5, NS = 5.4, and PI = 8.2. The pastoral value was calculated separately for each grazing species within the study area. For B, N, P, and D we took mean Pyrenean values from our own data and from the bibliography. The value of S was calculated from our own data based on vegetation maps and on the spatial distribution of livestock. The following pastoral values were obtained for sheep: BE = 7.3, FE = 0, FG = 1, and PI = 6.2; for cattle: BE = 7.5, FG = 0.6, and NS = 5.2; and finally for goats: BE = 3.2, FE = 8.5, and FG = 1.4.

Discussion

The proposed method requires a laborious compilation of data for the calculation of the index but increases the objectivity of valuation of pastures which are so heterogeneous and variables in mountain areas. The spatial and temporal variation of the pastures must be taken into account during the evaluation process, which means carrying out the necessary adjustments in each area in accordance with the objectives of each study. Due to this variability, the resulting values should be considered as relative estimates which allow comparisons to be made between different pastures and pastoral units, rather than as absolute values. With these modifications in mind, the eco-pastoral index and the vegetation maps which provide information about the extension of each type of grassland can be used as fundamental tools for the management of protected mountain areas.

Acknowledgements

This study was funded by CICYT Medio Ambiente Program, project nº AMB 97-0990.

References

Cirujano, S., Velayos, M., Castilla, F., and Gil, M. (1992) *Criterios botánicos para la valoración de las lagunas y humedales españoles.* ICONA. Colección Técnica. Madrid.

Daget, P. and Poissonet, J. (1972) Un procédé d'estimation de la valeur pastorale des paturages. *Fourrages* 49: 31-39.

Gómez, D., García-González, R., and Remón, J.L. (2001) Una valoración ecológica de los pastos del Pirineo. *Actas XLI Reunión Científica de la SEEP.* Pp. 201-207. Alicante.

Krebs, C.J. (1989) *Ecological Methodology.* Harper Collins. New York.