QUALITY AND PROMOTION
OF ANIMAL PRODUCTS IN MOUNTAIN

QUALITE ET VALORISATION
DES PRODUITS ANIMAUX DE MONTAGNE
Plant selection by large herbivores in supraforestal Pyrenean pastures.

Gañán N., Hernández Y., Aldezabal A., Gómez D. and García-González, R.

Instituto Pirenaico Ecología CSIC, Ap. correos 64, 22700 Jaca, Spain.

Introduction
Summer pastures in the Pyrenees (subalpine and alpine belt) have been used for grazing for centuries (Chocarro et al., 1990). Transhumant sheep flocks and cattle herds shared the different grazing areas during summer, in units which are normally separated, but which can occasionally overlap (Garcia-Gonzalez et al., 1991). Monospecific herds of horses, goats and chamois (Rupicapra pyrenaica) can also graze in the same areas (Aldezabal, 1997). In summer, pastures reach their maximum production and as the present stocking rates are low, food selection can be exercised with a minimum of availability restrictions (Dumont, 1997). Our objectives were to determine which species are the most utilized by grazing herbivores and their degree of preference, and to test if plant preferences depend on species availability or can be attributed to other factors. Due to the overlap of some grazing areas and the method used (bite traces) it was not possible to discriminate preferences between animal species.

Study area and methods
Two grazing territories (Aisa and Ordesa), representative of calcareous Pyrenean supraforestal pastures, were selected for this study. Their surface areas are 1,300 and 6,100 ha respectively. The altitude ranges between 1,600 to 2,400 m in Aisa and 1,800 to 2,800 m in Ordesa. Present stocking rates vary between 0.5 to 2.3 Animal Units x month ha⁻¹ depending on the site. Six plots in Aisa and 25 plots in Ordesa were sampled for plant species abundance and use during 1989 to 1993. Plots were selected to represent the different main pasture communities and animal grazing zones. The sampling method used was Point Intercept in Linear Transects with contacts at 20 cm intervals (Grant et al., 1985). Bitten plants were recorded as evidence of grazing use. The number of contacts per sampling obtained for Aisa and Ordesa were 2,000 and 500 respectively. Sampling periods were normally four per plot at monthly intervals (June to September), except when prevented by shortness of vegetative period. Plant species preference was measured by means of the Jacobs Selectivity Index: \( SI = (U_i - A_i) / [(U_i + A_i) - 2A_iU_i / 100] \) where \( A_i \) is the abundance proportion of species \( i \), and \( U_i \) is the used (bitten) proportion of the same species. In order to avoid excessive random error in the assessment of selectivity, we rejected samplings with less than 3% of total utilization and species with less than a value of 10 of absolute abundance in a specific sampling (Andrew, 1986).

Results and discussion
There was a significant association (Spearman rank correlation test) of abundance, utilization and selectivity of plant species between sampling periods 3 and 4 (sampling periods 1 and 2 had very low utilization). In one of the areas (Aisa) samplings were repeated during 3 years in the same plot. We did not find statistical differences (Kruskal-Wallis test) in abundance and utilization frequencies of the same plot between years. Totals of abundance and utilization frequencies of all plots for the third sampling did not show differences between Aisa and Ordesa grazing areas (Spearman rank correlation test \( Rho = 0.5 \) and 0.4; \( p \leq 0.001 \) for abundance and utilization respectively).

In figure 1 we plotted the mean abundance frequency of the most abundant species in respect to its mean selectivity index. Different samplings were used for each species
according to their absolute abundance in each particular sampling (see methods). Number of data varied between 10 to 70 samplings depending on the species. For several species, we observed a definite trend relating positively its preference with its abundance. Nevertheless there was a set of low to medium abundant species (between 1 to 5% of mean abundance frequency) showing high preference (e.g. Dactylis glomerata, Helictotrichon montanum, Poa alpina), rejection (Lotus alpinus, Merendera montana, Armeria pubinervis) or indifference (Luzula nutans, Agrostis rupestris, A. capillaris).

Figure 1. Relationship between abundance and selectivity for relevant species (more than 1% of relative abundance): mean values of abundance (%) and Jacobs Index for each species; bars indicate confidence intervals at 95%.

In addition to its abundance, plant species can be selected on the basis of their nutritive value (Arnold, 1985). In fact, for several species for which we have chemical information (Garcia-Gonzalez & Alvera, 1986), we found a significant correlation (r = 0.632; p = 0.05; n = 10) between the Selectivity Index and nitrogen content, if we exclude Trifolium alpinum. This last species provides an example of a species which is rejected in spite of its high abundance and its high protein content. In such cases the presence of anti-herbivore components could furnish a reasonable hypothesis of plant rejection (Palo & Robbins, 1991). These anti-herbivore components could be mechanical (silica in Nardus stricta, spinescence in Festuca gautieri), chemical (colchicine in Merendera montana, cyanogens in Lotus alpinus) or simply a strong smell (Trifolium alpinum, Thymus praecox) (Augner et al., 1998).

Conclusions
The results support the idea that in Pyrenean supraforestral pastures there is a high constancy of community structure (botanical composition) and patterns of herbivore plant utilization, which is independent of vegetative stage (sampling period), year and even grazing areas.
Selection of plant species usually depends directly on species abundance, but in some species other factors seem to be important, possibly linked to nutritive value or presence of anti-herbivore components.

References