STRUCTURE, PRODUCTIVITY AND ANIMAL UTILIZATION IN A COMMUNAL PASTURE IN THE BASQUE COUNTRY (NORTHERN SPAIN)

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ABSTRACT
The goal of this study was to determine the structure, productivity and utilization of mountain communal pastures of the Gorbea area in 1994. The area was classified in four zones according to topographic position and improvement activities: north slope brush removed, summit, south slope 50% brush, and south slope brush removed. Ecological profiles were used to relate the most abundant species to soil P and K contents at the different zones. Exclosure cages were used to estimate potential productivity, botanical composition and pasture utilization. Soil P and K contents are the parameters that relate best to floristic composition, being *Agrostis capillaris* related to higher soil fertility levels, and *Agrostis curtisii* and *Festuca rubra* to lower conditions of soil fertility. Pasture productivity was between 1.7 and 2.8 t DM/ha. *Agrostis capillaris* and *Festuca rubra* were the dominant species except in the brush removed zones. Average pasture utilization was 55%.

KEYWORDS
mountain pastures, cattle, sheep, grazing, *Agrostis capillaris*, *Agrostis curtisii*

INTRODUCTION
In the Basque Country, communal pastures are in the mountainous ranges at altitudes above 600 m above sea level and play an important role in animal grazing systems, mainly for ovine production. In these areas sheep flocks have two different phases at their productive cycle, one at the valley farm, in the winter and a large portion of the spring, and the other one, at the mountain pastures.

In recent years, the crisis of livestock production on marginal areas has induced their abandonment and reinvasion of land by brushy species (Wallis de Wries and Daleboudt, 1994).

The objective of this work was to study the structure, productivity and utilization of a pasture in the Gorbea area.

MATERIALS AND METHODS
The study was conducted in a communal pasture of the Gorbea area, Usotegieta. Usotegieta is a hill ranging in altitude from 1000 to 1285 m above sea level. Livestock management is simple with animals being taken up in May and staying at the pasture till December weather permitting. The improvement activities carried out consisted of brushing out mechanically 18 ha at the south slope and 10 ha at the north slope.

Vegetation study. Botanical composition was studied at the start of pasture growth, May-June, through stratified sampling of the vegetation. Four areas were defined: a) north (N) slope, brush removed, b) summit, c) south (S) slope, 50% brush cover, and d) S slope, brush removed. To study the behavior of each plant species in relation to soil P and K contents ecological profiles have been calculated (Daget and Godron, 1982) according to the expression:

$$F(C) = P(C)_k \, NM / M(C)_k \, PE$$

wherein, F(C), index of corrected frequency; P(C)k, number of occurrences of a given species in class K; $M(C)_k$, number of census performed in class K; PE, number of occurrences of a given species in all the census; NM, total number of census.

Soil sampling. Soil sampling (0-10 cm) was done in each one of the quadrats thrown randomly at the different zones for floristic determination. Available P was determined by the Olsen procedure and K by extraction with NH_4 AcO.

Herbage productivity, botanical composition and pasture utilization.
Herbage biomass was determined with exclosure cages (1x0.5 m). To estimate pasture potential productivity, at the start of the grazing period and every 28 days approximately, herbage inside the cage was cut and the cage displaced to a close point after herbage cutting at this new point.

Pasture daily growth for each cutting interval was calculated as (Davies *et al*., 1991): P= Hi/n; wherein, Hi, herbage mass inside cage at end of sampling interval; n, number of days between samplings.

Pasture utilization during individual sampling intervals has been estimated by the following expressions: Pa = (Hop + Hoa)/2 + Hia and I = (Hop - Hoa) + Hia; wherein, Pa, available herbage during a sampling interval; I, herbage intake during the sampling interval; Hop, herbage mass outside cage at start of sampling interval; Hoa, herbage mass outside cage at end of sampling interval; Hia, herbage mass inside cage at end of sampling interval. Finally, pasture utilization has been calculated dividing herbage intake by available herbage during the sampling interval.

RESULTS AND DISCUSSION
Soil fertility. Soil pH was strongly acidic (4.0±0.1), organic matter very high (16.6±3.9) and the C/N ratio normal (12.5±1.2). Phosphorus and K contents varied as a result of livestock movement through the area, so the summit and the S slope after brush removal showed the highest levels of P and K (1.1±0.2 and 253±55 mg/kg, respectively) in comparison to the other zones (0.4±0.1 and 177±65 mg/kg, respectively).

Structural aspects. The pasture was dominated by species of the genera Agrostis and Festuca, as well as by *Erica tetralix*, *Potentilla erecta*, *Serratula seoanei*, *Juncus acutiflorus*. Species like *A. curtisii* and *Festuca rubra* tend to appear at low P and K contents while A. capillaris appeared at higher values (Figure 1) (Montard, 1982).

Potential productivity and botanical composition. Herbage yields were 1.7, 2.8, 1.7 and 2.5 t DM/ha for the N slope brush removed, summit, S slope 50% brush, and S slope brush removed, respectively. Average daily growth was 8.9 kg DM/ha and the peak of maximum production occurred at September. Herbage productivity seemed to be relatively independent of the brush cover. Thus, the production per total area is narrowly related with brush cover. The strong reduction of the potential productivity justifies brush removal to favor the entry of animals and pasture growth. However, the relative difficulty of controlling livestock movement and grazing pressure may have the result that brush removal does not improve the pasture as much as wished. As a matter of fact in the zones in which brush was removed there was a higher proportion of *A. curtisii* (Fig. 2). At the summit and S slope with brush the dominant species was A. capillaris, followed by *Festuca rubra*. This may suggest that where brush is removed and soil fertility improves the substitution of *A. curtisii* by *A. capillaris* occurs.

Pasture utilization. Pasture utilization was calculated on a monthly base. Optimum utilization of mountain pastures should be arround 40-60% (Bourboze, 1994). Thus, pasture utilization was adequate and relatively constant through the season (June, 58%, July, 55%, August, 43%, September, 53%, October, 68%) with an average of 55% and this may show that sheep flock size at these pastures are well adjusted to potential productivity.

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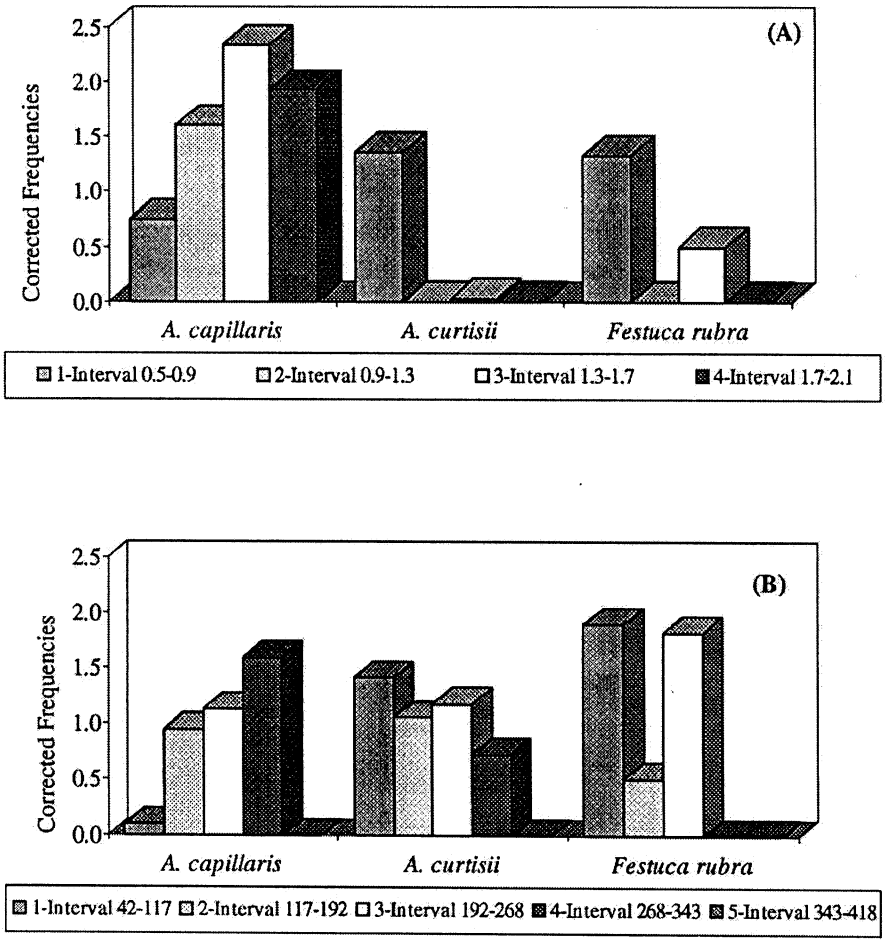

Figure 1
Ecological profiles of corrected frequencies of *Agrostis capillaris, Agrostis curtisii* and *Festuca rubra* in relation to soil P contents (A) and soil K contents (B). Numbers in the legend refer to P and K contents expressed in mg/kg.

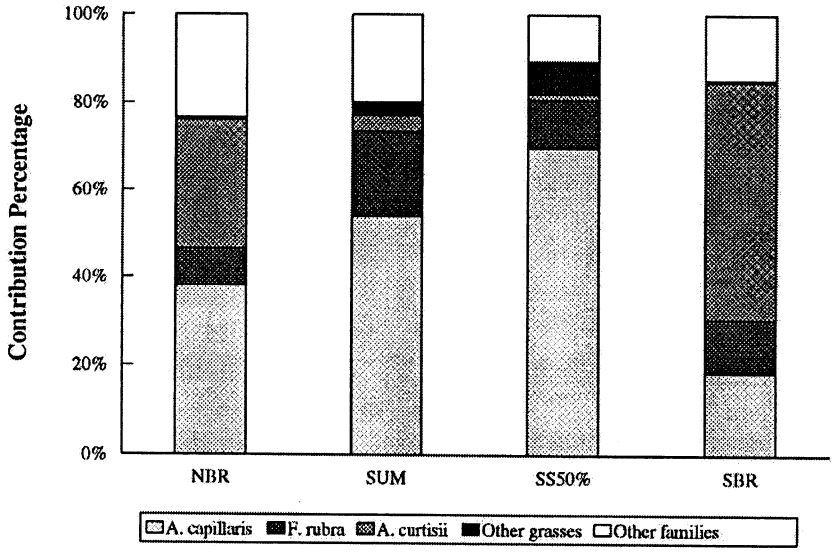

Figure 2
Spatial variability of the botanical composition (NBR, N slope, brush removed, SUM, summit, SS50%, S slope shrub cover 50%, and SBR, S slope, brush removed).