QUALITY AND COMPOSITION OF JUNIPERUS SATIVA L. PASTURES AND ACCORDING TO MANAGEMENT AND ENVIRONMENTAL FACTORS

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SUMMARY

Creeping savin (Juniperus sabina L.) confers a strong character to the pastures in the calcareous flat highlands of the Iberian Mountain System. Communities of creeping savin were found in 24% of sites in a startified sampling. Each of these was analized as a function of its specific composition, taking into account edaphic, geomorphologic and climatic factors.

Pastures with creeping savin are found in sites of extreme environmetal conditions with predominant degrated stony soils and where heaving has selected plants specialized in producing under these stresses. The pastures belong mainly to the subhumid type included in Al. Bromion, however according to soil stoniness and degradation and water holding capacity, a variation gradient can be found.

A traditional use, based on transhumance, with heavy grazing pressure during summer, outstands among the factors contributing to the make up of today's landscapes. These pastures high quality rests on its richness in perennial legumes of a high forage value. Chaemephyte and hemicrophyte creeping types have special importance in pastures structures.

INTRODUCTION

Mesoclimatic, soil and management factors are mainly responsible for the diversity in pastures of a mountanious area. With a view to intelligent exploitation planning for these resources, it would be important to work out the ecological characterization of the different types of communities and the requirements of the species in them. From this point of view, we have already made studies on the southern section of the Iberian Mountain System (4,6).

Flat landscapes prevail in our study a mean altitude of 1 400 m and stony

soils built over limestone. The climate is of a continental type, with lowest temperatures below -10ºC and highest over 38ºC.

These phisyigraphic and climatic features - with a scarce snow covering in winter - allow for the existence of population settlements at points over 1400 m in height, in close vecinity to "the grasslands of high altitudes", but do not eliminate the need for transhumance. In fact, these ranges constitute the southern most point in Spain where long distance movements for winter livestock stays have traditionally been made to.

In the present study we investigate factors affecting the structure and composition of grasslands with J.sabina and then analize the sort of exploitation they are under.

MATERIAL AND METHODS

We started from a stratified sampling (3) which takes into account climate, lithology and potential vegetation. It was carried out on the area stretching from 40º12' to 40º39' N and from 0º24' to 1º58' W. Juniperus sabina was found in 32 out of the 140 inventories made. We determined 22 environmental variables and collected samples from the soil upper 20 cm. in order to undertake physical, chemical and water holding capacity analyses (4). Ordination techniques (1), ecological profiles and mutual information (2,7) were used for the numerical treatment of data.

ENVIRONMENTAL FACTORS AND GRASSLANDS COMPOSITION

Creeping savin is peculiar to the environment where the investigated grasgrow; as a consequence, the rate between the mutual information of the presence of savin with the different variables and the entropy for each of them Table 1, indicates their influence on the distribution of such grasslands. From most to least signifficant, we found: climatic factors, pH, wilting point, coarse sand, shrub cover and exchangeable cations content in the last place.

TABLE 1

Hierarchical ordination of the variables according to their activity on the distribution of Juniperus sabina

	%		%		%
Altitude	14,5	Topography	3,4	Herbaceous cover	2 - 3
Climate	8,2	Coars sand	3,4	Magnesium 1	"
pH	4,8	Shrub cover	3,3	Gravel and stones	"
Co_3	4,2	Drainage	3,3	Tree cover	"
Silt	3,9	Texture	3,2	Sodium	"
Wilting point	3,7	Calcium	3,1	Organic matter	"
				Shrub cover	"

We have used the ecological profile method in order to determine J.Sabina distribution according to the most active factors (7).

The results (table 2) show grasslands with savin as mainly found over the 1500 m. in altitude, in continental cold climates, on flat surfaces with well drained and carbonate rich soils.

The high proportion in gravel and stones within the 2 mm. fraction means stony soils of an intense mechanic erosion due to heaving. A small proportion of coarse sand indicates a lacking in silicia. Silt-loam and clay-loam textures correspond to a high content in silt and to the decalcification clays, resulting from some surface washing.

TABLE 2

Corrected frequencies (F × 100) and "Indices" (I) of *Juniperus sabina* for the states of the environmental factors that favours its presence

	C.F.	I		C.F.	I			
Altitude			Coarse sand (%)			Mg 1 (meq/100g)		
1600-1700	277	++	< 5	215	+	1,3-2,0	170	+
> 1700	431	+++	5-10	149		> 2,0	144	
Topography			Silt(%)			Na (meq/100g)		
rounded or level tops	173	++	30-35	117		0,06-0,09	189	+
Climate			35-40	125		Ca 2 (meq/100g)		
Semicontinental	165	+	Texture			0,4-5	136	
Gravel and stones(%)			Silt-loam and Clayloam			5-10	287	++
> 95	242	++		187	+	Herbaceous cover (%)		
Wilting point (%)			pH			> 81	148	+
			6,4-7,3	188		Shrub cover (%)		
15,0-22,5	161	+	7,3-7,7	215	++			
> 22,5	154					< 9	145	
Drainage			Organic Matter %					
			> 10	157		Tree cover (%)		
Internal(surface)	125					9-16	288	++
" (deep)	165		Carbonates(%)					
			1-3	165				
			3-6	249	+++			

Herbaceous cover is of about 80% neanwhile shrubs occupy less than a 9% of the grassland surface.

Extractable cation contents are rather high and do not appear to constitute a limiting factor; organic matter values -between 3 and 6%- suggest a buffering effect on soil conditions from savin leaves, and contraints seem to rather come from the physical structural than the chemical-nutrition side.

Figure 1 shows the results of a factor analysis of correspondences carried out on a site by ligneous species matrix. It was elaborated on a previous study (10) in order to define phytoclimatic environment units. All sites with *J.sa-*

bina were marked and four different situations -whose most representative species appear in Table 3- can be pointed out:

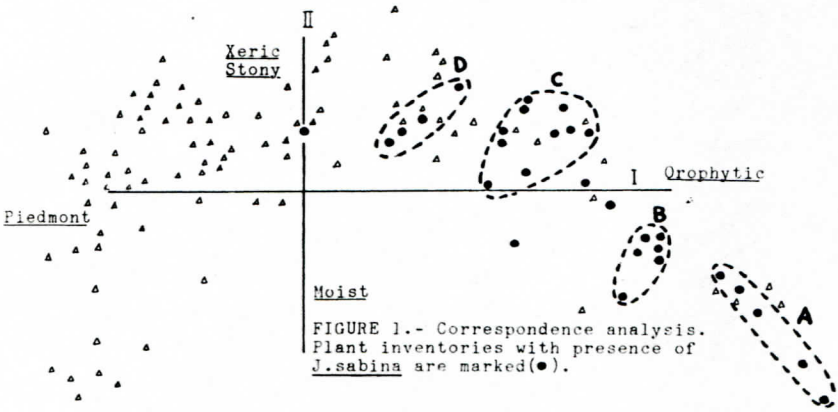

FIGURE 1.- Correspondence analysis. Plant inventories with presence of J.sabina are marked(●).

TABLE 3

Species with larger presence in the groups of plant inventoires

A	AB	BC	CD	D
Arrhenatherum elatius	Lotus corniculatus	Bromus erectus	Ononis pusilla	Festuca hystrix
Koeleria splendens	Plantago media	Coronilla minima	Teucrium gr. polium	Astragalus incanus
Trisetum flavescens	Astragalus austriacus	Onobrychis hispanica	Potentilla cinerea	Poa ligulata
Trifolium montanum	Ononis cristata	Ononis spinosa	Genista scorpius	Artemisia pedemontana
Trifolium ocrholeucon	Thymus pulegioides	Festuca gr. rubra	Helianthemum canum	
	Trifolium repens	Festuca gr. indigesta	Thymus bracteatus	
	Trifolium pretense		Festuca gr. indigesta	
			Astragalus sempervirans	

The first and second ones belong to subhumid grasslands of mountainous tendency. Group A, with Trisetum flavescens, Plantago media and Lotus corniculatus indicates higher water holding capacity soils and summer drought absence, while group B comprises the most representative types of grasslands in al. Bromion. Group C -which includes the majority of the inventories with J.sabina -assembles the most characteristic situations, because of their stoniness and degradation, in the studied conmunities, including a number of species of higher xerophytism. Finally, group D stands for a mixed savin open forest with Juniperus thurifera and represents the top altitude limit for the last species, with

Juniperus thurifera and represents the top altitude limit for the last species, with a more important presence of suprameditterranean shrubs (12).

PASTURES QUALITY AND MANAGEMENT

The main ecological interest of these pastures lies on the overcharge in abiotic exploitation they support -specially the effects produced by climate features such as pronunced oscilation in temperatures, scarce snow covering, strong insolation, and so on. That means that grasslands growing there are labile communities (8) whose survival is only possible when a low grazing pressure, from sheep and goat livestock in particular, is kept.

Traditional usage has given rise to true "dehesas" (sort of savannahlike forest), built around that creeping species, with a reputation for high quality pastures. In spite of its low value as forage, savin is rarely grubbed or burnt up, but left among grasslands. Its beneficial effect is most necessary in such hard environments as the ones we study and migrating livestok survival in southern ranges of the Iberian System (9) has rested on grasslands with savin usage.

Shepherds in the area think that the soil close to savins becomes deeper and organic. Slow decomposing leaves accumulation mollifies the soil and acts as buffer against heaving direct action on plants, favouring the establishment of good pastures species.

As savins grow older, acess to their interior becomes easier for livestock. The grass growing there is different from the above mentioned (abounding in Poa flaccidula). As shepherds say: "The animal which moves on and gets there, goes out full". There seems to be cyclic changes in these grasslands evolution, relate to development and maturing processes of the dominant species. The cycles would be similar to those already described (13) for other communities and depend closely on herbivorous action.

Table 4 gives a listing of legumes and gramineous species frequent in grasslands with savin, relating each other by means of an affinity index-quotient of percentage of presence for each species in inventories with savin among the same percentages for inventories without it-. Among legumes we mark out Ononis cristata, Astragalus austriacus and Onobrychis hispanica, regarded as

component of the best natural meadows in supermediterranean calcareous mountains (11), and Festuca gr, rubra and F. gr. indigesta with a high presence. Helianthemum canum, Thymus pulegioides and Th.bracteatus, which also appear in the table, contribute with their rampant stems and ligneousity to the community's structural built up. Pinus sylvestris and Juniperus communis, can be found besides Juniperus sabina in those orophytic environments, but their occurrence within the best grasslands on limestone is lesser.

TABLE 4

Species located preferentially on the area of Juniperus sabina

Legumes	I	Grasses	I	Other species	I
Anthyllis vulneraria	1,3	Agrotis tennuis	1,9	Berberis hispanica	1,9
Astragalus austriacus	2,0	Arrhenatherum elatius	2,7	Helianthemum camun	3,0
Astragalus semprevirens	6,1	Bromus erectus	2,0	Helia. nummlarium	1,7
Coronilla minima	2,4	Bromus hordaceus	4,3	Juniperus communis	3,5
Hipocrepis bourgaei	1,4	Deschampsia caespitosa	1,7	Linum tennuifolium	4,5
Lotus corniculatus	1,6	Festuca gr. indigesta	1,5	Pinus sylvestris	3,7
Medicago lupulina	2,6	Festuca gr. rubra	1,4	Plantago media	1,9
Onobrychis hispanica	1,4	Holcus lanatus	1,7	Thymus zapateri	3,8
Ononis cristata	4,0	Koeleria splendens	1,9	Thumus bracteatus	1,5
Ononis spinosa	2,1	Phleum partense	3,0	Thymus pulegioides	5,6
Trifolium campestre	2,0	Poa pratensis	2,2		
Trifolium montanum	2,0	Trisetum flavescens	3,3		
Trifolium pratense	2,5				
Trifolium ochroleucon	3,3				
Trifolium repens	3,0				
Trifolium scabrum	5,6				
Vicia pyrenaica	6,6				

I.- affinity index with respect to the distribution of creeping savin.

CONCLUSIONS

- J.Sabina communities are distinctive for an orophytic, extreme, continental environment in Iberian Peninsula, whose main peculiarity stems from exploitation overcharge due to climatic hardness.

- The most influential factors over these grasslands nature are more closely related to physical and structural than to chemical and nutritional contraints. J. sabina acts as buffer against them. Savin dense foliage collaborates to keep within it a higher humidity, which softens the strong thermal fluctuations.

- Traditional livestock usage -which has eliminated some tree and shrub species and kept isolated savins spekling the landscape- has played an important role in today's configuration.

- The type of communities accompanying savin vary from somehow humid pastures to grasslands with presence of some mediterranean mountain shrubs. But the highest frecuency is that of orophytic subhumid grasslands, pertaining .to al. Bromion.

- Good quality legumes such as Astragalus austriacus, Coronilla minima, Hippocrepis bourgaei, Medicago lupulina, Ononis cristata and some perennial clovers stand out among the pasture components. Presence of gramineae is lesser and in spite of a relative richness in some types of erect growth, their structural role is limited.

- Creeping and ligneous species such as Helianthemum canum, Thymus bracteatus and Th. zapateri, perform a basic pert for grasslands structure. Besides the above mentioned legumes they constitute the main component in pasture biomass. Gramineae such as, Festuca gr. indigesta and Festuca gr. rubra develop thick tussocks which the closure of the community framework when soil conditions allow for.

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