



Conservation status and protection measures for *Draba hispanica* Boiss. subsp. *lebrunii* P. Monts., endemic to the Altocarrionés subsector (Castile and Leon, Spain)

Marta Eva García González, Raquel Alonso Redondo, Estrella Alfaro Saiz, Raquel García Valcarce, Sara Alonso García & Noelia Ferreras Jiménez

To cite this article: Marta Eva García González, Raquel Alonso Redondo, Estrella Alfaro Saiz, Raquel García Valcarce, Sara Alonso García & Noelia Ferreras Jiménez (2011) Conservation status and protection measures for *Draba hispanica* Boiss. subsp. *lebrunii* P. Monts., endemic to the Altocarrionés subsector (Castile and Leon, Spain), *Acta Botanica Gallica*, 158:4, 577-594, DOI: [10.1080/12538078.2011.10516296](https://doi.org/10.1080/12538078.2011.10516296)

To link to this article: <https://doi.org/10.1080/12538078.2011.10516296>



Published online: 26 Apr 2013.



Submit your article to this journal [↗](#)



Article views: 120



View related articles [↗](#)

Conservation status and protection measures for *Draba hispanica* Boiss. subsp. *lebrunii* P. Monts., endemic to the Altocarrionés subsector (Castile and Leon, Spain)

by Marta Eva García González, Raquel Alonso Redondo, Estrella Alfaro Saiz, Raquel García Valcarce, Sara Alonso García and Noelia Ferreras Jiménez

Botany Section, Department of Biodiversity and Environmental Management, Faculty of Biological and Environmental Sciences, University of Leon, Vegazana Campus, E-24071 Leon; megarg@unileon.es

received June 29, 2010, accepted February 2, 2011

Abstract. - *Draba hispanica* subsp. *lebrunii* is an endemic plant restricted to a small area of the south-western part of the Nature Park and SCI called "Fuentes Carrionas and Fuente Cobre-Montaña Palentina" in the Castile and Leon Region of Spain, included in several regional and national protection catalogues. This paper provides a demographic study of the currently known populations, with the aim of reviewing the conservation status of the taxon in accordance with IUCN criteria, as well as detecting risk factors and providing appropriate management measures to guarantee survival of the taxon. Furthermore, the creation of a Micro-Reserve for Flora is proposed, as a specially protected area in the zone where the most abundant and best preserved population is located. Precise locations for all the previously known sites and others are provided through labelling by means of GPS technology. The current situation of the populations and changes in them are also analysed.

Key words : conservation - *Draba hispanica* subsp. *lebrunii* - management - Spain - threatened flora.

Résumé. - *Draba hispanica* subsp. *lebrunii* est un endémisme restreint à un petit territoire de la partie sud-occidentale du Parc naturel et SIC de "Fuentes Carrionas y Fuente Cobre-Montaña Palentina" (Castille-et-Léon, Espagne), inclus dans divers catalogues de protection aux niveaux régional et national. Ici, nous présentons une étude démographique des populations connues jusqu'à présent, dans le but de réviser le statut de conservation du taxon suivant les critères UICN, de détecter les facteurs de menace et d'apporter des mesures de gestion adéquates pour garantir la survie du taxon. En même temps, on propose la création d'une microréserve de flore, considérée comme une aire de protection spéciale, là où se trouve la population la plus abondante et la mieux conservée du taxon. Sont précisées les localisations exactes de toutes les citations existantes et d'autres nouvelles par marquage par GPS ; la situation actuelle des populations et leur évolution sont analysées.

Mots clés : *Draba hispanica* subsp. *lebrunii* - flore menacée - conservation - gestion - Espagne.

I. INTRODUCTION

Draba hispanica Boiss. subsp. *lebrunii* P. Monts. is a narrow endemic plant to be found in the northern mountains of the Palencia Province in the Castile and Leon Region of Spain (Fig. 1), specifically in the Peña Cueto, Pico Fraile, Peña Redonda and Alto de Miranda zones (Blanca, 1993; García González, 1990; García González *et al.*, 1992; Lainz, 1988; Montserrat, 1977; Rivas-Martínez *et al.*, 1991; various authors, 2007-2008), over an area of seven and a half square kilometres (7.5 km²). In terms of biogeography it is included in the Altocarrionés subsector of the Altocampurriano-Carrionés sector within Orocantabric subprovince of the Eurosiberian region, according to the innovative proposal put forward by Rivas-Martínez in 2007. As it is an extremely restricted endemic, it can be described as a very rare plant (Fig. 2 and 3). Hence, it has been included in several regional and national lists of flora at risk. Thus, the taxon was catalogued as *vulnerable* (Domínguez, 2000) in the 2000 Red List of Spanish Vascular Flora based on 1994 IUCN categories, then reclassified as *endangered* in the 2008 Red List of Spanish Vascular Flora based on 2001 IUCN categories (Moreno, 2008) and in the catalogue prepared by Llamas *et al.* (2009). It also appears in the catalogue of Protected Flora of Castile and Leon (Anonymous, 2007a) as *vulnerable* (a category which corresponds to that established by Article 29 of Spanish Law 4/1989, not the IUCN category). Moreover, it has been included in other scientific lists of threatened flora (Llamas *et al.*, 2003, 2007). Hitherto, neither censuses of this taxon

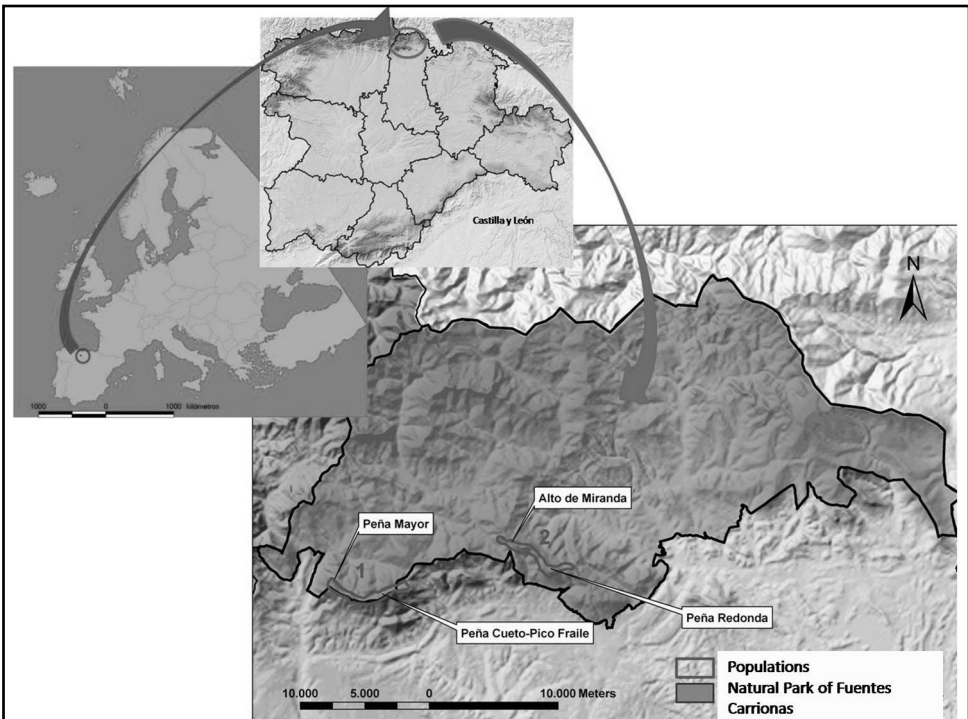


Fig. 1.- Situation map.

Fig. 1.- Carte de situation.



Fig. 2.- *Draba hispanica* subsp. *lebrunii* in bloom.

Fig. 2.- *Draba hispanica* subsp. *lebrunii* en fleur.



Fig. 3.- *Draba hispanica* subsp. *lebrunii* fruiting.

Fig. 3.- *Draba hispanica* subsp. *lebrunii* en fruit.

nor any estimates of the extent of occurrence and the area of occupancy had ever been undertaken with the exception of data published by Llamas *et al.* (2009) while this paper was being written, the results of which differ considerably from those presented here. At present, it is one of the taxa that are the object of conservation and geo-botanical studies, promoted by the Castile and Leon Regional Government through several projects and agreements with the Universities of Salamanca, León and Castilla-La Mancha during 2002-2010. Over the course of a number of years (1985 to 2009) data for the taxon have been collected and major risk factors were observed for one of the populations, which may have affected it negatively. However, in the other, larger, population there seems to be an upward or at least constant trend in the number of individuals. This is a further reason to carry out an exhaustive study of the taxon.

The area where it is to be found lies within the “Fuentes Carrionas y Fuente Cobre-Montaña Palentina” Nature Park (Anonymous, 2000), coded as SRI-ES4140011 (Anonymous, 2004) in the Natura 2000 Network. This natural zone is some 78,360 ha in extent and it is located in the South-East of the Cantabrian Mountain Range. Its large geological and climatic diversity and its geographic location, bordering the Castilian plateau, make it one of the most interesting and complex sections of the Cantabrian Mountain Range. The area has a rugged terrain, with very steep slopes that alternate with extensive valleys. Its backbone is a mountain range that crosses it from North to South and divides the waters of the Alto Carrión from those of the River Pisuerga. The lowest points lie at around 1000 m and the highest peaks Espigüete (2450 m) and Curavacas (2520 m), the first being a limestone, the second a flinty environment. It has two different geomorphologic environments: Palaeozoic relief, which generally corresponds to the Cantabrian Mountain Range, and Tertiary-Mesozoic relief, which mainly gives rise to the scree deposits and talus cones that may be observed at some points. Furthermore, glacial lakes are abundant in the zone (Lobato, 1977; Alcalde, 1982).



Fig. 4.- Habitat and census plot for *Draba hispanica* subsp. *lebrunii* in the population of Peña Cueto-Pico Fraile-Peña Mayor.

Fig. 4.- Habitat et parcelle de recensement pour *Draba hispanica* subsp. *lebrunii* dans la population de Peña Cueto-Pico Fraile-Peña Mayor

Populations of *D. hispanica* subsp. *lebrunii* are located on a range of calcareous mountains (composed of “Caliza de Montaña” limestone and clayey limestone), specifically in the highest altitude band, between (1400-)1600 and 2000 m, of the peaks Peña del Fraile (2025 m), Peña Redonda (1993 m), Peña Cueto (1907 m), Peña Mayor (1866 m) and Alto de Miranda (1745 m), primarily on northern slopes, although here and there it has also been observed in areas exposed to the south. This mountain barrier represents a transition between the Mediterranean territories of the Castilian Plateau and the Atlantic zones of northern Spain; its vegetation thus has a marked sub-Mediterranean character.

It is a typical taxon from calcareous psychrophilic-xerophilic grasslands growing on chalky Cantabrian Mountain outcrops and lithosols, included in the *Plantagini discoloris-Thymion mastigophori* A. Molina & Izco 1989 alliance, and is typical of the *Festuco hystericis-Thymetum mastigophori drabetosum lebrunii* M.E. García, Penas, L. Herrero & T.E. Díaz 1992 subassociation (Fig. 4). It represents the highest altitude version of the association: upper supratemperate and orotemperate (altimontano and subalpine) levels of the western part of Orocantabric subprovince (Altocampurriano-Carrionés sector). Secondly, it appears in chionophilic grasslands of *Kobresio myosuroidis-Seslerietea caeruleae* Br.-Bl. 1948, being the principal plant characteristic of the syntaxon *Drabo*

lebrunii-Armerietum cantabricae M.E. García, Penas, L. Herrero & T.E. Díaz 1992 (*Armerion cantabricae* Rivas-Martínez, T.E. Díaz, F. Prieto, Loidi & Penas 1984 alliance). The grasslands in question are basophilic and chionophilic. They are situated on deep soils of the orotemperate stage of the hyperhumid ombroclimate in contact with the serial grasslands arising from the degradation of scrub of *Daphno cantabricae-Arctostaphyletum uvae-ursi* Rivas-Martínez, Izco & Costa 1971 (García González *et al.*, 1992).

Both vegetation types are included under code 6170 (Alpine and subalpine calcareous grasslands) in Annexe I of the Habitats Directive (Anonymous, 2007b) and, with codes 52.b.09.002 and 45.a.03.001 respectively, in the classification drawn up by Rivas-Martínez *et al.* (1994), for Spanish vegetation of the habitat types of this Habitats Directive.

From a taxonomic point of view, *Draba hispanica* subsp. *lebrunii* was described by P. Montserrat in 1977 and later reclassified to rank as a species by Láinz in 1988 (*D. lebrunii*). In 1991 Rivas-Martínez *et al.* completed a taxonomic study of the section *Aizopsis* DC. of the genus *Draba* L. and recognized the rank of species as best fitting this taxon. Subsequently, Blanca in 1993 conserved it as a sub-species.

II. MATERIALS AND METHODS

In order to re-evaluate the state of the population of the taxon in accordance with IUCN criteria, an exhaustive literature review was first completed, including consultation of the Database of Vascular Flora of Castille and Leon (various authors, 2007-2008), the Information System on Spanish Plants (Anthos, <http://www.anthos.es>) and the National Node for Biodiversity Information (GBIF-Es, <http://www.gbif.es>). In addition, a considerable amount of fieldwork was carried out during the course of several projects and agreements with the Regional Government of Castilla y León for the production of detailed vegetation maps covering the “Fuentes Carrionas y Fuente Cobre-Montaña Palentina” Natural Park (Junta de Castilla y León, 2002-2007), and data was also obtained during the production of a preliminary Ph.D. project by one of the members of the research team and other studies relating to this (García González, 1990; García González *et al.*, 1992; Rivas-Martínez *et al.*, 1991).

The aim was to locate, then to confirm or to reject, all indications in the bibliography and to find, if possible, further populations of the plant by exploring zones with favourable habitats and mark their position geographically by means of GPS technology, so as to establish all the points at which the plant is present. For collecting data in the field, the guidelines used were essentially those of the Methodology Manual of the AFA (Atlas de Flora Amenazada de España [Atlas of the Endangered Flora of Spain]) Project (Albert *et al.*, 2004), and what it terms a “basic study” of the plant was performed. It was intended to provide information that would allow evaluation of species, rounding out these data with the GPS marking mentioned above, since all the points where the plant is present were georeferenced. Use of the expressions “population” and “sub-population” in the sense they are given by AFA was considered appropriate.

In the first stage of analysis, intended to calculate the current population size of *D. hispanica* subsp. *lebrunii*, an indirect census was carried out, using estimates based on plots twenty-five square metres (25 m²) in area along several transects, because of the large number of specimens and the difficulty of detecting them (Fig. 5).

The number of plots established differed, depending on the estimated density of the taxon in each population: six in the smaller at Peña Redonda-Alto de Miranda, thirteen in



Fig. 5.- Details of the marking of specimens in a plot with small flags.

Fig. 5.- Détails de marquage des spécimens sur une parcelle par petits drapeaux.

the larger corresponding to the Peña Cueto-Pico Fraile-Peña Mayor mountain range. In each plot, all individuals were marked with a small flag, and the count differentiated between reproductive, vegetative and dead specimens. These latter were obviously not taken into account when calculating the population size.

In the fieldwork, GPS labelling was applied to the perimeter of the area occupied by each population nucleus. The *Arc-View GIS 3.3* software package was used to create a polygonal shape with this data. By taking into account both data on the number of individuals counted in the plots data and the occupied areas whose perimeters were marked, an estimate was obtained for the average density of the populations, together with the total number of specimens in each population and in the area where the taxon is found as a whole. The area of occupancy of the taxon was calculated by adding the geo-referenced areas. The extent of occurrence of the taxon was calculated using the implementation of the minimum convex polygon in *Arc GIS 9.2*. In this process we have used orthophotographs obtained from 2007 flight coverage by the Regional Government of Castile and Leon, at a resolution of 50 cm, with European Datum 1950 (E.D.50) geographic projection, Universal Transverse Mercator, zone 30, page 106 (quadrants 1-4, 2-4, 3-4 and 4-4) and page 132 (quadrants 1-1 and 2-1).

A second stage of analysis was intended to study the internal structure of the population. Phenophases (stages in the annual life cycle) were studied. In the absence of data on population dynamics, diagrams of the structure of the stages in the life cycle of plants gave valuable aid (García González, 2002). In this analysis it was decided to enumerate plants during their reproductive phase. Thus, a direct count was made in each plot of reproductive individuals, that is to say, those bearing flowers, fruits, or both flowers and fruits; and vegetative individuals, having only rosettes. While seedlings were not counted, owing to the impossibility of differentiating them, dead specimens were counted, because it was considered that the proportion of them in the population might yield information of interest. An estimate of the population structure for each population present in the whole area where the taxon is found was made on the basis of the data from the plots. Bar graphs were

used to represent the relative abundance of individuals from each established classes. This information permitted an estimate of whether these populations show invasive, normal or senile behaviour (García González, 2002) to be made, and it constitutes the first step for a later study of population dynamics of the taxon, essential for proposing management and conservation measures.

Sampling was carried out during the spring and early summer period of 2009, from 18 May to 11 June, as several field studies pointed to these dates as the most suitable for finding the population in its reproductive period. This information was rounded out with further sampling on 6 and 7 July.

In assigning conservation status, 2001 IUCN criteria were followed and to ensure the evaluation was as objective as possible, the RAMAS Red List program (Akçakaya & Ferson, 2007) was used. As it is an endemic plant exclusive to these territories, the taxon evaluation is presented as a global assessment.

To enumerate potential risk factors that could have a negative impact on the conservation status of the species, the risk coding employed by the European Commission on 2000 Natura Network forms (European Commission, 1997) was used.

Finally, now that the populations have been recognized, located and counted, a conservation measure is proposed for the area where the most extensive, best preserved and most representative populations are located, in the shape of a Micro-Reserve for Flora, a form of protection established by regional legislation for Castile and Leon (Anonymous, 2007a). This protects relatively small areas, not exceeding 200 ha, where a major population of one or more catalogued species of protected flora are located, so as to guarantee checks on their favourable conservation status.

Sheets with specimens from all the populations studied are on deposit in the LEB-Jaime Andrés Rodríguez Herbarium of the University of Leon in Spain. Their references and details are in Annexe.

III. RESULTS

A. Population size

Two populations were located, one, larger, to the west (Peña Mayor- Pico Fraile- Peña Cueto), the other to the east (Peña Redonda- Alto de Miranda). These results coincide to some extent with those recorded in Llamas *et al.* (2009). However, the exact concept of population used by those authors is not fully clear, since at some points they speak of two populations with nine population nuclei or locations, at others of nine populations split into two groups. The view taken here is that there are quite clearly two populations, separated by a distance of 7.67 km and mountain barriers that render exchanges of genetic material between them very difficult. There do not exist studies of type of pollination not of method of dispersal of seeds. By the morphology of the grain of pollen (García González, 1990) and the presence of nectarios, we suppose an entomophilous pollination. The small size of seeds suggests a dispersal that possibly combines zoochory, anemochory and hydrochory. More detailed studies would be necessary to confirm it. There are 75 nuclei with a greater density of individuals that were geo-referenced (zones with marked perimeters), which together correspond to the area of occupancy of the taxon. In earlier work (Llamas *et al.*, 2009) just nine of these 75 nuclei split between two populations were discovered, so that the study being reported here implies a noteworthy increase in knowledge of the exact locations of this endemic plant. The extent of occurrence of the taxon was calculated to be

Table I.- Plot data.
Tableau I.- Données des parcelles.

Parcel	Extension	Vegetative adults	Reproductive adults	Died	Total	Vegetative adults	Reproductive adults	Died	Alive-dead	Population
1	6 X 4	43	111	2	156	28	71	1	154	1
2	5 X 5	47	51	3	101	47	50	3	98	1
3	5 X 5	74	94	6	174	43	54	3	168	1
4	5 X 5	47	42	0	89	53	47	0	89	1
5	5 X 5	47	90	1	138	34	65	1	137	1
6	6 X 4	39	86	2	127	31	68	2	125	1
7	5 X 5	32	46	0	78	41	59	0	78	1
8	5 X 5	37	56	5	98	38	57	5	93	1
9	5 X 5	33	35	2	70	47	50	3	68	1
10	5 X 5	15	29	1	45	33	64	2	44	1
11	5 X 5	36	76	2	114	32	67	2	112	1
12	5 X 5	23	81	1	105	22	77	1	104	1
13	5 X 5	25	18	1	44	57	41	2	43	2
14	5 X 5	7	22	0	29	24	76	0	29	2
15	5 X 5	43	41	1	85	51	48	1	84	2
16	5 X 5	7	12	0	19	37	63	0	19	2
17	5 X 5	1	4	0	5	20	80	0	5	2
18	5 X 5	31	32	1	64	48	50	2	63	1
19	5 X 5	21	12	2	35	60	34	6	33	2
	TOTAL	608	938	30	1576				1546	
	DESvest	17.52	31.78	1.64						
	%	38.58	59.52	1.90						

40.66 km², and the area of occupancy, 2.763 ha. In direct counting in the field of the specimens in the 19 plots (Table I), a total of 1576 individuals was reached and an average density was noted of 102 individuals per plot in population 1 (Peña Mayor- Pico Fraile-Peña Cueto), 35 individuals per plot of population 2 (Peña Redonda- Alto de Miranda) and 81 individuals per plot if both populations are taken together. From this data and bearing in mind the total area occupied that was sampled, population sizes were estimated at 48886 individuals in population 1 and 22305 individuals in population 2 (Fig. 6 to 11). The average density per hectare would be 41015 individuals per hectare (ind/ha) in population 1, 14200 ind/ha in population 2 and 32547 ind/ha overall. An estimate for the total population size would be 71191 individuals if the total number estimated for each population separately is considered, and 89919 individuals if the estimate is based on the average value for both populations together (Table II). From this information a difference of more than 18000 individuals between the most optimistic and the most pessimistic estimate can be inferred. Application of standard deviation (DESvest) to the series of samples would yield a population size of between 88077 and 91760 individuals in the most optimistic esti-

Table II.- Population size.
Tableau II.- Taille de la population.

		Final estimates		
		Perimetred area (ha)	Average density (ind./ha)	Estimate individuals
Separately estimate	Population 1	1.1919	41015.38462	48886
	Population 2	1.5708	14200	22305
Whole estimate		2.7627	32547.36842	89919

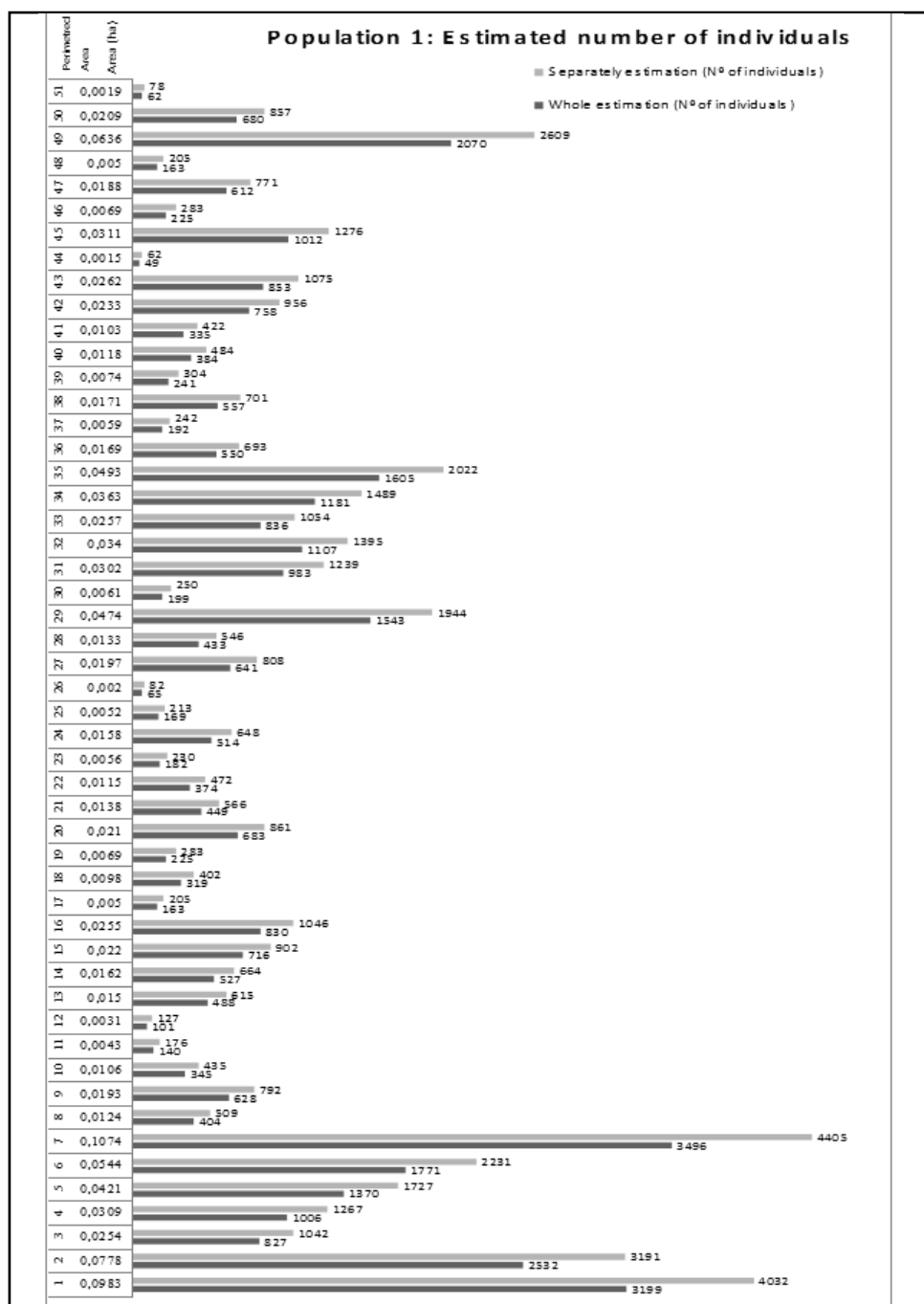


Fig. 6.- Population 1, estimated number of specimens.

Fig. 6.- Population 1, estimation du nombre de spécimens.

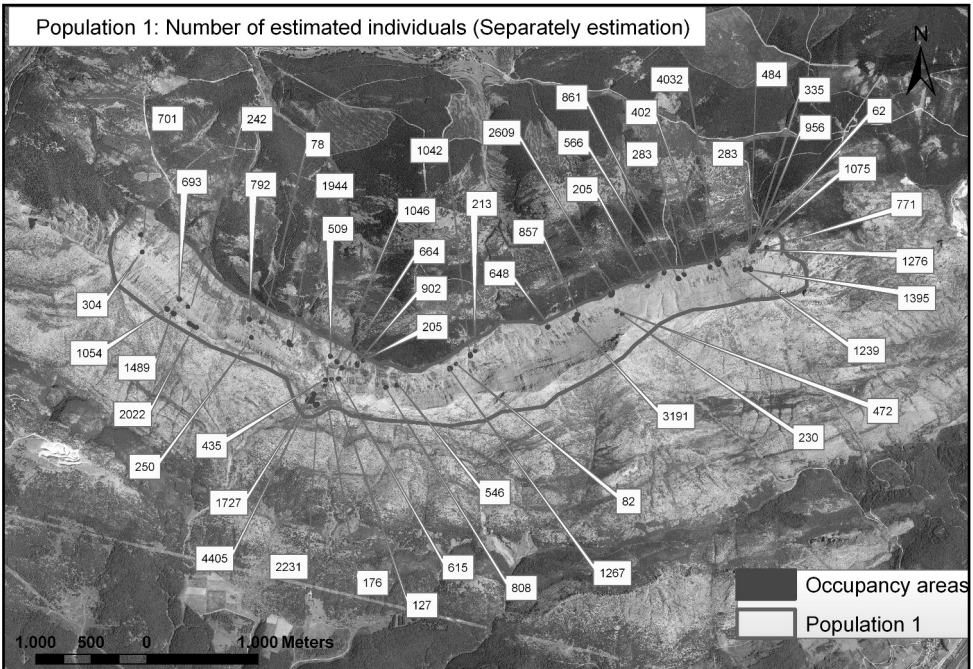


Fig. 7.- Map of population 1, separately estimation.
 Fig. 7.- Carte de la population 1, estimation différenciée.

mate (taking both populations together). The most pessimistic estimate (taking both populations separately), the population would be between 68984 and 73399 individuals.

These results differ from those presented by Llamas *et al.* (2009), whose direct census counted 3191 individuals, considerably fewer than the number being reported here. This may be the outcome of less exhaustive sampling of the area where the taxon is present, since it would appear that they investigated only nine of the 75 nuclei or locations sampled in the present work (for instance, the nuclei at Alto de Miranda, Arroyo de la Tijera and Peña Mayor II, which were taken into account in the study being reported here, but were not detected in the sampling done by Llamas *et al.*, as these authors themselves indicate). Naturally, owing to the previous considerations, there are also noteworthy increases in the extent of occurrence, calculated as 37 km² in the earlier sampling (Llamas *et al.*, 2009) but now expanded to 40.66 km². Also the area of occupancy is rather different, previously given as 0.17 km² (Llamas *et al.*, 2009), and now calculated as 2.763 ha (0.027 km²). On this point, it should be noted that these authors state that the area of occupancy is 0.17 km², but the sum of the areas occupied at the nine locations that they note amounts to 166 656 m², not 170 824 m², which suggests that there has been some sort of data-processing error, which should be clarified so as to avoid future misinterpretations.

B. Population structure

The population studied shows a normal balanced structure, where the majority of adult individuals are reproductive. Vegetative adults represented 38.58% of the total (Fig. 12 and

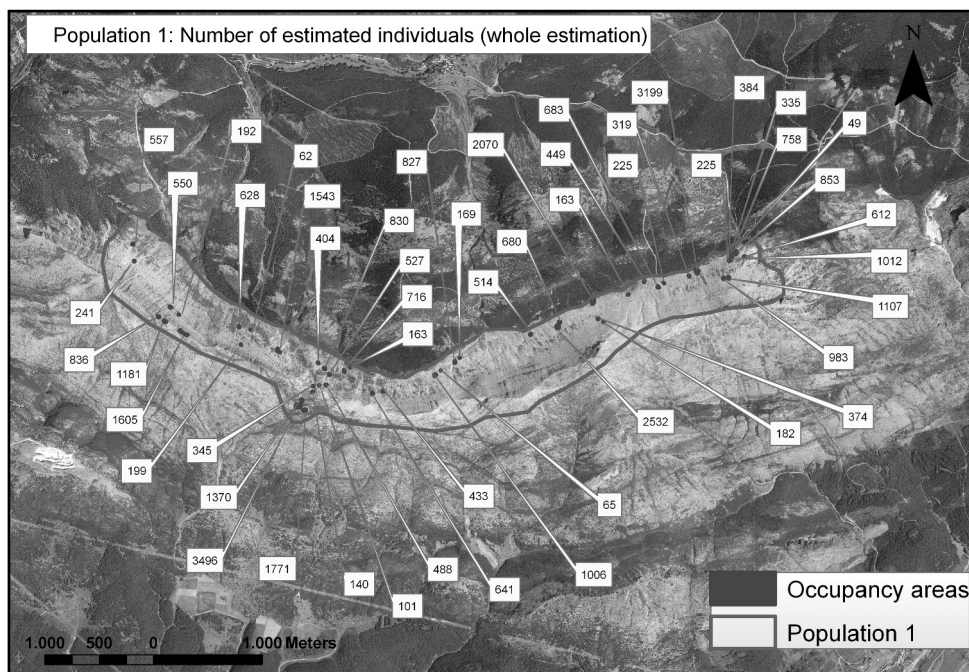


Fig. 8.- Map of population 1, whole estimation.
Fig. 8.- Carte de la population 1, estimation globale.

13). This is a long-standing population which remains in balance because of the environmental conditions of the area it occupies, a high mountain territory with thin soil and greater or lesser snow cover almost throughout the year. These conditions limit the growth of seedlings and the reproductive period of adult individuals to no more than two months at the end of the spring. Colonization by the population is slow.

IV. DISCUSSION AND CONCLUSIONS

A. Taxon evaluation: conservation status

On the basis of the studies undertaken and processing of all data using the RAMAS-Red List program (Akçakaya & Ferson, 2007), it is suggested the taxon should continue classified in the *vulnerable* category (VU D2):

- criterion D: a population that is very small (in terms of the number of mature individuals) or restricted (in terms of the area of occupancy);
- sub-criterion 2: area of occupancy less than 20 km² (actual figure 0.03 km²), subject to the effects of human activity or random events, liable to deteriorate into other more threatened categories in a short space of time. Sub-criterion 1 is not fulfilled because the number of mature individuals is greater than 1000 (actual figure between 70000 and 80000).

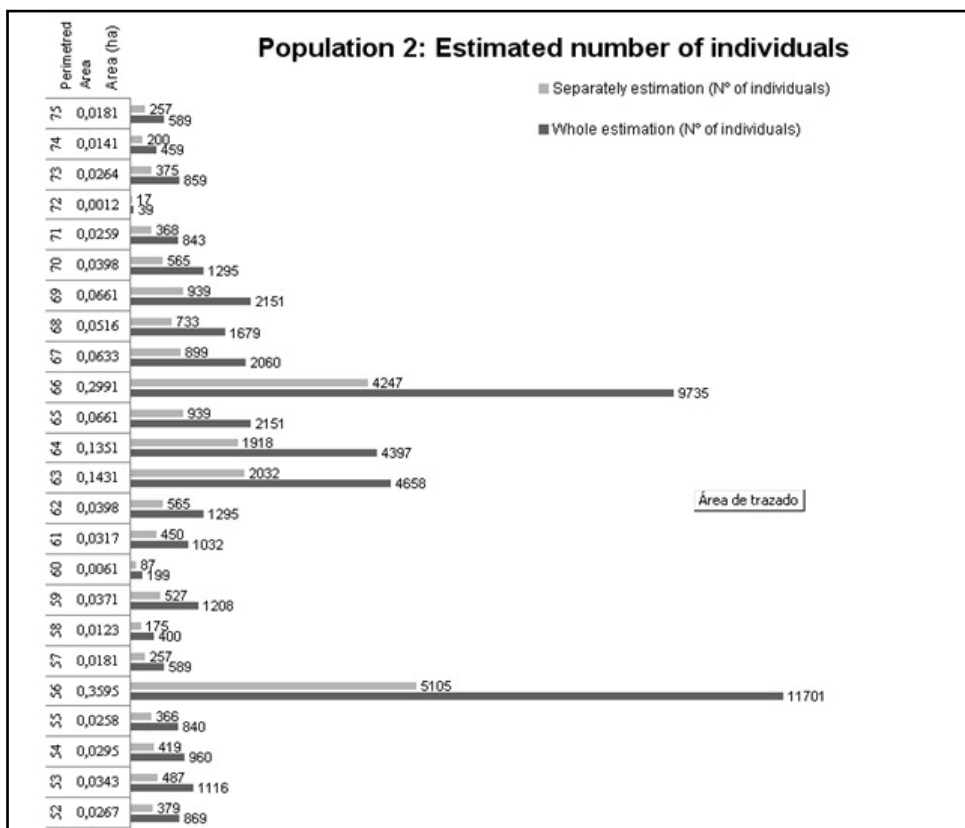


Fig. 9.- Population 2, estimated number of specimens.

Fig. 9.- Population 2, estimation du nombre de spécimens.

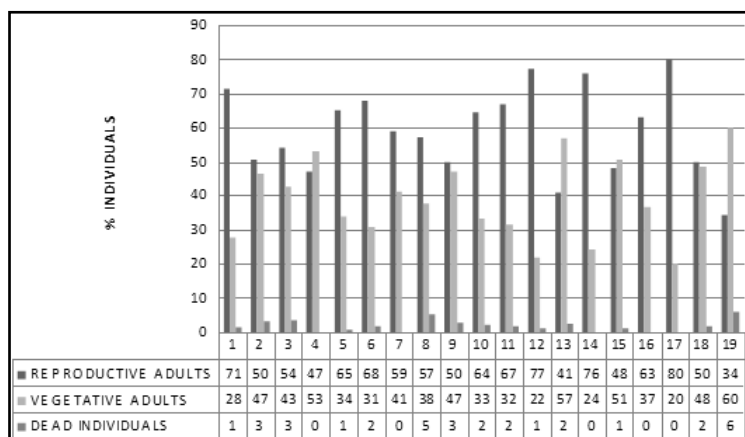


Fig. 12.- Population structure in the 19 plots sampled.

Fig. 12.- Structure de la population sur les 19 parcelles étudiées.

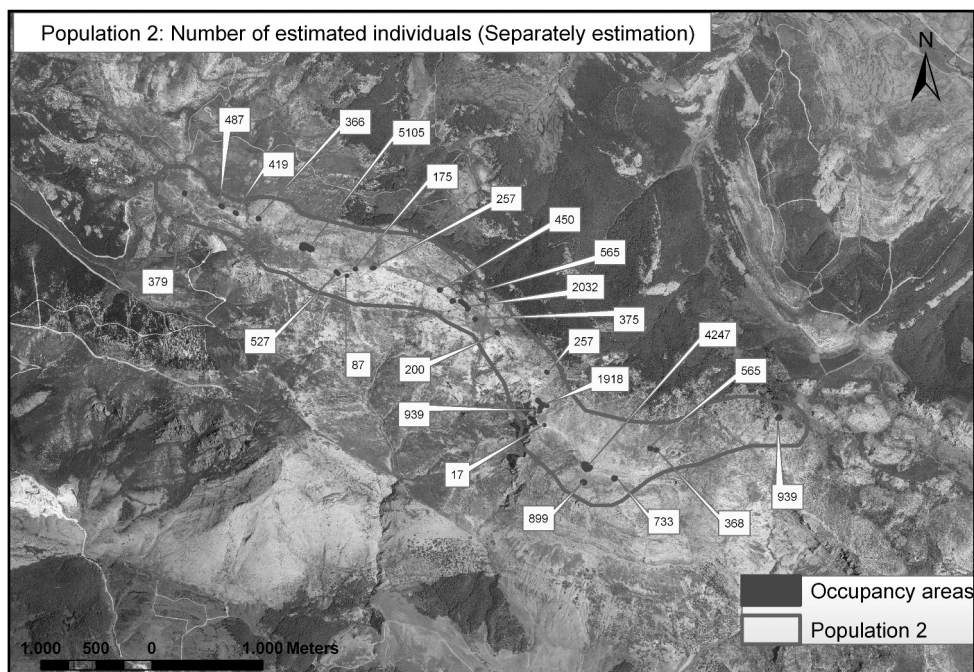


Fig. 10.- Map of population 2, separately estimation.

Fig. 10.- Carte de la population 2, estimation différenciée.

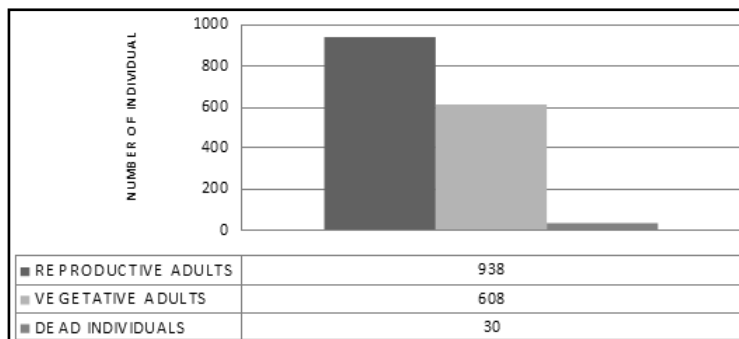


Fig. 13.- Population structure of *D. hispanica* subsp. *lebrunii*.

Fig. 13.- Structure de la population de *D. hispanica* subsp. *lebrunii*.

It does not seem that the taxon can retain its current category of *endangered* (EN), as indicated in 2008 Red List and the catalogue provided by Llamas *et al.* (2009). Although it initially appears to fulfil criteria B1 and B2 (limited geographical distribution by extent of occurrence and/or area of occupancy) for this category, since the extent of occurrence is under 5000 km² (actual figure 40.66 km²) and the area of occupancy is under 500 km² (actual figure 0.03 km²), it does not fulfil two of the subcriteria (a), (b) or (c). It fulfils only (a) because fewer than five locations are known (actual Fig. 2), but neither a continuing decrease, nor any extreme fluctuation in the population is observable. Criterion C1 cannot

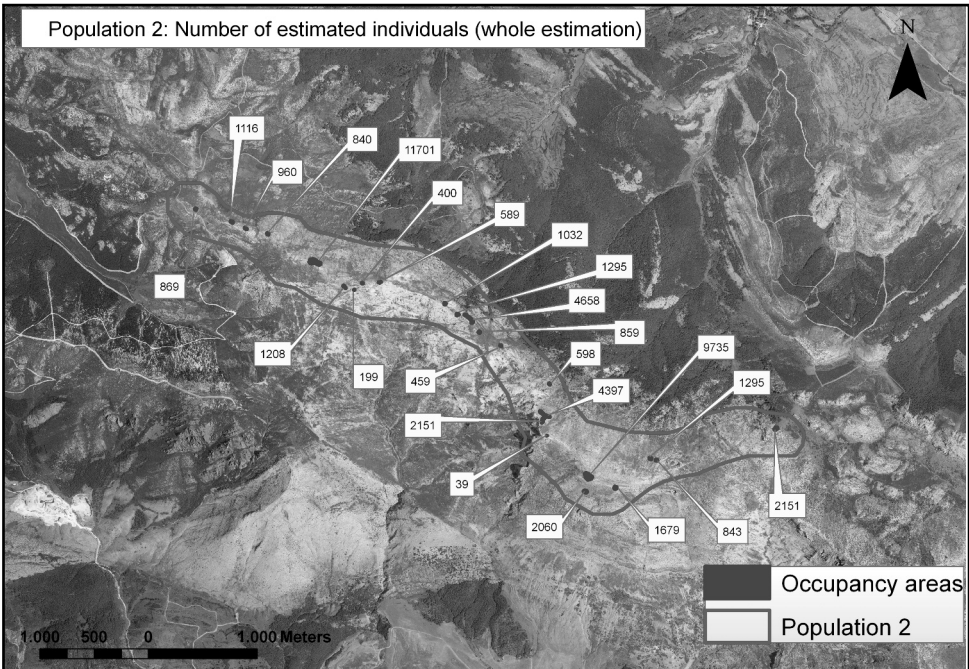


Fig. 11.- Map of population 2, whole estimation.
 Fig. 11.- Carte de la population 2, estimation globale.

be applied either, as the number of individuals exceeds 2500 (actual figure between 70000 and 80000) and no decrease in this total has been observed, nor are there signs of such a decrease.

The work on the size and population dynamics of this taxon that are presented here permit greater optimism with respect to its situation, as there is no clear evidence for reductions or oscillations in the recent past, the present and the foreseeable near future, whether in the area of occupancy, or the quality of habitat, or the number of mature specimens, such as to comply with either the spirit or the letter of the IUCN criteria for the highest-risk categories (*endangered* or *critically endangered*). It would appear to match best the category *vulnerable*: VU D2. This is because its area of occupancy is well under 20 km², which is in itself reckoned an appreciable risk factor for future viability, without it being necessary to include the taxon in any higher-level category of risk.

B. Risk factors

The actual and potential threat factors that might have a negative influence upon the conservation status of the taxon are listed below, according to the codification of threats used by the European Commission in the Natura 2000 Network forms (European Commission, 1997):

- 140. Pastoral farming; it is possible that greater pressure from livestock affected the taxon negatively some years ago; at present, farm animals are not very numerous in the zone and cattle never go up to the heights where the species grows; however, signs of

predation by wild animals were observed in the plant's habitat, specifically specimens that had been grazed, with stems but no inflorescences, specimens that had been trodden down and soil that had been turned over. To judge by the animal tracks and excrement found, it seems probable that the causes of this predation suffered by the plant are principally red deer *Cervus elaphus* L., a very abundant species in the zone as it is preserved for hunting, and chamois *Rupicapra pyrenaica* Bonaparte subsp. *parva* Cabrera, typical ungulates for middling to high mountains, abundant throughout the Cantabrian Mountain Range, although less frequent in Fuentes Carrionas.

- 160. General forest activity. Next to the area occupied by the plant, there has been reforestation with allochthonous species, principally *Pinus sylvestris* L. This species does not affect the taxon directly, but it could produce indirect effects arising from improvements in approach roads, the passage of machinery, new ploughing of the soil, and similar.

- 180. Burning. Reforestation with pines on hillside terraces around some of the populations involves a potential risk of fire. For instance, pines are to be found on the hillside opposite the area where the taxon is located in Peña Cueto. Fire could be a potential disturbance in the communities where the taxon lives, specially when the taxon is in chionophile grasslands of *Drabo lebrunii-Armerietum cantabricae*. However, there is no record of fires in recent years, whether deliberately started or naturally occurring.

- 331. Open-cast mines and quarries. Limestone is extracted near the area occupied by the plant (on the southern slopes of Peña Redonda) and this activity has the potential to affect it directly. Hence, no extension of this activity towards the habitat of the taxon should ever be permitted.

- 624. Mountaineering, rock climbing and pot-holing. Some of the peaks where this taxon grows are favourites with tourists and often visited by mountaineers, which could affect the plant. One example is Peña Redonda, where pilgrimages to the peak take place and people walk over areas where the endemic taxon lives. Observations made in the course of this work suggest that the population of *Draba* in this location is smaller than it otherwise might be, having been reduced by the negative influence these popular events have upon it.

- 720. Human intrusions and disturbance (see point 624).

- 948. Fire (natural). Around the area occupied by the plant, there are pine reforestations (see point 160) where the likelihood of fire (natural or deliberately lit) is high, which could affect the populations of the taxon studied.

All of these threat factors, other than 140 and 624, are only potential and have never been observed as posing any major risk of current changes. In any case, the greatest threats at present are human intrusions and disturbance and grazing by ungulates, especially deer. However, both these activities have taken place since immemorial times and would seem to be compatible with the survival and development of the taxon.

C. Proposed management measures

- Taking periodic censuses similar to the one presented in this paper, so as to carry out studies of population dynamics.

- Continuing intensive, systematic searches for other populations of the species in nearby territories presenting similar ecological conditions, so as to locate new populations. However, because of the type of habitat where the taxon grows, the surrounding landscape and number of visits required to locate plants, it does not seem probable that this can be undertaken.

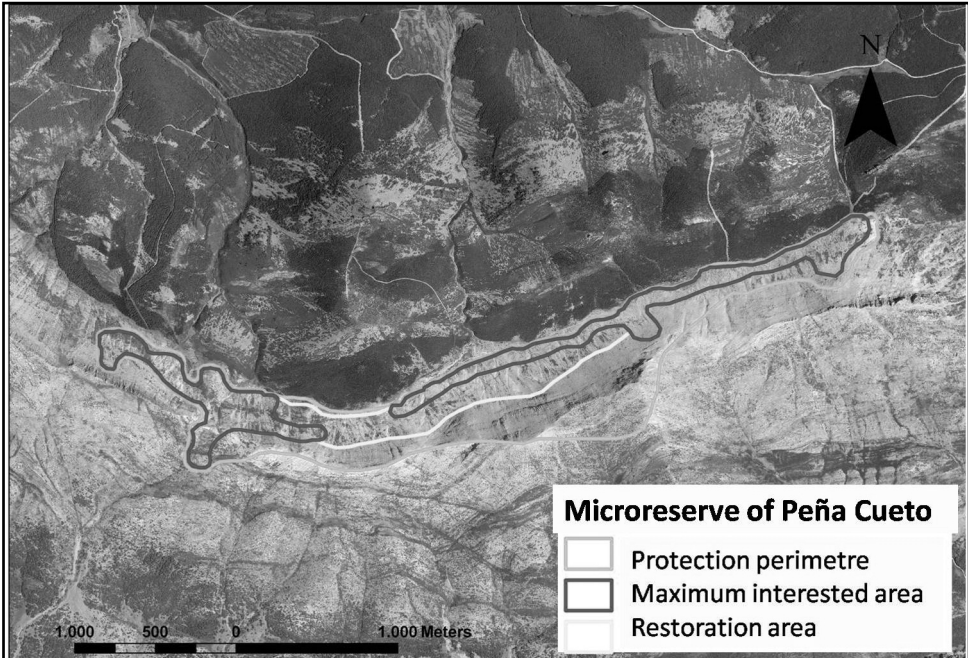


Fig. 14.- Micro-reserve of Peña Cueto.

Fig. 14.- Microréserve de Peña Cueto.

- In the unlikely event that there were to be any increase in pressure from pastoral farming in the zone, such as to affect the area where the plant develops or lead to the deliberate starting of fires in order to clear land for pasture, imposing controls on such actions.
- Checking effects of predation of grazing suffered by the plant.
- Prohibiting any act that implies the destruction or changing of plant cover. Among these would be ploughing, new reforestation, installing power cables and telephone wires, setting up ski runs, wind-farms or aerals, prospecting or mining, and the like.
- Collecting germplasm, with storage of genetic material and the development of germination and seed viability tests. In this domain, initial conservation measures are already under way. Seeds have been gathered and deposited in the LEB-Jaime Andrés Rodríguez Herbarium of the University of León and germination tests have been initiated, the first results from which are currently being obtained.
- Carrying out exhaustive studies related to the biology of the species that hitherto have not been undertaken, especially studies of its reproductive biology.
- Campaigns of training for technical staff who work in the zone and of awareness-raising for the general public.

D. Proposal for a micro-reserve

As envisaged by Decree 63/2007 (Anonymous, 2007a) of the Castile and Leon Regional Government, it is proposed that a micro-reserve should be created at Peña Cueto,

as the best measure for protecting the Iberian steno-endemic *Draba hispanica* subsp. *lebrunii*. Such a micro-reserve would be located in the “Fuentes Carrionas y Fuente Cobre-Montaña Palentina” Natural Park, in the North-West of the province of Palencia, within the Protected Natural Sites Network of Castile and Leon (Anonymous, 1991) (Fig. 14).

As regards biogeography, it belongs to Altocarrionés subsector, Orocantabric subprovince (Atlantic European province), of the Eurosiberian region, although with considerable Mediterranean influence. As regards bio-climatology it is of the upper supratemperate (altimontano) and orotemperate (subalpine) thermotype with submediterranean character and belongs to the humid-hyperhumid ombrotype. These mountains, with their strongly continental climate, although apparently denuded of vegetation, are in fact very rich as regards plant diversity.

The proposal is based on the presence of the most extensive and best preserved population of *Draba hispanica* subsp. *lebrunii*, as can be observed from the population study completed. It is also the most difficult zone to reach anywhere in the potential distribution area of the taxon, so in principle should suffer from fewer real threats. Other taxa of interest that co-exist with the plant in this area: *Armeria cantabrica* Boiss. & Reut. ex Willk. in Willk. & Lange, *Draba aizoides* L. subsp. *cantabriae* (Lainz) Lainz, *Saxifraga conifera* Coss. & Durieu, *Minuartia villarii* (Balb.) Wilczek & Chenevard, *Euphorbia pyrenaica* Jord. or *Botrychium lunaria* (L.) Swartz.

Acknowledgements - This work was carried out in part within the framework of a specific agreement for collaboration between the University of Leon and the Environmental Bureau [Consejería de Medio Ambiente] of the Castile and Leon Regional Government [Junta de Castilla y León]. This relates to the undertaking of scientific work linked to the implementation of Decree 63/2007 of the Castile and Leon Regional Government, of 14 June 2007, which established the Catalogue of Protected Flora for Castile and Leon and the protection format named a Micro-Reserve for Flora. Our thanks to María Dolores Alonso for the French abstract.

REFERENCES

- Akçakaya H.R. & S. Ferson, 2007.- *RAMAS Red List. Threatened Species Classifications under Uncertainty*. Version 3.0. Applied Biomathematics, New York.
- Albert M.J., Á. Bañares, M. de la Cruz, F. Domínguez, A. Escudero, J.M. Iriando, M.B. García, D. Guzmán, M. Marrero, J.C. Moreno, H. Sainz, F. Tapia & E. Torres, 2004.- Manual de metodología de trabajo corológico y demográfico. Versión 4.2. In: *Atlas y Libro Rojo de la Flora Vasculare Amenazada de España*. Á. Bañares et al. (eds.), Dirección General de Conservación de la Naturaleza, Madrid, 5-31.
- Alcalde G., 1982.- *La montaña palentina: Fuentes Carrionas*, IV. Artes Gráficas Merino, Palencia, 233 p.
- Anonymous, 1991.- Ley 8/1991, de 10 de mayo, de Espacios Naturales de la Comunidad de Castilla y León. *BOCYL (Boletín Oficial de Castilla y León, España)*, **101**, 1970-1980.
- Anonymous, 2000.- Ley 4/2000, de 27 de junio, de declaración del Parque Natural de Fuentes Carrionas y Fuente Cobre-Montaña Palentina (Palencia). *BOCYL (Boletín Oficial de Castilla y León, España)*, **129**, 8292-8293.
- Anonymous, 2004.- Decisión de la Comisión de 7 de diciembre de 2004 por la que se aprueba, de conformidad con la Directiva 92/43/CEE del Consejo, la lista de lugares de importancia comunitaria de la región biogeográfica atlántica. *DOUE-Es (Diario Oficial de la Unión Europea, España)*, **382**, 1-189.
- Anonymous, 2007a.- Decreto 63/2007, de 14 de junio, por el que se crean el Catálogo de Flora Protegida de Castilla y León y la figura de protección denominada Microrreserva de Flora. *BOCYL (Boletín Oficial de Castilla y León, España)*, **119**, 13197-13204.
- Anonymous, 2007b.- Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad. *BOE (Boletín Oficial del Estado, España)*, **299**, 51275-51327.
- Blanca G., 1993.- *Draba* L. In: *Flora Iberica*, **IV**. S. Castroviejo et al. (eds.), 203-220.
- Domínguez F. (ed.), 2000.- Lista Roja de la Flora Vasculare Española. *Conservación Vegetal*, Boletín de la Comisión de Flora del Comité Español de la UICN, **6** (número especial), 1-40.
- European Commission, 1997. Appendix E. Activities and Impacts Liable to Affect the Conservation Status of Sites. *Official J. Eur. Comm.* L 107/153 24.4.97.
- García González M.E., 1990.- *Flora y vegetación de la Sierra del Brezo y de la comarca de La Peña (Palencia)*. Servicio de Publicaciones de la Universidad de León, microficha **54**, 1, 666 p., 2, 622 p.
- García González M.B., 2002.- Inventario y seguimiento en poblaciones de especies amenazadas. In: *Biología de la conservación de plantas amenazadas*. A.

- Bañares (coord.), Ministerio de Medio Ambiente, Parques Nacionales, Serie Técnica, Madrid, 27-42.
- García González M.E., A. Penas & L. Herrero, 1992.- Sobre *Draba lebrunii* (P. Mons.) Lainz y su comportamiento fitosociológico. *Lazaroa*, **13**, 127-137.
- IUCN, 1994.- *Categories in the red lists of the IUCN, prepared by the Commission on Species Survival of the International Union for the Conservation of Nature and Natural Resources (IUCN, The World Conservation Union)*. Gland, Switzerland.
- IUCN, 2001.- *Categories and Criteria of the IUCN Red List*, version 3.1. Commission on Species Survival of the IUCN, Gland, Switzerland and Cambridge, United Kingdom. ii + 33 p.
- Lainz M., 1988.- Asientos para una flora occidental, 8. *Fontqueria*, **16**, 51.
- Llamas F., C. Acedo, R. Alonso, C. Lence, S. del Río & I.A. Felpete, 2003.- Flora palentina amenazada. *Acta Bot. Barcinon.*, **49**, 67-75.
- Llamas F., C. Acedo, C. Lence, R. Alonso, A. Molina & V. Castro, 2007.- Flora Cantábrica de interés en Castilla y León. *Naturalia Cantabrigiae*, **3**, 57-78.
- Llamas F., A. Alonso, H. Arráiz, A. Molina & C. Acedo, 2009.- Cartografía detallada y catalogación de *Draba hispanica* subsp. *lebrunii* P. Monts. *Lagascalía*, **29**, 89-103.
- Lobato L., 1977.- *Geología de los valles de los ríos Esla, Yuso, Carrión y Deva (NE de León, NO de Palencia, SO de Santander)*. Institución Fray Bernardino de Sahagún. Excm. Diputación Provincial de León. 192 p.
- Montserrat P., 1977.- Quelques aspects de géobotanique historique au nord de l'Espagne. *Doc. Phytosociol.*, NS, **1**, 175-181.
- Moreno J.C. (coord.), 2008.- *Lista Roja 2008 de la flora vascular española*. Dirección General de Medio Natural y Política Forestal (Ministerio de Medio Ambiente, y Medio Rural y Marino, y Sociedad Española de Biología de la Conservación de Plantas). Madrid, 86 p.
- Rivas-Martínez S., 2007.- Mapa de series, geoserias y geopermaseries de vegetación de España. *Itin. Geobot.*, **17**, 5-436.
- Rivas-Martínez S., A. Asensi, M. Costa, F. Fernández-González, L. Llorens, R. Masalles, J. Molero, A. Penas & P.L. Pérez de Paz, 1994.- El proyecto de cartografía e inventariación de los tipos de hábitats de la Directiva 92/43/CEE en España. *Coll. Phytosociol.*, **XXII**, 611-661.
- Rivas-Martínez S., M.E. García González & A. Penas, 1991.- Revisión taxonómica de la Sect. *Aizopsis* DC. del género *Draba* L. en la Península Ibérica. *Candollea*, **46** (2), 439-473.
- Various Authors, 2007-2008.- *Base de datos del catálogo de flora vascular silvestre de Castilla y León. Datos completos revisados y corregidos correspondientes al proyecto de cartografía detallada de hábitats 2002-2007*. Universidad de Salamanca, Universidad de Castilla-La Mancha, Universidad de León. Junta de Castilla y León. Línea, Estudios y Proyectos, S.L.

Annexe

Spain. Palencia: Pico Fraile, 30TUN5544, pastizal calizo, 10-VIII-1985, M.E. García, 32997 (LEB). Peña Cueto, 1700 m, pastizal calizo, 1-V-1987, M.E. García, 34780 (LEB). Peña Redonda, cumbre, 30TUN6845, pastizal calizo, 20-VII-1988, M.E. García, 38989 (LEB). Peña Cueto, base, 30TUN5546, pastizal calizo, 6-V-1988, M.E. García, 39900 (LEB). Alto de Miranda, 30TUN6547, pastizales basófilos, 9-VIII-1986, M.E. García, 41562 (LEB). Pico Fraile, 30TUN5544, pastizal calizo, 10-VIII-1985, M.E. García, 47162 (LEB). Peña Cueto-Pico Fraile, 30TUN533438, pastizales psicroxerófilos y fisuras en calizas, 20-V-2009, M.E. García, R. Alonso, E. Alfaro, R. García, S. Alonso & N. Ferreras, 101768 (LEB). Peña Cueto-Pico Fraile, 30TUN531434, pastizales psicroxerófilos y fisuras en calizas, 20-V-2009, M.E. García, R. Alonso, E. Alfaro, R. García, S. Alonso & N. Ferreras, 101769 (LEB). Peña Cueto-Pico Fraile, 30TUN513435, 1789 m, pastizales psicroxerófilos y fisuras en calizas, 20-V-2009, M.E. García, R. Alonso, E. Alfaro, R. García, S. Alonso & N. Ferreras, 101770 (LEB). Peña Cueto-Pico Fraile, 30TUN528440, 1802 m, pastizales psicroxerófilos y fisuras en calizas, lugares venteados, 20-V-2009, M.E. García, R. Alonso, E. Alfaro, R. García, S. Alonso & N. Ferreras, 101771 (LEB). Peña Cueto-Pico Fraile, 30TUN567447, 1693 m, pastizales psicroxerófilos y fisuras en calizas, 18-V-2009, M.E. García, R. Alonso, E. Alfaro, R. García, S. Alonso & N. Ferreras, 101772 (LEB). Peña Cueto-Pico Fraile, 30TUN570449, 1720 m, pastizales psicroxerófilos y fisuras en calizas, 18-V-2009, M.E. García, R. Alonso, E. Alfaro, R. García, S. Alonso & N. Ferreras, 101773 (LEB). Peña Cueto: Las Neveras, 1642 m, pastizales calcícolas, 2-V-2009, Llamas & Acedo, 101932 (LEB). Peña Cueto: Las Neveras, 1747 m, pastizales calcícolas, 9-V-2009, Llamas & Acedo, 101953 (LEB). Alto de Los Llanos, 1752 m, pastizales calcícolas, 14-V-2009, Llamas & Acedo, 101954 (LEB). Pico Rabanal, 1529 m, pastizales calcícolas, 14-V-2009, Llamas & Acedo, 101955 (LEB). Pico Fraile, 1732 m, pastizales calcícolas, 9-V-2009, Llamas, Alonso, Arraiz & Acedo, 101956 (LEB). Peña Blanca, 1704 m, pastizales calcícolas, 21-V-2009, Llamas, Alonso, Arraiz & Acedo, 101957 (LEB). Cueto de la Horca, 1678 m, pastizales calcícolas, 21-V-2009, Llamas, Alonso, Arraiz & Acedo, 101958 (LEB). Pico Fraile, 1719 m, pastizales calcícolas, 21-V-2009, Llamas, Alonso, Arraiz & Acedo, 101960 (LEB). Cumbre de Peña Redonda, 1995 m, pastizales calcícolas, 3-VI-2009, Llamas, Alonso, Arraiz & Acedo, 101961 (LEB). Base de Peña Redonda, 1470 m, pastizales calcícolas, 3-VI-2009, Llamas, Alonso, Arraiz & Acedo, 101962 (LEB).