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PLANT SPECIES PROTECTION IN SPAIN,
WITH ESPECIAL REFERENCE
TO THE SPANISH MEDITERRANEAN ISLANDS

SUMMARY

Ex situ and *in situ* methods of plant species protection in Spain are briefly indicated, with special reference to the Spanish Autonomous Regions with islands in the Western Mediterranean area. Some threatened species endemic to Western Mediterranean islands are indicated. Two examples of reintroductions are given: *Diplotaxis siettiana* Maire, successfully reintroduced in the Island of Alborán from seed stored in a gene bank, and the attempts to reintroduce *Lysimachia minoricensis* J.J. Rodr. in Minorca from plants growing in botanic gardens.

RIASSUNTO

Protezione delle specie vegetali in Spagna, con speciale riferimento alle isole mediterranee spagnole. In questo lavoro si riassumono i metodi *in situ* ed *ex situ* per la protezione delle specie vegetali in Spagna, con speciale riferimento alle Comunità Autonome spagnole che comprendono isole nell'area occidentale del Mediterraneo. Si illustrano alcune specie endemiche minacciate nelle isole del Mediterraneo occidentale. Si fa riferimento a due esempi di reintroduzione: *Diplotaxis siettiana* Maire, reintrodotta con successo nell'isola di Alborán attraverso semi conservati in una banca dei semi, e il tentativo di reintroduzione di *Lysimachia minoricensis* J.J. Rodr. a Minorca, attraverso piante provenienti da Orti Botanici.

INTRODUCTION

As result of the evolutionary processes that have taken place through the geological periods and for Angiosperms especially during the Tertiary and Quaternary, the Mediterranean Region is one of the more rich areas in plant diversity in the World. From extrapolation of the volumes so far published of

Med-Checklist (GREUTER *et al.*, 1984-1989; GREUTER & VON RAAB-STRAUBE, 2008), the Mediterranean Region holds about 25,000 taxa (species and subspecies) of which almost 63% are endemic (GREUTER, 1991).

In the Iberian Peninsula (Spain and Portugal) and the Balearic Islands the richness in vascular plants has been estimated in about 7,000 species (CASTROVIEJO, 2002; DEVESA & ORTEGA, 2004), about 8,300 taxa also including subspecies (BLANCO, 1988), of which 30% are endemics (DEVESA & ORTEGA, 2004). For Andalucía, a Region in Southern Spain that covers 15% of the total Spanish territory and that is by far the richest area in Spain, there are c. 4,000 taxa (species and subspecies; HERNÁNDEZ BERMEJO & CLEMENTE, 1994) of which c. 12% are strictly Andalusian endemics and another c. 12% are Iberian or Ibero-Mauritanian endemics (463 and 466, respectively, according BLANCA *et al.*, 1999: 23).

This high number of species make up the components of our forests, scrubs and herbaceous formations, of which therophytic communities are especially rich as far as the number of taxa is concern.

But these plant formations are threatened in many ways due to an abusive profit of the natural resources. Forests have been cut down for centuries for agricultural and domestic uses, which has often resulted in enormous erosion and loss of soils. There has been an overexploitation of water resources. The industrial development has produced a high level of atmospheric, soil and water pollution.

Some of the factors which affect the natural populations are overgrazing, fire, overexploitation of wild plants (commercial bulb and aromatic plant collection, etc.), exploitation of rocks and minerals, urban expansion, tourism, etc. And small isolated populations are much affected by endogamy and ageing. The Mediterranean coast of the Iberian Peninsula and many areas of the Balearic Islands are particularly threatened by tourism development. Most of the natural areas have been substituted there by buildings, hotels, golf courses, etc. Cities are particularly aggressive to Nature, as all inputs and outputs generate environmental alterations in one way or another, as schematised in Fig. 1.

So, Nature is seriously threatened in many ways, and we have the duty to protect it in order to transfer to the new generations the richness we have inherited.

Nature protection can be effected by both *in situ* and *ex situ* conservation.

IN SITU CONSERVATION

In situ conservation has two different aspects: area protection and species protection.

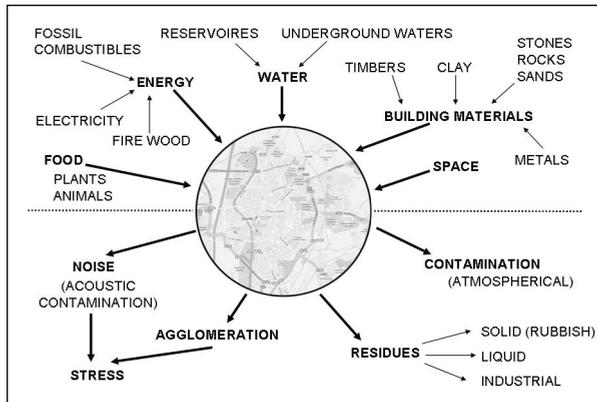


Fig. 1 — What a city needs (upper half) and produces (lower half) negatively affect Nature and Mankind (stress).

Protection of areas is the most efficient way to protect floristic richness because the complete ecosystems are protected, including plants and animals, of which in the Mediterranean Region insects are an important pollination vector for entomogamous species, and birds and mammals important vectors for endocorial and exocorial dispersal.

Protected areas in Spain range from National Parks (GÓMEZ-CAMPO, 1997), which are 14 in the Country (nine in peninsular Spain, one in the Balearic Islands, four in the Canary Islands), to the small Microreserves which have been established by law in the Valencia Autonomous Community (ANONYMOUS, 1994b).

National Parks (Fig. 2) cover several hundred ha each, while Microreserves often cover only a few hundred square meters. Other figures of protected areas are Natural Parks, Natural Reserves, Natural Monuments and Protected Landscapes (DEVESA & ORTEGA, 2004). Most National Parks were established to protect animals, as is the case, for instance, of Doñana and the Tablas de Daimiel Parks, or even to protect hunting, as, for instance the National Parks of Montaña de Convadonga and Ordesa y Monte Perdido. But plants are equally protected in them. However, the Sierra Nevada and the four Canarian National Parks were declared to protect plants and the landscape.

There are protected areas all around the country, under the control of each Autonomous Community. In Andalusia, by instance, 19% of the territory is protected, with 144 protected areas, including two National Parks, 32 Natural Spots, 28 Natural Reserves, three Concerted Natural Reserves, 19 Periurban Parks, one Protected landscape and 35 Natural Monuments



Fig. 2 — Spanish National Parks.

(CABEZUDO *et al.*, 2005). Surface covered by these protected areas varies from 5 ha (concerted Natural Reserve “Cañada de los Pájaros” near Sevilla) to 209,418 ha (Natural Park of Cazorla-Segura-Las Villas) (RENPA, 2001).

Species protection is the second *in situ* effective way to protect diversity. For Peninsular Spain and the Balearic Islands the *Atlas y Libro Rojo de la Flora Vasculare Amenazada de España* (BAÑARES *et al.*, 2003, *Atlas* in the text) lists 20 extinct, 157 critically endangered and 95 endangered *taxa* (species and subspecies), which are protected at the national level. Each Spanish Autonomous Region, of which there are 17 in the country, has its own Red Book and a series of species protected by law. I will only refer to the two Peninsular Communities which include in their territory Western Mediterranean Islands, and to the Balearic Community whose territory covers the Balearic Islands.

In Andalusia, with almost 500 endemic plant species, the Red Book (BLANCA *et al.*, 1999, 2000) includes the 182 species protected by law since 1994 (ANONYMOUS, 1994a, 2003). Three of them are endemic to the Island of Alborán, a small island at the mid-way between the coasts of Andalusia and Morocco of only *c.* 7 ha. These are *Senecio alboranicus* Sennen and *Anacychus alboranensis* Esteve & Varo, both considered as critically endangered in the *Atlas* and in *the Red Book of the Andalusian Flora*, and *Diplotaxis siettiana* Maire, considered as extinct in both red books.

In the Valencia Community there are 64 *taxa* protected by law since 1985 (ANONYMOUS, 1996). One of them, *Medicago citrina* (Font Quer) Greuter, has one of the only two known populations on the Columbretes Islands, a group of small volcanic islands near the coast of the province of Castellón. Another species: *Reseda hookeri* Guss. (considered by VALDÉS BERMEJO (1993) in *Flora Ibérica* as subspecies of *R. alba*), has one of the two Spanish populations in the Columbretes. It is not protected by the law of 1985 (ANONYMOUS, 1985), but it is considered as endangered in the *Atlas* and was included as vulnerable in a proposal for the legal protection of Vascular Plants in Valencia Community by LAGUNA *et al.* (1998).

The Balearic Islands have 163 endemic *taxa* of which 42 are protected by law from 1984 (ANONYMOUS, 1984), as well as all *Tamarix* and Orchidaceae species. Amongst them, *Euphorbia fontquerana* Greuter, with a few dozen plants in a single locality (Massanella, N Mallorca), *Euphorbia margalidiana* Kuhbier & Lewj. with about 200 plants in a very small island, almost a rock (Els Margalides, North of Ibiza) and *Genista dorychnifolia* Font Quer, with only two populations, both in the island of Menorca, are considered critically endangered in the *Atlas*. Other endangered species are not protected yet, such as *Limonium barceloi* L. Gil & L. Llorens, which is really a hybrid between *L. gibertii* Sennen and *L. boirae* L. Llorens & Tébar, with a single population near Palma de Mallorca with only some dozen plants, and *Hippocrepis grosii* (Pau) Boira, L. Gil and L. Llorens, of which only two populations in NE Ibiza are known, one of them with only 25 specimens. The *Atlas* lists them as critically endangered and endangered, respectively.

EX SITU CONSERVATION

Ex situ conservation can be effected either by growing the plants in botanic gardens or by storing the seeds and other propagules in seed banks.

In Spain, there are two botanic gardens especially devoted to *ex situ* conservation: the Botanic Garden of Cordoba (Andalusia, Southern Spain) and the Botanic Garden of Soller (Northern Mallorca), the latter founded in 1985 for the specific purpose of growing and protecting Mediterranean plants.

It is worth adding that in Andalusia the Consejería de Medio Ambiente has established and maintains a network of botanic gardens for conservation (ANONYMOUS, 2001). It is formed by 11 botanic gardens each established in one of the different biogeographical sectors that according to RIVAS MARTÍNEZ (1982) can be recognized in Andalusia. Eight of them are already operative and three are still being built (VALDÉS, 2006). Their main aims are (ANONYMOUS, 2002): to develop basic and applied research on wild plants,

vegetation, ethnobotany and traditional crops; to recover, preserve and manage the Andalusian protected plant species and endemics; to preserve plant genetic diversity. These gardens develop a series of open-door activities covering: programmes on conservation, research on and the recovery programmes of endangered plant species; educational programmes at all levels, and programmes on the spreading of plant sciences. There is a responsible for the garden, usually a biologist, and one or more guardians with a good knowledge on the local flora, especially on the local endangered plants.

Ex situ conservation can also be done in a gene bank, of which the most important in Spain is the Gene Bank of the School of Agronomic Engineering of the Polytechnic University of Madrid. It was founded in 1966 by an initiative of the late Prof. Cesar Gómez Campo (MARTÍNEZ-LABORDE & ORTIZ, 2009) and it now holds over 10,000 accessions that represent over 3,500 species, most of them from the wild and native to the Mediterranean Region.

REINTRODUCTION OF SPECIES

To illustrate how important *ex situ* conservation can be, there are two examples of insular species extinct in Nature but that are maintained in gene banks or botanic gardens from where reintroduction may be attempted.

One is *Diplotaxis siettiana* Maire. It was described in 1933 (MAIRE, 1933) and it is endemic of the Island of Alborán. It was very common in 1972 in the areas W of the light house. But in 1974 only 15 specimens were recorded. And in 1985 it was already extinct probably as a consequence of the introduction of pigs and rabbits and the watering of the helicopter's landing area with sea water. However, Prof. César Gómez Campo had collected seeds in 1971 for Madrid's gene bank. From seeds produced by plants grown from the preserved seeds it has been possible to reintroduce this species between 1995 and 2000, and so it is again growing on this island (NEVADO *et al.*, 2006; PARACUELLOS *et al.*, 2007).

The second example is *Lysimachia minoricensis* J.J. Rodr. It was described by Rodríguez Femenias in 1879 from the valley of Se Vall, N Menorca (RODRÍGUEZ, 1879). In 1926 it was observed there by A. BOLÒS, O. BOLÒS & P. MONTSERRAT. But sometime between 1926 and 1950 it became extinct in Nature, as no more plants have been seen in wild. Maybe its extinction was due to the fact that the irrigation system used to water the crop fields in the valley was abandoned and the appropriate humid spots decreased, and besides, shrubby vegetation invaded the former agricultural areas.

However, seeds were collected in 1926 and the plant was grown in the Botanic Garden of the Botanical Institute of Barcelona. Seeds were sent in

exchange to other botanic gardens, and this species, extinct in Nature is still growing in several of those gardens. Experts of the Botanical Garden of Soller tried to reintroduce this species from seeds in 1993 unsuccessfully in three localities: Sa Vall, Trebaluger and Algentar. Only some plants grew for a short while in Algentar, but they did not establish and reproduced. Reintroduction was again tried in 1996 with plants grown in the Garden (FRAGA ARGUINBAU, 2000).

To summarize, species conservation can be successfully effected both *in situ* and *ex situ*, and this can guarantee the protection of the rich species diversity, and even to try to reintroduce one species at its original area if it has become extinct.

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