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1 HOW IS BIODIVERSITY CHANGING IN SPAIN?

Revealing the values underlying biodiversity conservation in Spain

KEY FINDINGS

- **Biodiversity is an essential component of ecosystems and is therefore key to the wellbeing of Spanish society due to its ability to generate services. Among the components of biodiversity, the functional diversity associated with microorganisms, vegetation and invertebrates is the most important because it contributes most to the provision of ecosystem services in Spain.**
- **The goal of biodiversity conservation from the perspective of intrinsic values has led to political, social and scientific attention being focused on particular taxonomic groups, especially on large vertebrates, hence, ignoring those taxa (microorganisms, fungi, vegetation and invertebrates) that are responsible for providing most ecosystem services and agro-biodiversity (genetic diversity associated with human uses).**
- **Spain failed to achieve the goal of reducing the rate of biodiversity erosion for 2010, despite the significantly improvement of conservation policies in response to increased social awareness of the problem. In fact, the rate of biodiversity losses in Spain in the last 50 years have been similar to those found at a global or European scale.**
- **Spain has a great responsibility to preserve ecosystem services in a European context, as it is the largest reservoir of wild species in Western Europe.**

How we perceive biodiversity determines how we conserve it. In Spain, the conservation debate has mainly been guided by the intrinsic value of biodiversity, that is, the human moral obligation to preserve nature because of the right of non-human species to exist. Intrinsic value indicates that biodiversity has value in itself and is valued as an end in itself, independent of its usefulness. This motivation for conserving biodiversity usually obscures its instrumental value, which assumes that biodiversity is valuable only as a means or tool for achieving human welfare and wellbeing. Instrumental value lies not in the object itself but in its current uses or potential uses. This dichotomy of biodiversity values constitutes the core of modern environmentalism in western cultures. However, the conservation debate in Spain is moving away from biocentric ethics, which refer to the promotion of conservation on the basis of the idea that all living beings possess intrinsic value, to anthropocentric arguments, which indicate that biodiversity conservation should be supported as a tool for improving human quality of life through the delivery of ecosystem services.

In this debate, the main issue is whether the two approaches for biodiversity conservation are complementary (Martín-López and García-Llorente 2013). Here, if we consider that our relationship with nature is innate to human evolutionary history, then we should conclude that all humans have an innate need to connect with nature from both dimensions, that is, utilitarian and ethical. In fact, the Millennium Ecosystem Assessment (MA 2005) acknowledges that people can make decisions concerning biodiversity based on their own wellbeing and that of others as well as based on ethical concerns related to species, thus recognizing both instrumental and intrinsic values.

Therefore, biocentric and anthropocentric arguments should coexist in strategies aimed at biodiversity conservation. However, biodiversity conservation policies in Spain have mostly been guided by biocentric arguments that, ultimately, depend upon certain factors promoting human affection towards species. If intrinsic values have been responsible for most Spanish biodiversity conservation policies, have these conservation policies been biased towards those species that evoke positive feelings in humans?

Recent scientific research has demonstrated that specific likeability factors, such as particular physical traits (e.g., body size or eye size) as well as whether a species is phylogenetically closed to humans, play an important role in defining species conservation policies in Spain (Martín-López et al. 2011). In fact, during the years 2003-2007, 89% of total species conservation funds were invested in vertebrates, particularly in birds and

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mammals, which received 79.6% of the total budget. As a consequence, the majority of species (i.e., invertebrates, vegetation, fungi and microorganisms) that are critical for maintaining ecosystem services are underrepresented in priority-setting schemes for conservation.

STATUS AND TRENDS OF BIODIVERSITY IN SPAIN

Systematic national assessments of threatened species have only been carried out for a few taxonomic groups, such as vertebrates and vegetation, in recent years, and the proportion of species evaluated in each taxonomic group differs greatly from their representation in Spanish specific diversity. Vertebrates are the taxonomic group in which the highest proportion of species has been assessed based on the criteria of the Red Lists. Assuming that it is impossible to assess extinction risks for all taxa, the Spanish Ministry of Agriculture, Food and the Environment has recently expanded its assessments of endangered status to more taxonomic groups, such as bryophytes.

Despite the fact that vertebrates are the taxonomic group receiving the most political and scientific attention, their extinction rates in Spain are slightly higher than global trends. While the proportion of vertebrates threatened at a global scale in 2010 was approximately 20% (Hoffmann et al. 2010), in Spain, 23.6% of vertebrate species are categorized as critically endangered, endangered or vulnerable based on national assessments (Figure 1.1). Most of these threatened terrestrial vertebrates occur in Mediterranean forests and mountain ecosystems or agroecosystems (see Box 1.1).

The Red List status of species provides a snapshot of what is happening to the assessed taxa at a given time, but it cannot provide information about trends. However, the Red List Index can be used to compare the proportion of species in different categories over time. Calculation of the Red List Index for vertebrates shows an increase in the proportion of threatened species since 1986 (Figure 1.2).

While much less is known about other taxonomic groups as well as marine organisms, on the basis of the National Catalogue of Threatened Species and the National Red List Assessment, we found that of the species assessed in Spain, between 40% and 68% are threatened, respectively.

José Luis Benito

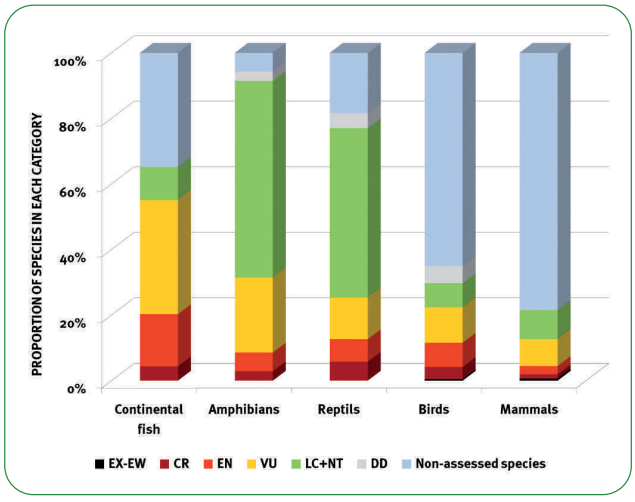

Figure 1.1 Proportion of endangered vertebrates in Spain according to national assessments. (EX: extinct; EW: extinct in the wild; CR: critically endangered; EN: endangered; VU: vulnerable; LC: least concern; NT: near threatened; DD: data deficient). (Sources: Doadrio et al. 2001, Martí and del Moral, 2003, Pleguezuelos et al. 2004, Palomo et al. 2007).

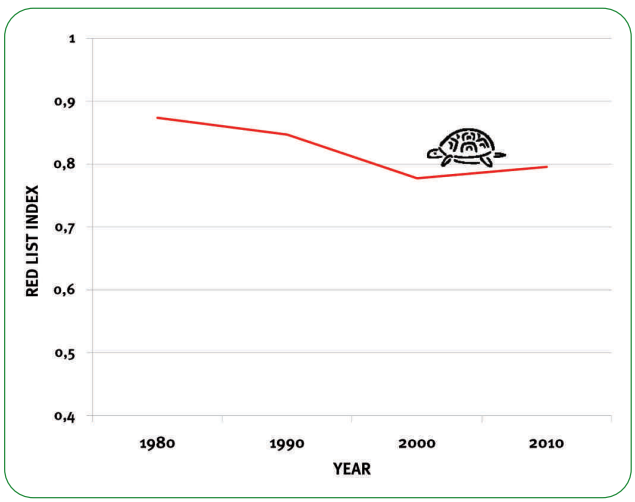

Figure 1.2 Trend of the Red List Index for Spanish vertebrates (N=233). (Data Sources: 1.Blanco and González (1992) 2. Bubb et al. (2009) 3.Doadrio I (2001) 4.ICONA (1986) 5. Martí R, Moral JC (2003) 6. Morales J, Lizana M (2011) 7.Palomo JL, (2007) 8.Pleguezuelos JM, Márquez R (2004).

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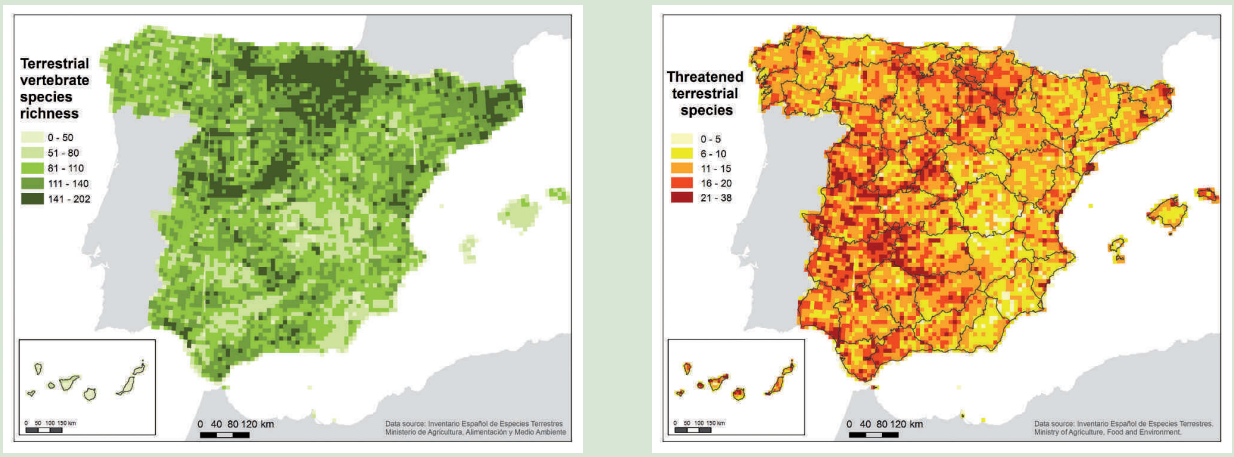
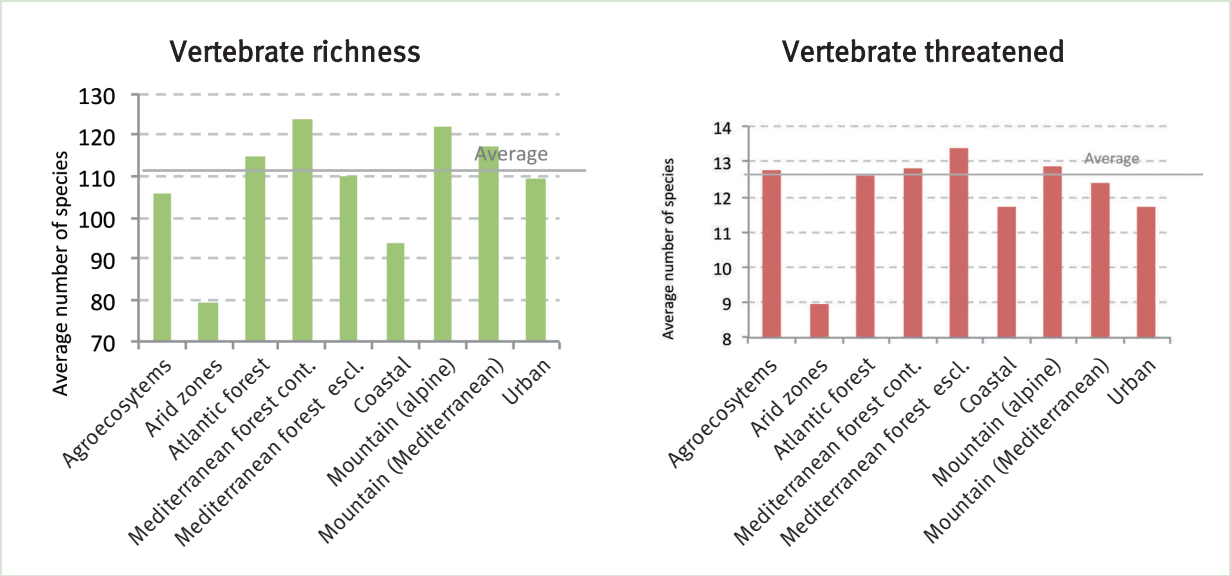
Box 1.1. Spatial distribution of terrestial Spanish biodiversity

Based on data from the National Inventory of Biodiversity **(Ministry of Agriculture, Food and Environment, 2007)**, the spatial distribution of biodiversity by taxonomic groups is presented. This distribution shows the species richness and the number of threatened species of terrestrial vertebrates in each grid of 5 km x 5 km covering the Iberian Peninsula and the Balearic and Canary Islands.



Spatial distribution of terrestrial vertebrates in Spain. (Source: Spanish inventory of terrestrial species. Ministry of Agriculture, Food and Environment, 2007).

There is a positive association between the above two maps, indicating that in areas where there are many species of vertebrates, there are also many endangered vertebrate species. These results highlight the fact that there is a clear bias in the spatial biodiversity data because there are some areas in which there have been a greater efforts to study biodiversity than others. This spatial pattern shows that forest and mountain ecosystems exhibit the greatest species richness and number of threatened species of vertebrates. In contrast, coastal and arid ecosystems display the lowest levels of vertebrate richness and threatened species.



The figure was developed through an GIS-analysis that based on an overlay of the map with ecosystem types with the map of species occurring calculated the average richness and number of threatened species occurring in each ecosystem.

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In addition, the **genetic diversity of domesticated animal species has suffered considerable erosion.** According to the UN Food and Agriculture Organization's Global Databank for Spain, of the approximately 215 autochthonous animal breeds for which sufficient data are available, **48% are considered at risk, and a further 8% have become extinct** (Figure 1.3). Most of this deterioration of genetic diversity has occurred because of the intensification of farmland systems, in addition to the abandonment of traditional farming practices. In fact, we found that land-use change is the most important direct driver of change affecting the state of biodiversity in Spain. Thus, in line with global assessments (MA, 2005; Pereira et al. 2012), **the driver of land-use change has a much greater effect than the impacts of the other four drivers of change (i.e., pollution, over-exploitation, invasive alien species, or climate change)** (Figure 1.4).

In addition, it is well-known that in Mediterranean ecosystems, intermediate conditions of disturbance (i.e., multifunctional landscapes) are related to high levels of species diversity (García-Llorente et al. 2012). However, the multi-functionality of Mediterranean agro-silvo-pastoral systems is declining due to landscape homogenization as a result of landscape intensification, rural abandonment, and strict conservation policies, which, in turn, can result in decreases in biodiversity and ecosystem services (Box 2.1) (García-Llorente et al. 2012). **Consequently, biodiversity management policies should stimulate the revitalization of traditional rural practices and value the role of local communities as 'sculptors' of landscapes that promote high levels of species diversity, maintenance of genetic diversity, and the preservation of a diverse set of ecosystem services.**

RELATIONSHIPS BETWEEN BIODIVERSITY AND ECOSYSTEM SERVICES

This loss of specific and genetic diversity is inextricably linked to the deterioration of ecosystem services because of the important functional role that biodiversity plays in the processes that underpin ecosystem services. A review of the evidence of links between biodiversity and the delivery of ecosystem services shows that the **functional role of microorganisms, fungi, vegetation and invertebrates is the main component of biodiversity that influences the delivery of ecosystem services** (Table 1.1). However, this is the component of biodiversity receiving the least social, scientific and political attention (Martín-López et al. 2011). Consequently, **there is a need to improve Spanish monitoring, scientific, and conservation programs to incorporate the components of biodiversity with a high capability to supply ecosystem services.**

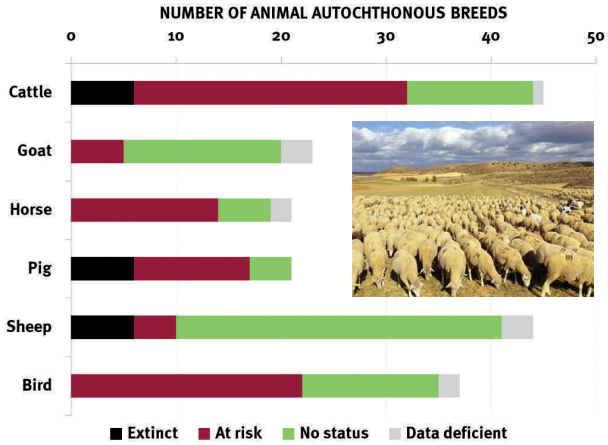

Figure 1.3 Proportion of threatened autochthonous animal breeds in Spain according to the UN Food and Agriculture Organization's Global Databank (www.dad.fao.org/).

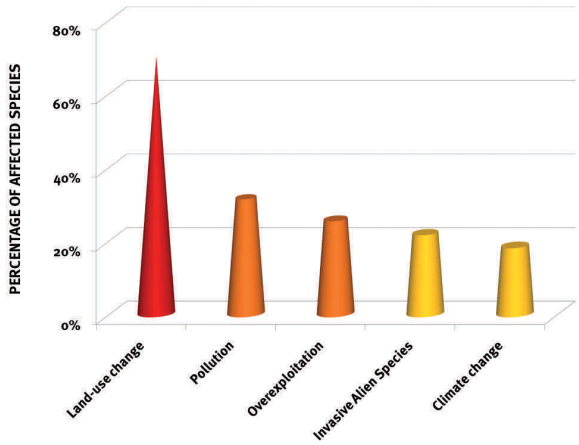

Figure 1.4. Proportion of species in Spain affected by the direct drivers of change.

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Table 1.1 Links between the delivery of ecosystem services and biodiversity, considering both the organizational level of biodiversity and the main taxonomic groups involved. Modified from Martín-López and García-Llorente (2013).

Ecosystem services	Organizational level at which biodiversity is involved	Main taxonomic groups involved
Provisioning		
Food	Genes, species populations, communities	Mainly vegetation (plant crops, wild fruits, etc.), fish, birds, mammals. In specific cases, fungi, invertebrates, and other vertebrates
Medicine	Genes, species populations	Microorganisms, fungi, vegetation, and animals
Regulating		
Micro-climate regulation	Communities, functional groups	Vegetation
Air purification	Species populations, functional groups	Microorganisms, vegetation
Water depuration	Communities, functional groups	Microorganisms, vegetation, and aquatic invertebrates
Hydrological regulation, erosion control and flood mitigation	Species populations, communities, functional groups	Vegetation
Soil fertility	Communities, functional groups	Soil microorganisms, nitrogen-fixing plants, soil invertebrates, and waste products of animals
Pollination	Species populations, functional groups	Insects, birds and mammals
Cultural		
Recreation activities and nature tourism	Species populations, communities.	Vegetation, fish, birds, mammals.

DEPICTING THE FUTURE OF BIODIVERSITY CONSERVATION IN SPAIN

Justifying conservation exclusively based on ethical considerations about the right of species to exist (i.e., intrinsic value) ignores an important motivation for preserving species: the importance of biodiversity as a source of human wellbeing through the delivery of ecosystem services (i.e., instrumental value). Consequently, **the two approaches should co-exist in Spanish policies aimed at biodiversity conservation.**

Despite the large body of evidence indicating strong links between biodiversity and ecosystem services, the taxonomic bias in the available scientific information prevents us from assessing the specific role of the different components of biodiversity in the delivery of ecosystem services. Therefore, **there is a need to extend the research objectives of scientific programs to less-studied taxonomic groups as well as to emphasize the functional role of biodiversity (i.e., functional diversity).** In addition, conservation programs should focus on preventing the continued effects of drivers of change, particularly those related to land-use change. **Thus, conservation programs should be embedded within landscape management policies to preserve multifunctional Mediterranean landscapes that promote not only high levels of biodiversity but also a diverse flow of ecosystem services.**

Biodiversity Fundation