SPANISH STRATEGY FOR THE CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY

MINISTERIO DE MEDIO AMBIENTE

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DIRECCIÓN GENERAL DE CONSERVACIÓN DE LA NATURALEZA

INTRODUCTION

Biological diversity or biodiversity, taken to mean the variety and variability of wild and domestic living organisms along with the ecosystems they are part of (*), has become a predominant concept in conservation due to its all-embracing scope. The concept of biodiversity has arisen from the need to view nature as a whole and to sustain the total sum of its components if the world we are building in it is to be maintained. Two largely conflicting needs arise from this biodiversity: its conservation and its use, which are overlapped by a third concept, sustainability, as the only possible way out of the paradox.

If human society is to develop, it needs to exploit natural systems, extract their resources and use them. This has always happened, however the present rate is so high that it is threatening the very existence of these resources, and in general the elements that make up the natural world. These biological resources are indispensable for humankind, not only because they supply food, medicine and industrial products, but also because they increasingly provide environmental, cultural, social and scientific types of benefits. Thus, nature conservation is not only an ethical obligation but it has also become a necessity for survival.

Society is now aware of this situation, and since the start of the 1970s has begun to tackle the problem and acquire a range of legal tools to halt the deterioration by means of a conservation policy for the most seriously endangered components of our natural heritage. The high point of this concept was reached with the ratification of a series of agreements with broad governmental backing, which in turn influenced the passage of conservation legislation in most countries. Although there was some success during this initial stage, the contradiction between conservation and development was ever present, generally resulting in the victory of the latter.

A new concept is considered to have begun in the 1980s with the design of the World Conservation Strategy, which proposed the concept of sustained development. The Strategy stresses the need for development based on resource exploitation within limits that permit their regeneration and the absorption of their impact by the ecosystems. The term biodiversity was coined later, and nature ceased to be regarded as a set of isolated components. The institutional response to this new concept was the Convention on Biological Diversity signed at the United Nations Rio de Janeiro Conference on the Environment and Development in 1992.

The aim of the Convention is the knowledge and conservation of biodiversity as a whole, i.e. the variety of genetic, species and community life forms, and the preservation of the ecological processes. In addition to the specific conservation measures to be taken, the rational use of biological resources is proposed as a basic tool, understanding by this that such use by present generations should not diminish their potential usage by our heirs in the future. This implies the acceptance that the conservation of the world's biological diversity is the common responsibility of humanity, and necessarily involves the adoption of the concept of shared responsibility and the precautionary principle in resource usage as basic criteria.

The contradiction between exploitation and conservation is thus resolved conceptually, but sustainable usage would be just another empty term with no real repercussions if it was not put into practice, impregnating every effect of society on nature. For this reason, the agreement itself establishes the need and the obligation for the signatory parties to draft national strategies, plans

(*) The Convention on Biological Diversity defines it as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.'

and programmes in relation to the objectives, and to include conservation and sustainable usage of biodiversity in their sector and cross-sector plans, and programmes and policies.

Spain shares and pursues these objectives, having ratified the Convention on 21 December 1993, thus joining the group of nations that have viewed it as a stimulus to the inclusion of the principle of biodiversity conservation in their industrial policies. For this purpose, and as a response to this obligation, the Spanish Environment Ministry agreed to co-ordinate the development of the present Strategy. This process aims to involve the broadest possible number of interest groups which, given the importance of the objective, should encompass the whole of society. As a result, a series of sector round table discussions involving national, regional and local governments, scientists and research centres, environmentalist NGO's and social agents have provided a vast amount of ideas and information that has led to the production of this Strategy.

The Strategy establishes a general framework for the national policy on the conservation and sustainable usage of biological diversity, it diagnoses the state of Spain's biodiversity, and it identifies the processes and industries that are causing its deterioration. Finally, it sets out both the guidelines for future sector plans and specific programmes aimed at ensuring compliance with the proposed goal, as well as some of the steps that should be taken immediately by the national, regional and local governments as well as society as a whole. In accordance with the new approach defined by the Convention, the fundamental points for its application are defined by this Strategy as the adoption of measures in relation to in-situ and ex-situ conservation, and the equitable distribution of the benefits generated by the use of these resources.

The utility of this Strategy thus depends on the degree of influence it has on the range of social contexts, not only on the development of the different sectors of the economy, but also on education, research, leisure and culture, and in general the necessary changes in attitudes to nature that spanish society must adopt.

The Spanish Strategy should not be regarded as just another document produced as a result of just another conservation agreement. The Convention on Biological Diversity provides several novelties to the long list of international conventions. Its all-embracing approach to the concept of conservation sets it above the rest of the agreements currently in force. This Strategy must thus not only respond to the commitments made by Spain in its ratification of the Convention on Biological Diversity, but also to those deriving from other conventions, international agreements and European Union Regulations, as well as those deriving from the text itself, drafted as a document by the greatest possible degree of consensus after the corresponding national debate. This document should therefore contain the guidelines for future changes to Act 4/1989 on the conservation of natural areas and wild flora and fauna, for the purpose of describing the mechanisms for drafting and applying new public policies on biodiversity. Only by this means will it become a true Spanish Strategy and not just another document. Nevertheless, it is important to note that the entire sector has undergone profound changes since 1989 in its development (explosion of biotechnology), its overall concepts (the very concept of biodiversity was popularised at a later date), its experience within the European Union (Directive 92/43/CEE on the conservation of natural habitats and wild fauna and flora, and the Habitats Directive, its lynchpin, date back to 1992), and in the experience acquired by regional and local governments.

Finally, the Spanish Strategy must be regarded as the logical bridge between the one being drafted by the European Union for the whole of Europe and those which should ideally be produced by regional governments in their role as the authorities responsible for the application of the measures and actions on the ground. It should strive to be consistent with the former and

provide a framework for the latter. The Community Strategy (Appendix XIX) has a similar framework to the Spanish approach, basing the application of measures to the design of sector plans that contemplate the effects of such sectors on biodiversity, as well as applying solutions that such effects may require. Appendix XIV contains the text of the European Commission Communiqué which constitutes the Community Strategy.

1 BASIC OBJECTIVES

The aim of this Strategy is the conservation and sustainable use of biological diversity, which can only be achieved if a series of essential objectives are fulfilled, and which inspire the entire Strategy in general:

1. Active co-operation between all parties involved, including public institutions, social and economic groups to achieve a commitment by the whole society to the conservation of the country's biological diversity through its rational and hence sustainable use.

2. To include the principles of restoration, conservation and sustainable use of biological diversity in the planning and execution of sector and cross-sector policies.

3. To create the mechanisms required to plan for natural resource management and conservation in the medium and long term.

4.To stimulate research, awareness-raising and training in issues related to biological diversity.

5. To stimulate education, knowledge dissemination and information aimed at raising public awareness and citizen involvement in the conservation and sustainable use of biological diversity.

6. To articulate the necessary legal and financial instruments, whether it be through the adaptation of those already in force or the design of others.

7. To stimulate active international co-operation in this field through bilateral and multilateral programmes, as well as active participation in all initiatives that arise amongst these countries aimed at improving the conservation of natural heritage.

GUIDING PRINCIPLES 2

The basic objectives of this Strategy are to be achieved by actions which in turn are framed by a set of guiding principles.

PARTICIPATION AND CO-ORDINATION

1. The actions must be based on the principle of subsidiarity, shared responsibility by each and every party, which means the involvement of all social and economic sectors of the nation.

2. National, regional and local governments have a clear responsibility in this issue within the scope of their respective responsibilities. The achievement of the objectives must be based on their active participation, supplemented by the co-operation and participation of all social sectors.

3. In the application of the above, the Spanish regional governments are recognised as playing the main role in achieving the objectives of this Strategy and the development of the tasks pursuing this end, on the basis of both their responsibilities in conservation and sustainable use of biological diversity and the territorial scope of the future Sector Plans.

4. Non-governmental organisations must be accepted as fundamental participants in the drafting and execution of all conservation-aimed policies.

5. Action taken both within governments and between them and public groups must be co-ordinated. The encouragement of the existing co-ordinating instruments is indispensable, along with the creation of others considered necessary.

PREVENTION AND PLANNING

6. The avoidance of environmental degradation wherever possible must be considered to be a primary strategy for action. This involves the creation of the mechanisms necessary to anticipate the conflicts acting to the detriment of biodiversity.

7. Prevention means long-term thinking, and is based on a dynamic diagnosis of the state of nature conservation and the prediction of the responses by the environment to the changing action, which should be verified by the appropriate type of monitoring.

8. The guidelines for natural resource planning must be channelled by the recommendations arising from monitoring the conservation pulse, and be put into practice via natural resource planning as well as other planning instruments.

9. Territorial planning and environmental impact evaluation included in the planning process are considered to be instruments that can guarantee the inclusion of sustainability as objectives in the early stages of the decision-making process.

10. An efficient biodiversity conservation policy requires integrated planning in co-ordination with the different territorial and sector plans which in every case must embrace all ecological, social and economic aspects that encourage rural development.

CONSERVATION

11. In order to avoid the significant reduction or loss of biological diversity, the root causes of such loss must be tackled. Nevertheless, the correction of disturbances in the natural environment and the recovery of the degraded components are a co-substantial part of this action.

12. Corrective action on disturbances to biological diversity that may be required should be based on the 'polluter pays' principle.

13. The lack of unequivocal scientific proof should not be used as a justification to delay the necessary measures when there is a threat of substantial reduction or loss of biological div-

ersity. It should also be a stimulus to undertake further research, systematisation and dissemination of new knowledge.

14. The basic priority is to conserve biological diversity in its natural environment or in the environment where domestic breeds have developed their specific properties. The importance of adopting ex-situ conservation measures must also be considered, especially if they are part of in-situ recovery strategies.

15. A primordial part of Spanish biological diversity conservation is an adequate, coherent and representative system of protected areas with special attention paid to the encouragement of biological interconnectivity. Particular attention must be paid to agrobiodiversity, defined as domestic genetic resources, both within and outside protected areas.

16. Biological diversity conservation and sustainable usage action plans and programmes on Spanish soil should also be regarded as action taken on an international scale, in particular with countries in our immediate geographic and political environment. International co-operation based on this Strategy should be encouraged for the purpose of promoting common conservation action, particularly with nearby developing countries and helping to define Spanish foreign policy on biodiversity conservation on a global scale.

SUSTAINABLE USE

17. It is essential to encourage participation by local populations and socio-economic agents working in rural areas, to encourage the maintenance of environment-friendly traditional uses and to recover and encourage the traditional knowledge and techniques in rural communities with positive repercussions on biodiversity conservation.

18. Local communities should have a share in the benefits from the use of natural resources that they help to conserve, and for whose historic development and achievement they have been directly responsible thanks to their time-honoured management patterns.

19. The use of a certain biological resource should not reduce its potential long-term usage. Such use should also be compatible with the maintenance of the ecosystems the resource is part of, and should not diminish the viability of associated resources.

20. Our responsibility as large-scale consumers of biological resources from foreign countries makes it necessary to orient co-operation towards the conservation and sustainable use of these resources at their source, as well as reduce or gradually eliminate the unsustainable aspects of our consumption patterns.

TRAINING AND RESEARCH

21. A well-informed, educated society that is sensitised to participation is a vital requirement if the objectives of this Strategy are to be achieved, and thus must become a priority issue. Environmental education should focus on every area of society.

22. Research into biodiversity should be a priority, involving a multidisciplinary approach that embraces the evaluation of policies, plans and programmes. The conservation of biological diversity requires the encouragement of knowledge and research in all areas: genetics, population, living organisms, habitats and ecosystems. Inventories must therefore be drafted to facilitate the updating of information on the state of biological diversity, to evaluate the losses already suffered by its components and to stipulate the required level of species richness to be achieved through restoration.

23. There is a high priority need for a biodiversity information mechanism that includes the data generated by scientific research, natural history collections, gene pools and all activities,

deposits, archives and data bases that make up the current state of knowledge about Spanish biological diversity.

REGULATION AND ECONOMIC ASPECTS

24. It is necessary to develop or update legislation in accordance with the importance of the problems posed by the conservation and sustainable usage of biological diversity, particularly with a view to enforcing compliance with its dictates, using all the stimulatory and coercive measures deemed necessary.

25. It is essential to consider the total value of the components of Spain's biodiversity, stressing, in addition to the values already recognised due to their productive or recreational use, those which are not tacitly recognised due to their lack of market value, but which nevertheless provide a basic service to society (options, existence, ecological and cultural values).

26. The costs that may be entailed in the conservation of biological diversity and the transformations required to achieve a type of resource management based on sustainability should be accepted by society as a whole and distributed proportionally to the responsibility of each party.

27. The benefits arising from the use of biological resources should be distributed evenly and transparently amongst all of the agents involved.

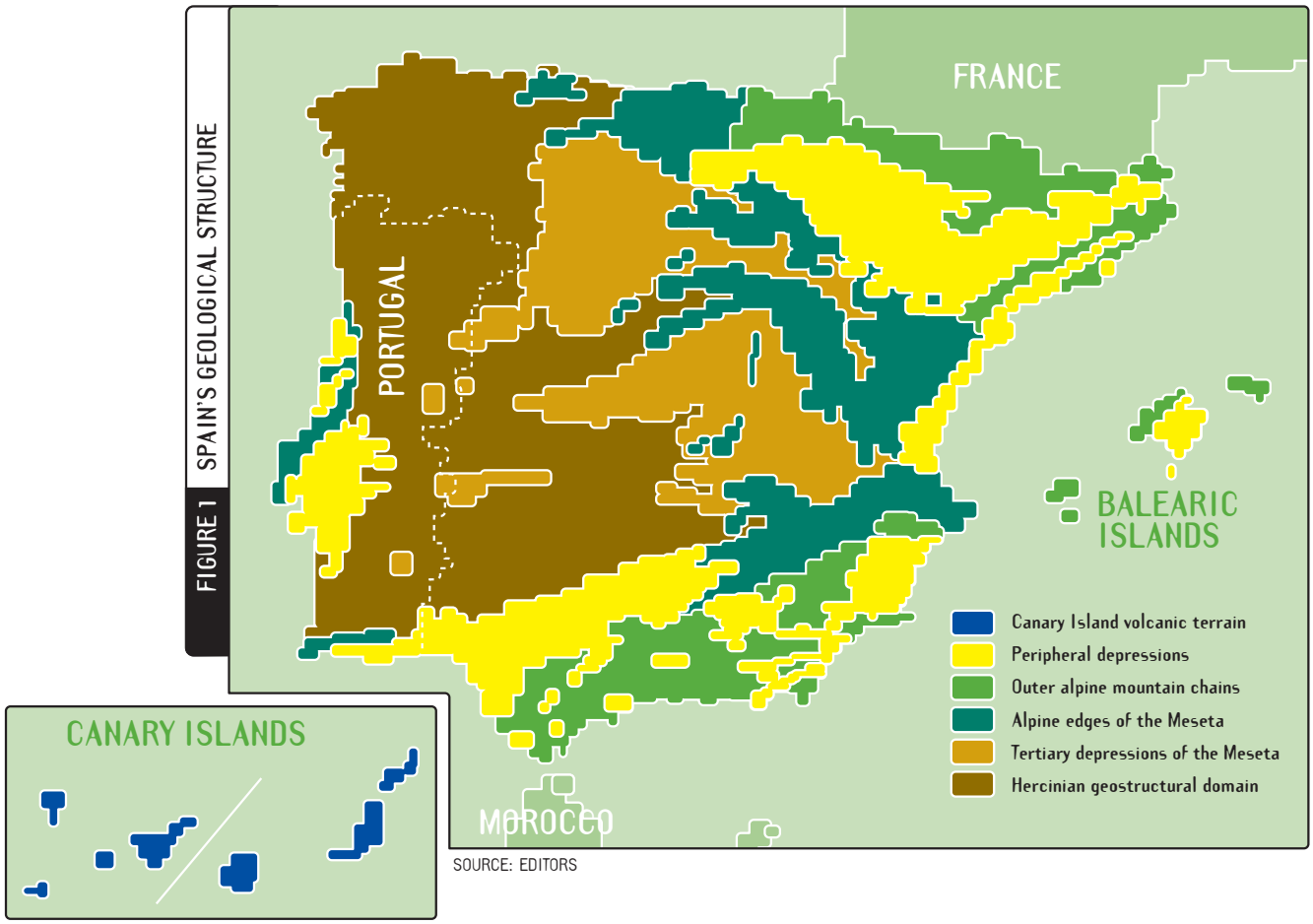
PART ONE
BREAKDOWN OF CURRENT SITUATION

1 THE PHYSICAL ENVIRONMENT

GENERAL FEATURES OF SPANISH GEOMORPHOLOGY 1.1

Spain covers more than half a million square kilometres, which include several units containing quite distinct geological histories: Peninsular Spain, the Balearic Islands, the Canary Islands, and the North African enclaves of Ceuta and Melilla (Fig. 1).

FIGURE 1 SPAIN'S GEOLOGICAL STRUCTURE



SOURCE: EDITORS

Perhaps the most important feature of peninsular Spain is its relief, with large mountain chains mainly running east-west, and its average altitude, more than 600 metres above sea level. In combination, these features make Spain the second most mountainous country in Europe, one of the key environmental characteristics.

The physical structure of the Peninsula is relatively complex. The Castilian Meseta, a great plateau covering more than 210,000 km^2, dominates the central region. This Meseta is dissected in a northeast-southwest direction by the Sistema Central, a mountain range rising 1,000-2,300 metres above the plateau, which divides it into a northern sub-meseta averaging 800-850 metres in height, and the slightly lower southern sub-meseta (500-700 metres), including the highest points. The sub-mesetas are linked north-east of the Sistema Central at an altitude of 1,000-1,200 metres in the Hespérica Meseta, which covers the Soria and Guadalajara moorlands.

The southern sub-meseta consists of the upper and middle Tagus River depressions and La Mancha, along with the two middle Guadiana River basins, separated by the Cíjara gap. A group of hilly alignments generically called the Montes de Toledo runs in an east-west direction between the Tagus and Guadiana River basins. The Meseta and the two mountain ranges it encompasses together account for more than one third of the total Iberian Peninsula area.

This morphological core is surrounded by an inner ring of ranges which are low in the south-east, rising gently in the Sierra Morena to 1,3000 metres. The Sistema Ibérico cuts off the Meseta to the north-east and, like the Sierra Morena, gradually relinquishes its mountainous relief to the vast plateau areas. A central subsidence linked to the Jalón-Jiloca River system divides the Sistema Ibérico into a north-east branch twisting towards the Ebro River basin, and another inland-facing branch. The north-eastern half features the Demanda-Moncayo alignment which rises above 2,300 metres.

The highest peaks in the northern mountain wall enclosing the Meseta are in the Picos de Europa (above 2,600 metres). The eastern continuation, the Cantabrian Range (1,700 metres) forms a link with the Pyrenees, and should be regarded as a different geomorphological unit. Finally, the north Portuguese mountain zone encloses the western flank of the northern sub-meseta.

All of these ranges surrounding the Meseta form the interior periphery, while beyond them, there are a series of landscape features. The generally low Montes Galaicos, rising to a maximum of 1,200 metres, cover the north-western extreme with broad plains and numerous interspersed depressions. The Guadalquivir depression (lower Andalusia) runs south from the Sierra Morena to the sea, while the Ebro depression (lower Aragon) lies east of the Sistema Ibérico, cut off from the Mediterranean by the Catalonian-Coastal Range. Parallel to these two depressions are the highest, outermost limbs of the Iberian relief, the Pyrenees and the Bétic Ranges, both of which reach 3,400 metres. The latter formation stretches from the Gibraltar Straits to Cape La Nao, and continues underwater until it rises from the Mediterranean in the form of the Balearic Islands.

The Canary Islands are a recent volcanic archipelago which formed the islands in chronological succession from east to west. The steep insular slopes include Spain's highest peak- Teide, and includes the malpaís scrubland as the most common type of relief. Spain also includes two small enclaves on the North African coast that are geologically independent from the rest of the country. Ceuta and Melilla lie on the point of inflection of the Betic-Rif Arc, adjacent to the controversial geological accident of nature, the Straits of Gibraltar.

The extremely complex hydrographic network of peninsular Spain can be summarised in two outflows- the Atlantic and the Mediterranean. The catchment network is grouped into four sectors: North (54,000 km^2) with regular flow; Atlantic, (257,000 km^2) including the basins of the largest rivers- the Douro, the Tagus, the Guadiana and the Guadalquivir, characterised a more irregular flow and summer ebbs; Ebro and the associated eastern Pyrenees sector (86,000 km^2); and the Levante sector, which includes the rest of the rivers flowing into the Mediterranean, with very low flow and torrential episodes.

The total length of Spain's rivers is estimated to be close to 75,000 km, covering a total area of 178,000 ha. There are approximately 1,000 reservoirs on this river network, along with 1,500 natural wetlands.

CLIMATE, RELIEF AND SOIL: THE NATURAL LANDSCAPE 1.2

The landscape is primarily determined by the relief along with the climate, which in many cases is heavily influenced by the latter factor. The climate also models the relief, leading to the formation of soil from the base rock, the two being the primordial factors that determine the presence of different types of vegetation- the other key component of the natural landscape. All of these natural elements condition the types of human exploitation which finally configure the real landscape in a large part of the territory.

The Iberian Peninsula has a wide range of climates. Its orographic aspect, the influence of the Atlantic Ocean, the Mediterranean Sea and the Sahara change the overall climate that should correspond to Spain's position in the temperate boreal belt north of the Tropic of Capricorn. Spain thus has an extremely wide range of rainfall, temperatures, solar radiation and predominant regional winds (galernas, bochornos, solano, mistral, etc.). While mean temperatures in most of Spain range between 14 and 20ºC, the combination of altitude and continentality leads many areas, such as the Mesetas, to endure extremes of 30ºC in a single day and more than 60ºC over the year.

A clear distinction can be made on the Iberian Peninsula between moist, sub-humid, dry and semiarid Spain, although the rainfall regime is often simplified into moist and dry. Dry Spain has less than 500mm annual rainfall, with the semi-arid south-east part receiving less than 300 mm, while moist Spain receives over 1,000 mm with some areas of the north-west and Cantabria receiving more than 2,000 mm. The sub-humid area, with intermediate rainfall, divides these two extreme zones. The national average is estimated to be around 650 mm. The precipitation/evaporation water balance is negative in more than half of the Iberian Peninsula, enabling one to speak of a 'Brown Spain' and a 'Green Spain'. Brown Spain has a Mediterranean climate, mild winters on the coast and severe winters inland, hot, dry summers, abundant sunshine throughout the year and extremely uneven rainfall in autumn, winter and spring. Green Spain has a similar climate to Western Europe, with mild winters, cool summers, moist air, frequent cloudy periods and frequent rainfall throughout the year.

The relief obviously produces great changes in the climate by causing a gradual fall in temperatures as altitude rises. It permits mountain zones of the Mediterranean region, for example, to have similar thermal conditions to the temperate-moist zone, and enables similar deciduous leafy forests to those in northern Spain to develop under favourable moisture conditions. The same causes facilitate the development of somewhat similar vegetation formations to those corresponding to the temperate/cold or boreal zone on the coolest mountains, and similar alpine pastures to those found on the arctic tundra to develop at higher altitudes where the temperatures are too low to permit the development of any type of forest.

The soil types give rise to a Siliceous Spain, seated on crystalline rock that forms acid soils, and a limestone Spain over sedimentary rock that forms basic soils. The conjugation of these soil types with the rainfall patterns leads to the division into sectors listed in Table 1, an important tool in defining the species distribution patterns. The Canary Islands, on the other hand, are on volcanic soil, with a desert climate at low altitudes on the eastern islands and a more Mediterranean climate at mid and high altitudes. They embrace an arid sector closer to the African coast, influenced by the desert winds, and a moist sector affected more by the moisture-laden trade winds from the north. Relief and aspect once again play an important role in producing local variations to these broad patterns on the islands.

TABLE 1 SPANISH LANDSCAPE UNITS

SILICEOUS SPAIN

MOIST	MONTES GALAICOS (ALL GALICIA EXCEPT S-E)
	ASTÚRICA RANGE (ASTURIAS)
SUB-MOIST	SOUTH-EASTERN GALICIA
	WESTERN CASTILLA-LEÓN
	SISTEMA CENTRAL
	MONTES DE TOLEDO
	SIERRA MORENA
DRY	LA MARAGATERÍA
	CACERES PENEPLAIN
	TAGUS PIT
	GUADIANA DEPRESSION

LIMESTONE SPAIN

MOIST	CANTABRIAN RANGE
	PYRENEES
SUB-MOIST	NORTHERN CASTILLA-LEÓN
	SISTEMA IBÉRICO
	CATALONIA-COASTAL RANGE
	PRE-PYRENEES
	BÉTICA RANGES
DRY	DUERO DEPRESSION
	TAGUS-LA ALCARRIA VALLEY
	LA MANCHA
	EBRO DEPRESSION
	GUADALQUIVIR DEPRESSION
	MEDITERRANEAN COAST
	SEGURA RIVER COUNTRY
	BALEARIC ISLANDS
SEMIARID	ARID SOUTHEAST
	LOS MONEGROS

VOLCANIC INSULAR SPAIN

MOIST	WESTERN CANARY ISLANDS
DRY	EASTERN CANARY ISLANDS

NORTH AFRICAN SPAIN

DRY	CEUTA & MELILLA

SOURCE: EDITORS

THE COASTAL AND MARINE ENVIRONMENT 1.3

The marine environment as a whole includes other features such as the lack of similar boundaries to the terrestrial environment, the attenuation of seasonal variations due to the thermal inertia of the water, its three-dimensional scope, the factors limiting biological production and the way its life forms are exploited.

The first problem that arises is the consideration of the scope of the national marine biodiversity. From a strictly territorial approach, the boundary may be drawn slightly beyond the edge of the continental shelf at a depth of roughly 240 metres and in the open sea to 200 nautical miles from the coast, coinciding with the boundary of the exclusive economic zone. However, action affecting the marine biodiversity outside these limits in other countries or areas on the high seas is obviously a Spanish responsibility. Such territories should also be included in national plans for sustainable usage.

The total area of the Spanish continental shelf down to 200 metres covers 80,000 km^2, including the Balearic and Canary Island shelves (10,500 and 5,500 km^2 respectively). The area lying within the more appropriate 240 metre depth limit covers 95,000-100,000 km^2.

The Spanish coastline is washed by the waters of the Atlantic Ocean and the Mediterranean Sea (Fig. 1) which, due to their geographic position, belong to the temperate sea group. In Spain, however, local distinctions are made between the coastal zones of the two seas (Cantabrian Sea, Alborán Sea, Balearic Sea, Cadiz Gulf, etc.).

Three main sections of coastline are distinguished. The Mediterranean section is the longest, covering a little over 3,200 km including 1,900 on the Peninsula coast and less than 1,400 around the Balearic Islands; the Cantabrian coast (1,200 km) from the French border to La Coruña; the Atlantic coast (almost 3,500 km) which includes part of the coast of Galicia, Huelva and Cádiz (1,915 km) and the Canary Islands (1,540 km). In all, Spain has almost 8,000 km of coastline.

There are substantial differences between the Atlantic and Mediterranean geographic regions, both on an oceanographic scale and in terms of the morphology of the continental boundaries, the sea bed, the sediments and the tectonic styles. The Atlantic region also includes substantial differences between the Cantabrian section, the Gulf of Cadiz and the Canary Islands, reflected in the marine fauna and flora as well as in the fishing industry.

The Cantabrian continental shelf is narrow, especially in the eastern sector and then broadens westward from the Llanes canyon, while the western Galicia shelf is even narrower. The Galician coastline is extremely complex. The main features are the numerous estuaries or rias, former river valleys now covered by the sea, which are under the influence of a process of coastal emergence.

The most important geographic feature on the south-western coast is the Strait of Gibraltar which forms the transition between the broad platform of the Gulf of Cadiz and the Alboran Sea. The Balearic islands are set on a large promontory in the Balearic Sea, one of the western Mediterranean basins.

The features of the Canary Island waters and coastline differ considerably, even between islands, due to their volcanic origin, the distance from the African coast and the local oceanographic phenomena including an extraordinarily important coastal emergence.

1.4 BIOGEOGRAPHIC REGIONS AND BIOCLIMATIC STOREYS

This section does not deal strictly with the physical environment as the biogeographic regions and bioclimatic storeys are demarcated by a relationship between physical and biological aspects. A certain type of vegetation has been established in each area under the predominant influence of the climate and soil, as well as the historic development of each location. The close relationship between these physical factors and the plant communities makes it more practical to define the demarcation in terms of the distribution of the plant communities despite the climatic and soil basis of the sector formation.

This section presents the most widely used classification method of all those that have been advanced in response to the country's extremely broad environmental variety. Spain is part of the Holarctic flora and fauna kingdom, and forms part of three chorological or biogeographic regions: Eurosiberian, Mediterranean and Macaronesian. Several areas in the Galicia-Cantabria-Pyrenees zone are part of the Eurosiberian region, while the rest of peninsular Spain, the Balearic Islands, Ceuta and Melilla are part of the Mediterranean region. The Canary Island archipelago lies in the Macaronesian region, along with other Atlantic islands.

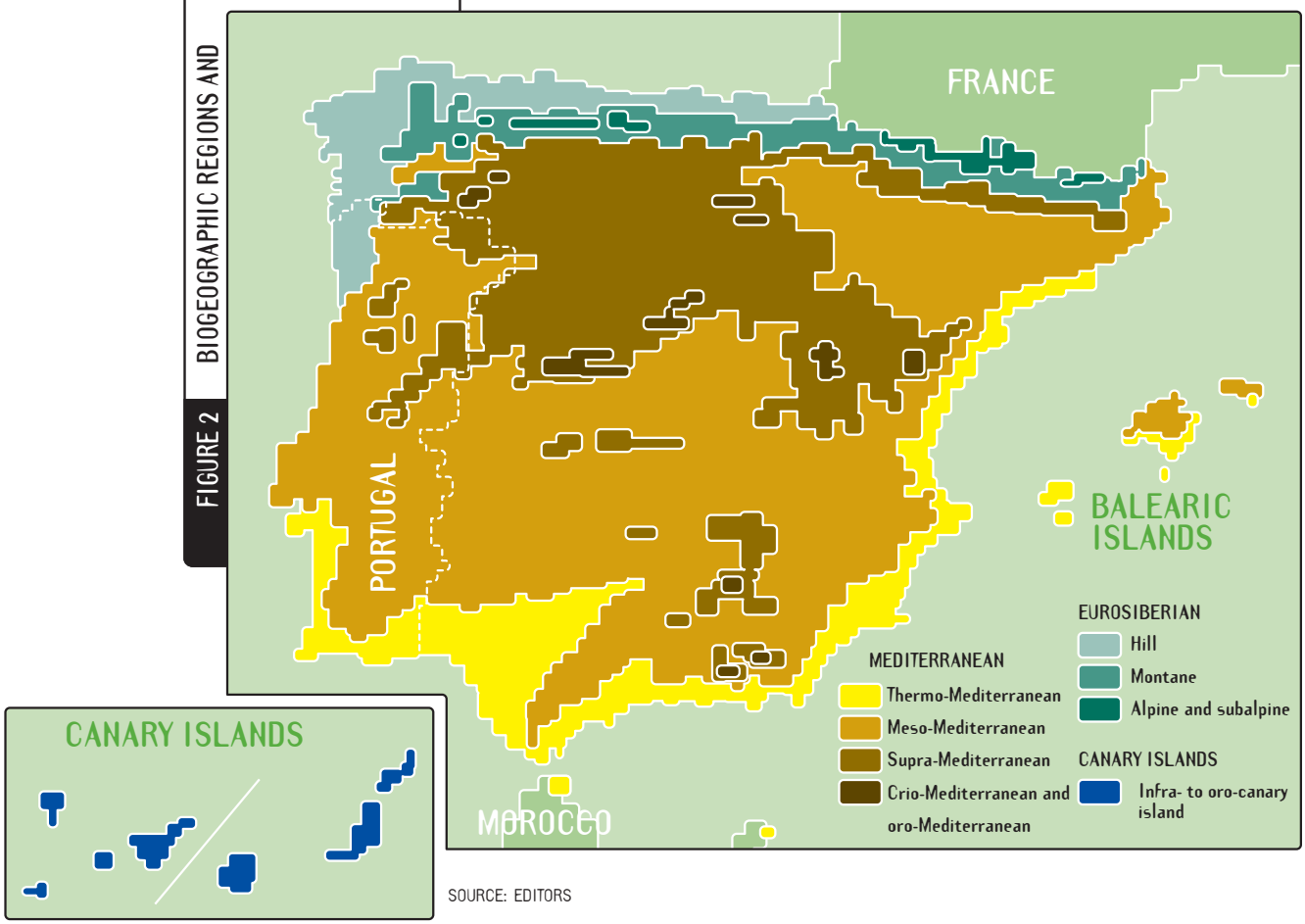
The rainfall factor provides the clearest separation of the two peninsular regions, given that the Mediterranean region always has a summer drought of varying length regardless of the average annual rainfall. Northern Spain lies squarely within the Eurosiberian biogeographic region, and potentially could be covered by forests of broadleaf deciduous species such as oak, beech, service-trees, maple, ash and others, which would be distributed naturally in accordance with their ecological preferences. Mixed forests of firs, beech and sub-alpine black pine would only be found in the Pyrenees. In all cases there are potential interspersions of sub-sclerophyllous and sclerophyllous forests with relict stands of laurels inherited from the end of the pre-glacial Tertiary or Quaternary. The Pyrenees contain alpine areas lacking forest and a predominance of sub-sclerophyllous and interspersed sclerophyllous habitats, with a mosaic of Mediterranean and Eurosiberian vegetation containing a mixture of stock from both floristic domains in varied proportions with alternations, interspersions and transitions.

The rest of peninsular Spain, the Balearic Islands, Ceuta and Melilla lie in the Mediterranean region and hence are generally dominated by sclerophyllous formations, i.e., hard, persistent leaves, although less frequent forms such as montane pine forests and semi-desert saline scrub in the most arid zones are also present.

The western half of the Mediterranean region features holm oak and cork oak woodlands over siliceous substrata, while holm oaks on limestone are found in the eastern part. In addition

to this simple outline, there are marchescent oak formations containing Pyrenean and Lusitanean oaks (halfway between deciduous and sclerophyllous) in the higher rainfall areas, Phoenician Juniper found on the continental moorlands and thermophytic formations of holm oak and/or cork oak sheltering from frost throughout the coastal belt, along with wild olive, carob, dwarf fan palm and other species.

FIGURE 2 BIOGEOGRAPHIC REGIONS AND BIOCLIMATIC STOREYS



SOURCE: EDITORS

The totally distinct location of the Canary Islands in the Macaronesian biogeographic region and their range of ecological conditions have brought about the evolution of unique species and communities. These include subtropical plant communities with varying degrees of aridity consisting of shrubs and thickets such as *cardonales* and *tabaibales* with a clear African influence; groves of juniper and Canary pine, and tropical laurel formations that are rich in endemic species, some with tropical affinities.

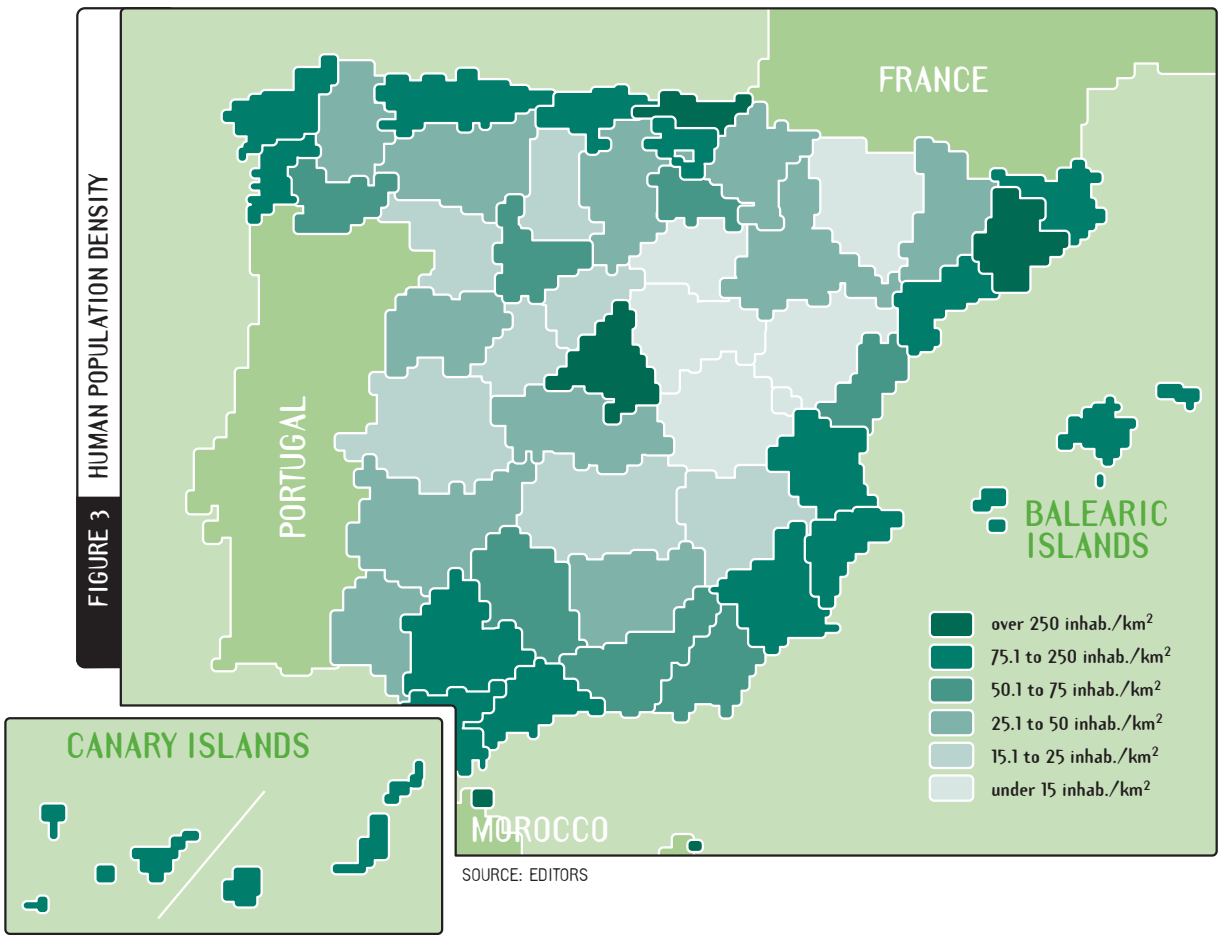
Four bioclimatic belts have been defined for the Eurosiberian zone of Spain (hill, montane, sub-alpine and alpine), five for the Mediterranean zone (infra-, thermo-, meso-, supra- and crio-Mediterranean) and five for the Macaronesian region (infra-, thermo-, meso-, supra- and oro-Canary), all defined by thermoclimatic values, each one with its characteristic species and communities (Fig. 2).

BIOLOGICAL DIVERSITY: COMPONENTS AND CONSERVATION STATUS 2

A brief review of the varied components of Spain's physical environment leads to the supposition that there must also be great biological variety. Moreover, diverse historical events that had a negative effect on fauna and flora in the rest of Europe were less severe in Spain as its location further south and nearer the Atlantic Ocean moderated their effects. Such was the case with the gradual increase in seasonal variation, the glaciations and the desertification of the Sahara. During the glaciations, for example, the ice did not cover the south-eastern part of the Iberian Peninsula, thus making it an ecological refuge zone.

These factors, together with a relatively low human population density, with a current average of 77.5 inhabitants per square kilometre concentrated to a great extent in a few cities, the coastal strip and the islands (70% of the population is concentrated in 10% of the territory, while only 30% of the population lives in rural areas, which cover 90% of the territory; Figure 3) are the reasons behind the generally better state of Spain's biological diversity, especially when compared with that of neighbouring countries with a similar level of development. This does not mean that there has not been a high level of degradation, especially as regards loss and alteration of natural habitats. However, given the extent of such deterioration in Europe, Spain is responsible for conserving a large part of the continent's biological diversity.

FIGURE 3 HUMAN POPULATION DENSITY



SOURCE: EDITORS

Despite the above, the lack of unified criteria for measuring and evaluating biodiversity, which makes study and comparisons difficult, should be highlighted. It is clear, for example, that greater biological diversity is not always better. Conserving a very rich ecosystem is not, as a general rule, more important than conserving a poorer one as this poverty may be precisely an attribute

of the ecosystem itself and is not, therefore, less valuable for that reason. Conserving biological diversity is particularly interesting in cases where it is associated with the natural character of the ecosystems and their internal processes. In conclusion, parameters need to be established by means of an integrated approach that measures and evaluates all the above. Such a task requires an interdisciplinary effort.

NATURAL HABITATS 2.1

2.1.1 THE TERRESTRIAL ENVIRONMENT

Unlike the concept of species, the concept of habitat is rather more complex and difficult to characterise as it allows for different approaches and even depends on the scale of work. Although relative classifications of plant communities exist, it is more difficult to obtain comprehensive and concise data on ecological systems.

Looking first at the terrestrial environment, one of the most characteristic features of Spain's vegetation is its extraordinary diversity. Its great climatic, lithological and topographical heterogeneity, as has already been pointed out, has given rise to territory that is very compartmentalised in ecological terms, which has led to the growth of a broad spectrum of vegetation types. In addition to these factors, intense human activity has gradually transformed the natural environment since Neolithic times, often diversifying even further the habitat types.

The Iberian Peninsula's special geographical position in the contact zone of the Euroasiatic and African plates and the paleobiogeographical events made possible by that position explain the diverse origin of Spanish flora and, therefore, of Spanish vegetation. Examples of the many influences exerted in the course of those events are to be found in, for example, the remains of subtropical-lauroid vegetation conserved in some areas with a mild rainy climate, the continental steppe features of eastern Mediterranean and Asiatic origin, the Eurosiberian vegetation represented by certain deciduous forests, tracts of heathland and cut grassland, as well as by some Arctic-alpine plants and relict associations, which survive in the highest and wettest Mediterranean mountain systems.

Besides the above, there is a great variety of ecosystems associated with the coast, including, in particular, the intertidal zone, beaches, cliffs, dune systems, salt meadows and saline steppes, etc. Moreover, as already indicated, Spain is also rich in freshwater habitats, with 75,000 kilometres of rivers and at least 1,500 wetlands, which represent 0.22% of the country's surface area. The wetlands are generally very small, but of prime importance as centres of biological diversity.

Under natural conditions, virtually the whole of Spain is suitable for forest growth; only certain areas in the highest mountain systems and some extremely dry parts of the south-east and the Canary Islands do not allow it. Nevertheless, the vegetation landscape of today's Spain is a mosaic in which natural arboreal, shrub and herbaceous formations together with agricultural land and forestry plantations are distributed unequally over the territory. Thus, forests, natural or planted, currently occupy 15 million hectares (approximately 30% of the territory), the most characteristic being Atlantic forest, with a predominance of oaks and other broad-leaved deciduous trees; riverine woodland on 20% of Spanish riverbanks; deciduous, sclerophyllous and montane variants of Mediterranean forest; and subapline coniferous forest, which alternates with montane scrub and wet or semi-wet pastures.

However, it is the agricultural, livestock and forest uses, with over 42 million hectares (80% of territory) that currently characterise land occupancy in Spain. Of that 80%, the land given

TABLE 2 BREAKDOWN OF DIRECTIVE 92/43/EEC-LISTED HABITATS FOUND IN SPAIN

	IMPORTANT IN THE EUROPEAN UNION	PRIORITY STATUS
COASTAL AND HALOPHILOUS HABITATS	Submarine coastal inshore waters, intertidal zones. Estuaries, rias and reefs. Coastal cliffs. Freshwater marshes, coastal and inland salt meadows and marshes.	Posidonia meadows. Tidal lagoons. Steppe scrub on gypsum or saline soils.
COASTAL AND INLAND DUNES	Dunes, coastal and inland sands	Grey Atlantic dunes. Heath, pinewoods and juniper woodland on dunes.
FRESHWATER HABITATS	Lakes and oligotrophic or distrophic lagoons. Natural eutrophic lagoons. Mountain rivers and streams. Submerged communities in river courses. Permanent or intermittent Mediterranean water courses.	Ephemeral Mediterranean lakes.
HEATH	Atlantic, Mediterranean and Macaronesian heath. Subalpine and alpine Ericaceae scrub. Papilionatae scrub of Mediterranean and Canary Island mountains.	Canary Island fayal-heath. Coastal cliff heath with gorse.
SHRUBLANDS AND SCLEROPHYLLOUS SHRUB FORMATIONS	Stands of box. Stands of Spanish broom and white Spanish broom. Shrubby juniper woodland. Thermophilic garrigue with dwarf fan palm. Thermo-Mediterranean scrub and thyme stands. Thorny scrub on Mediterranean coastal cliffs.	Stands of Periploca laevigata & jujube of the arid southeast of the Peninsula. Shrubby laurel formations.
NATURAL & SEMI-NATURAL MEADOWS	High altitude grassland. Mesophilous pasture on calcareous soils. Holm oak and cork oak dehesa (savannah). Juncus meadows, cut meadows, megaphorbia meadows.	High altitude wet grassland. Crassifolia grassland with outcrops of Karst rock. Low perennial or annual xerophilous Mediterranean grassland.
PEATLAND	Habitats on peaty soils.	Active ombrogenous peatbeds. Stands of Cladius mariscus & limestone tors.
ROCK AND CAVE HABITATS	Vegetation of rocks, stony ground and scree slopes. Communities on larva flows and other volcanic structures. Terrestrial and marine caves.	
FORESTS	Deciduous forest: beech, common oak, Pyrenean oak and Mediterranean oak, chestnut.	Mixed Cantabrian-Pyrenean lime forest.
	Riparian forest: Mediterranean ash woodland.t, Alder, poplar and willow woodland. Prunus lusitanica woodland. Birch woodland of Montes de Toledo. Nettle tree (Celtis australis) woodland. Stands of tamarisk, oleander and Flueggea tinctoria in ramblas (intermittent water courses).	Atlantic alder, common ash & willow woodland.
	Sclerophyllous forest: stands of carob or wild olive. Cork oak and holm oak woodland. Stands of holly. Coniferous forest: Subalpine forests of mountain pine. Woodland of Spanish fir, Aleppo pine, Canary Island pine. Junipers.	Laurisilva forest, otherwise known as Canary Island "monte verde". Canary Island palm woodland. African savannah forest (Tetraclinis). Mediterranean and Macaronesian juniper woodland.

SOURCE: EDITORS

over to dry-farmed crops (just over 30%), forestry (30%) and xerophilous grassland (12%) is the most notable. Irrigated crops account for 7%. The flora and plant communities of these environments are not lacking in interest as many endemic Spanish plants and more than a few animal species live in these agropastoral systems. In addition to the above, 8% of land consists of urban areas and infrastructures, representing totally altered habitat that cannot be recovered.

The outcome of all the above data is that 65% of the 179 habitat types described in Council Directive 92/43, and specifically the *Interpretation Manual of European Union Habitats* of the European Commission, which includes a few more than the directive's annex, occur in Spain (Table 2). Despite its limitations, the latter listing represents the first attempt to systematise the diversity of European habitats from a conservation standpoint. Likewise, 50% of habitats considered as priority habitats from a conservation point of view at European Union level occur in Spain. Implementation of the Habitats Directive indicates that Spain has the greatest diversity of natural habitats among the member countries of the European Union (Table 3). The plant associations that define these habitats are the basis for protection of the vegetation in accordance with objective and selective criteria. From all the above, it is obvious that Spain has a fundamental role to play in maintaining biodiversity in the Community and in Europe in general.

Some habitats are particularly valuable, either for their originality, endemic status or conservation status among other criteria i.e. wetlands and hydrological systems, *pseudosteppe ecosystems,* Atlantic and Mediterranean forests, savannah-like grasslands (dehesas), coastal ecosystems or laurisilva formations and scrub consisting of Cistaceae and labiates from the Mediterranean region and of Papilionatae and Ericaceae from the Eurosiberian region.

However, the conservation status of the above series is far from positive (see Table 4). Not only has the natural character of the habitats covering most of the territory been lost, but the natural habitat types that have been conserved are also in a state that cannot be considered satisfactory.

One specific problem for habitat conservation worthy of mention is erosion. 18.2% of Spanish territory (9.16 million hectares) presents soil loss rates per Ha/year of over 50 Tm. These loss levels require urgent action in the affected areas, 90% of which are under the influence of the Mediterranean climate.

TABLE 3 BREAKDOWN OF THE BIODIVERSITY OF DIRECTIVE 92/43 LISTED HABITATS IN SPAIN

	NUMBER OF HABITAT TYPES
COASTAL AND HALOPHYTIC HABITATS	140
COASTAL AND INLAND DUNES	21
FRESHWATER HABITATS	77
HEATH	48
SCRUBLAND	205
NATURAL AND SEMI-NATURAL GRASSLAND	208
BOGS AND FENS	20
ROCK & CAVE HABITATS	230
FORESTS	260
OTHERS	16

SOURCE: S. RIVAS-MARTÍNEZ ET AL., DOC. PHYTOSOC. 22 (1994)

TABLE 4 NATURAL STATUS (1,2,3) OF SPANISH HABITATS AS AN INDICATION OF THEIR CONSERVATION STATUS (LOW, MODERATE, HIGH). HECTARES & PERCENTAGES SHOWN IN GROUPS OF HABITAT TYPES LISTED IN EU HABITATS DIRECTIVE 92/43/CEE

HABITAT GROUP	AREA (HA.)	NATURAL STATUS RATING					
		1 LOW	%	2 MODERATE	%	3 HIGH	%
MEDITERRANEAN REGION							
COASTAL AND HALOPHYTIC HABITATS	290816.0	37829.8	13.0	124554.9	42.8	128431.3	44.2
COASTAL AND INLAND DUNES	38599.1	15353.0	39.8	13772.7	35.7	9473.4	24.5
FRESHWATER HABITATS	23651.4	7189.2	30.4	8691.4	36.8	7770.8	32.9
TEMPERATE HEATH AND SCRUB TEMPERATE HEATH AND SCRUB	1722232.2	240699.2	14.0	1095920.8	63.6	385612.2	22.4
SCLEROPHYLLOUS SHRUBLANDS	1162348.1	185059.4	15.9	643195.9	55.3	334092.8	28.7
NATURAL AND SEMI-NATURAL GRASSLANDS & GRASSLAND	2562794.7	191075.6	7.5	936017.9	36.5	1435701.2	56.0
RAISED BOGS, MIRES & FENS	3363.7	194.0	5.8	1657.7	49.3	1512.0	45.0
ROCK HABITATS	116094.3	6979.1	6.0	49503.3	42.6	59611.8	51.4
FORESTS	2989227.8	431168.4	14.4	1552737.2	51.9	1005322.2	33.6
MACARONESIAN REGION							
COASTAL AND HALOPHYTIC HABITATS	845.0	52.2	6.2	699.9	82.8	92.9	11.0
COASTAL AND INLAND DUNES	4769.5	75.2	1.6	1081.3	22.7	3613.0	75.8
FRESHWATER HABITATS	0.1	0.0	3.8	0.1	94.5	0.0	1.7
TEMPERATE HEATH AND SCRUB	30825.3	1368.5	4.4	13267.6	43.0	16189.2	52.5
SCLEROPHYLLOUS SHRUBLANDS	18647.7	1262.4	6.8	14721.6	79.0	2663.6	14.3
NATURAL AND SEMI-NATURAL GRASSLANDS	35.9	7.3	20.4	27.6	77.0	0.9	2.6
RAISED BOGS, MIRES & FENS	58.6	2.5	4.3	1.9	3.2	54.1	92.4
ROCKY HABITATS	5335.4	109.8	2.1	1651.2	31.0	3574.3	67.0
FORESTS	54737.8	4294.8	7.9	31673.6	57.9	18769.5	34.3
ATLANTIC REGION							
COASTAL AND HALOPHYTIC HABITATS	23310.5	2274.0	9.8	6028.7	25.9	14511.8	62.3
COASTAL AND INLAND DUNES	2227.0	337.0	15.1	778.0	34.9	1108.1	49.8
FRESHWATER HABITATS	4285.3	789.9	18.4	2168.0	50.6	1326.4	31.0
TEMPERATE HEATH AND SCRUB	1124481.6	113703.7	10.1	826955.5	73.5	182590.4	16.2
SCLEROPHYLLOUS SHRUBLANDS	10215.9	1704.0	16.7	8062.3	78.9	436.0	4.3
NATURAL AND SEMI-NATURAL GRASSLANDS	171998.3	15448.3	9.0	123189.8	71.6	32861.6	19.1
RAISED BOGS, MIRES & FENS	10588.0	1439.4	13.6	4626.1	43.7	4518.0	42.7
ROCKY HABITATS	116434.0	3668.5	3.2	106259.9	91.3	6329.5	5.4
FORESTS	466947.3	77211.0	16.5	180594.2	38.7	208736.7	44.7
ALPINE REGION							
COASTAL AND HALOPHYTIC HABITATS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COASTAL AND INLAND DUNES	48.3	0.0	0.0	20.8	43.0	27.5	57.0
FRESHWATER HABITATS	1052.7	12.0	1.1	543.6	51.6	497.1	47.2
TEMPERATE HEATH AND SCRUB	49421.4	14021.7	28.4	15724.3	31.8	19675.4	39.8
SCLEROPHYLLOUS SHRUBLANDS	26422.4	337.0	1.3	7913.5	30.0	18171.9	68.8
NATURAL AND SEMI-NATURAL GRASSLANDS	209382.3	10700.3	5.1	50017.9	23.9	148664.1	71.0
RAISED BOGS, MIRES & FENS	260.4	0.0	0.0	56.9	21.9	203.5	78.1
ROCK HABITATS	49750.3	1865.2	3.8	1096.0	2.2	46789.1	94.1
FORESTS	173589.4	9758.3	5.6	96461.1	55.6	67370.0	38.8

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL, ENVIRONMENT MINISTRY

The list of natural habitats must be accompanied by the results of traditional uses of some of those habitats, which people have altered in humanised environments and which are in many cases the medium for a large part of real biological diversity. These are the agricultural landscapes, which, in recent years, have become increasingly interesting from a conservation standpoint. Many of these landscapes are also declining due to the abandonment of the traditional farming practices that kept them going after they became economically less attractive and the rural population migrated to the cities.

Eleven per cent of the hydrological network is highly polluted and a further 15% presents an average level of pollution. A large part of the palustrine terrain, marshes and lakes was drained in the past for health reasons. It has been estimated that over 60% of the surface area occupied by the Iberian wetlands was drained in less than 50 years. The marshes of the River Guadalquivir, for example, still considered the jewel in the Spanish conservation crown, have been reduced from 200,000 to 36,000 hectares.

2.1.2 THE MARINE ENVIRONMENT

It is more difficult to talk about natural habitats in the marine environment. The biological diversity of Spain's coastal waters is one of the greatest in the European Union due to the oceanographic and biogeographical factors present there. In the south of the Peninsula, three marine regions, the Mauritanian, Lusitanian and Mediterranean, border one another: According to the global classification system of the coastal marine environment, to date, 49 large marine ecosystems have been identified, of which three –the Iberian Coasts, Mediterranean and Canary Islands Current– include Spanish waters. Those ecosystems in turn contain distinct regions that are considerably different one from another. Spain's Iberian Atlantic waters, for example, include the Cantabrian Sea, the platform and rias (estuaries) of Galicia, and the Gulf of Cadiz, while Mediterranean waters contain the Tramontana region, the Balearic region, Gulf of Vera and Alborán Sea. In order to illustrate the differences between the oceanographic characteristics of the three regions, Table 5 presents the values of some variables in each of them.

Besides the differences shown in the table, there is the vertical distribution of temperatures, which in the Atlantic decrease with depth, while in the Mediterranean they remain stable between 12º and 13ºC from a specific depth down to the sea floor.

TABLE 5 OCEANOGRAPHIC FEATURES OF MARINE AREAS

	MEDITERRANEAN	CANARY I.	CANTABRIAN SEA
MAXIMUM TIDAL RANGE	LESS THAN 1m	3-3.5m	APPROX. 5m
MAXIMUM SURFACE TEMPERATURE, SUMMER	24 - 27ºC	24 - 26ºC	20 - 21ºC
MINIMUM SURFACE TEMPERATURE, WINTER	12 - 13ºC	17 - 18ºC	10 - 11ºC
MEAN SURFACE TEMPERATURE, SUMMER	21 - 25ºC	23 - 24ºC	17 - 19ºC
MEAN SURFACE TEMPERATURE, WINTER	12 - 14ºC	18 - 19ºC	12 - 13ºC
MEAN SURFACE SALINITY, SUMMER	36.25 - 37.50	36.50 - 36.75	35 - 35.50
MEAN SURFACE SALINITY, WINTER	36.25 - 37.75	36.75 - 37	34 - 35.50
CHLOROPHYLL (MG/M3, NORMAL LEVELS)	0.1 - 0.5	0.1 - 0.3	0.7 - 3
PRIMARY PRODUCTION (GC/M2/YEAR, NORMAL LEVELS)	50 - 80	60 - 100	100 - 200
NITRATES (µG/AT/L, NORMAL LEVELS)	0 - 3	0.01 - 2.5	5 - 20
PHOSPHATES (µG/AT/L, NORMAL LEVELS)	0 - 0.3	0.01 - 0.2	0.5 - 1.5
APPROX. 5M			

SOURCE: COMPILED BY J. CORRAL

From the biogeographical point of view, there are notable differences between the Atlantic and Mediterranean regions. In the Atlantic, the different regions are connected by currents running along the western side of the continent, while the Mediterranean is a semi-isolated sea with a gradient of influence of Atlantic fauna from the Straits of Gibraltar eastwards and northwards.

The Mediterranean has a greater diversity of habitats and species, its fauna and flora accounting for 7.5% of total recorded marine species although, in terms of size, it represents only 0.8% of total ocean surface. Such richness is explained by the coexistence of species of different origins; for example, tropical, temperate, boreal Atlantic and even from the Red Sea, which is part of the Indo-Pacific region, but with continuity in Mediterranean waters due to the opening of the Suez Canal. As regards the Atlantic, there are observable differences between the Cantabrian Sea, the Gulf of Cadiz and the Canary Islands, the littoral fauna of these islands being very diverse due to the North Atlantic, Mediterranean, African and even West Indian influences.

The conservation status of the marine environment is, in general, less critical than that of the terrestrial environment. Chemical pollution, physical alteration and habitat eutrophication have a clear impact, although one that is often local and limited.. All in all, nearly 40% of the Spanish coastline has been built on or otherwise occupied by infrastructures which, logically, have an impact on the nearby waters. This considerably alters coastal marine habitats, but the breadth and extent of such alterations has not yet been quantified.

2.2 WILD SPECIES

TERRESTRIAL AND FRESHWATER SPECIES 2.2.1

In the European Union as a whole, Spain is an exceptional country as regards the natural environment. As has already been mentioned, the changes that occurred throughout its geological history, the regional and local environmental mosaic (climate, soils, relief, etc.) and, more recently, human occupation of the territory are the causal factors behind the high degree of natural diversity that is a feature of Spain.

Knowledge of the taxonomy and spatial distribution of all this biological diversity, especially of species, is very scarce for many groups despite the fact that Spanish science has attained a high level of development. This represents a serious problem for the implementation of the Strategy as far as conservation of wild species is concerned.

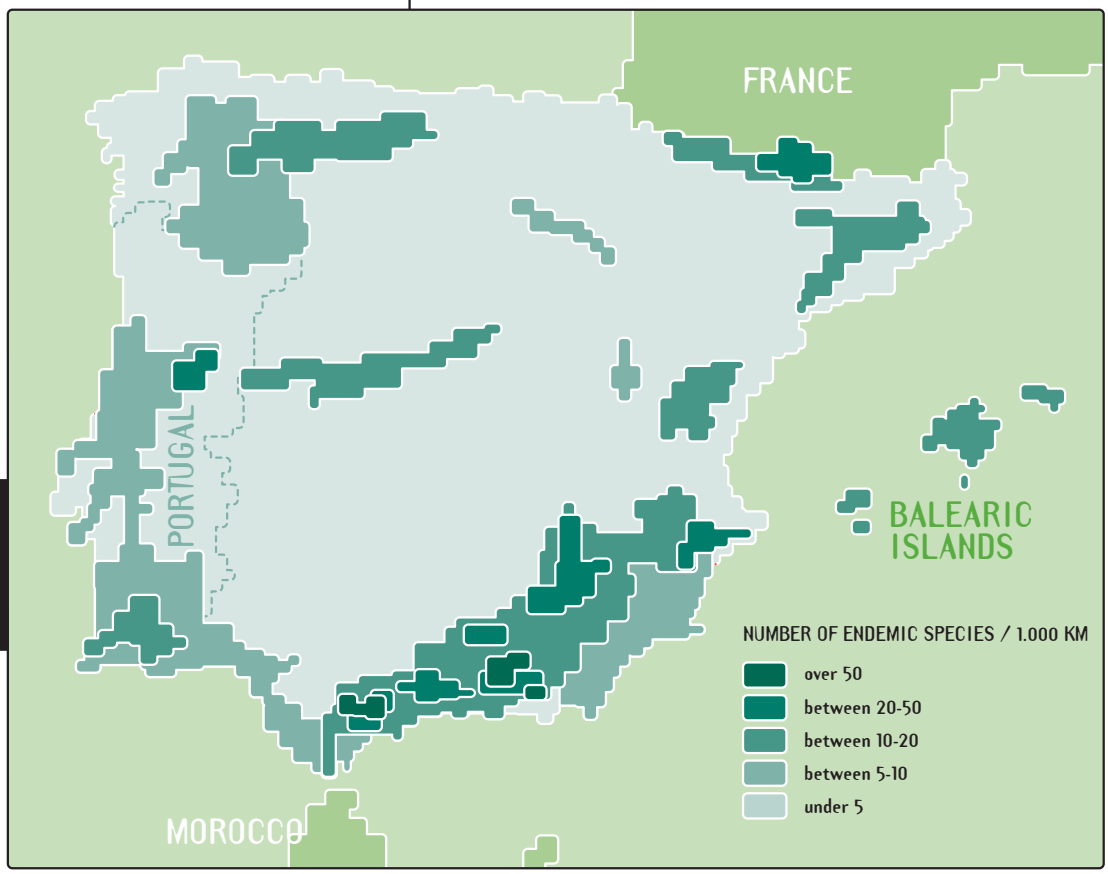
The number of stocks of vascular plants (ferns and flowering plants) present in Spain is estimated to range from 8,000 to 9,000, which represents approximately 80 to 90% of the total found in European Union countries. Due to Spain's special geographical situation, however, it is not only important to stress the total number of stocks, but also their diverse biogeographical origins. There are species from the Arctic zone, the boreal forests of Northern Europe, the steppes of Eastern Europe, the subdeserts of the Middle East, the subtropical Atlantic islands, North Africa, etc., as well as pantropical, Saharan, Cosmopolitan and other stocks.

Furthermore, there are around 1,500 plants with a worldwide distribution restricted to Spain (the so-called endemic species and a further 500 shared only with North Africa (Ibero-African endemic species). Moreover, Ceuta includes four Yebalic endemic species, only present on the southern shore of the Straits of Gibraltar. Virtually half of European endemic species are Spanish although Spain accounts for only 4.5% of Europe's total surface area. In the Canary Islands, an endemic paradigm, the isolation factor has made its presence felt in the evolutionary processes in an extraordinary way as 15% of the plant species (vascular or otherwise) are endemic.

As far as other groups of terrestrial plants are concerned (fungi, lichens and mosses), the figures are less reliable as considerably less is known about them. The only group with accurate estimates of species numbers is that comprising briophytes or mosses, with 1,012. For lichens, a tentative figure of between 2,000 and 2,500 has been suggested. There are around 10,000 known species of fungi, but it is thought there may be as many as 20,000.

Besides the number of species, the importance of Spanish flora as a whole is clear in Figure 4, which shows the density of endemic plant species on the Peninsula and Balearic Islands.

FIGURE 4 ENDEMIC PLANT SPECIES OF THE IBERIAN PENINSULA AND BALEARIC ISLANDS



SOURCE: GÓMEZ CAMPO, C. (Ed.) 1985. PLANT CONSERVATION IN THE MEDITERRANEAN AREA. THE HAGUE.

As for fauna, there are estimated to be between 50,000 and 60,000 species. 770 are vertebrates (excluding marine fishes) and the rest are invertebrates. In both cases, they exceed 50% of total species in each group in the European Union.

Here again, endemic status increases the value of Spain's biological diversity, especially in the case of the Canary Islands. Of the 6,893 animal species present there, 3,066 are endemic, representing 44% of total island fauna.

The Iberian Peninsula, Ceuta and the two archipelagos are important for the migrations of a very large number of animals. Many species are involved, above all birds. Fish and marine

mammals which do not strictly belong to Spanish fauna use Spanish territory for stopovers between their breeding grounds in the north and their wintering areas in the Mediterranean and the southern Sahara, or between their breeding grounds in the Mediterranean and wintering areas in the Atlantic. These species require specific sites that they use for a relatively long time, but whose conservation state is not crucial to the completion of their biological cycle.

The estimated total taxa for Spanish territory rises, therefore, to almost 80,000, making conserving biodiversity in Spain a real challenge; one that is far from being met at the present time.

As has already been pointed out, Spain's biological heritage takes on special relevance within the European context. Taking into account both the number of species and the diversity expressed as the number of species present in each country divided by the logarithm of the total area of the country, Spain obviously conserves the largest range of diversity on the entire continent. Table 6 illustrates a comparison of these values for various European countries in respect of the two best-known groups of species: vascular plants and animal vertebrates.

TABLE 6 DIVERSITY OF VASCULAR PLANTS AND VERTEBRATES IN EUROPEAN COUNTRIES

COUNTRY	VASCULAR PLANTS	VERTEBRATES
GERMANY	483	62
BELGIUM	324	59
DENMARK	270	53
SPAIN	1401	99
FRANCE	805	74
GREECE	969	79
NETHERLANDS	264	57
IRELAND	195	36
ITALY	1021	76
LUXEMBOURG	365	60
PORTUGAL	518	65
UNITED KINGDOM	301	53

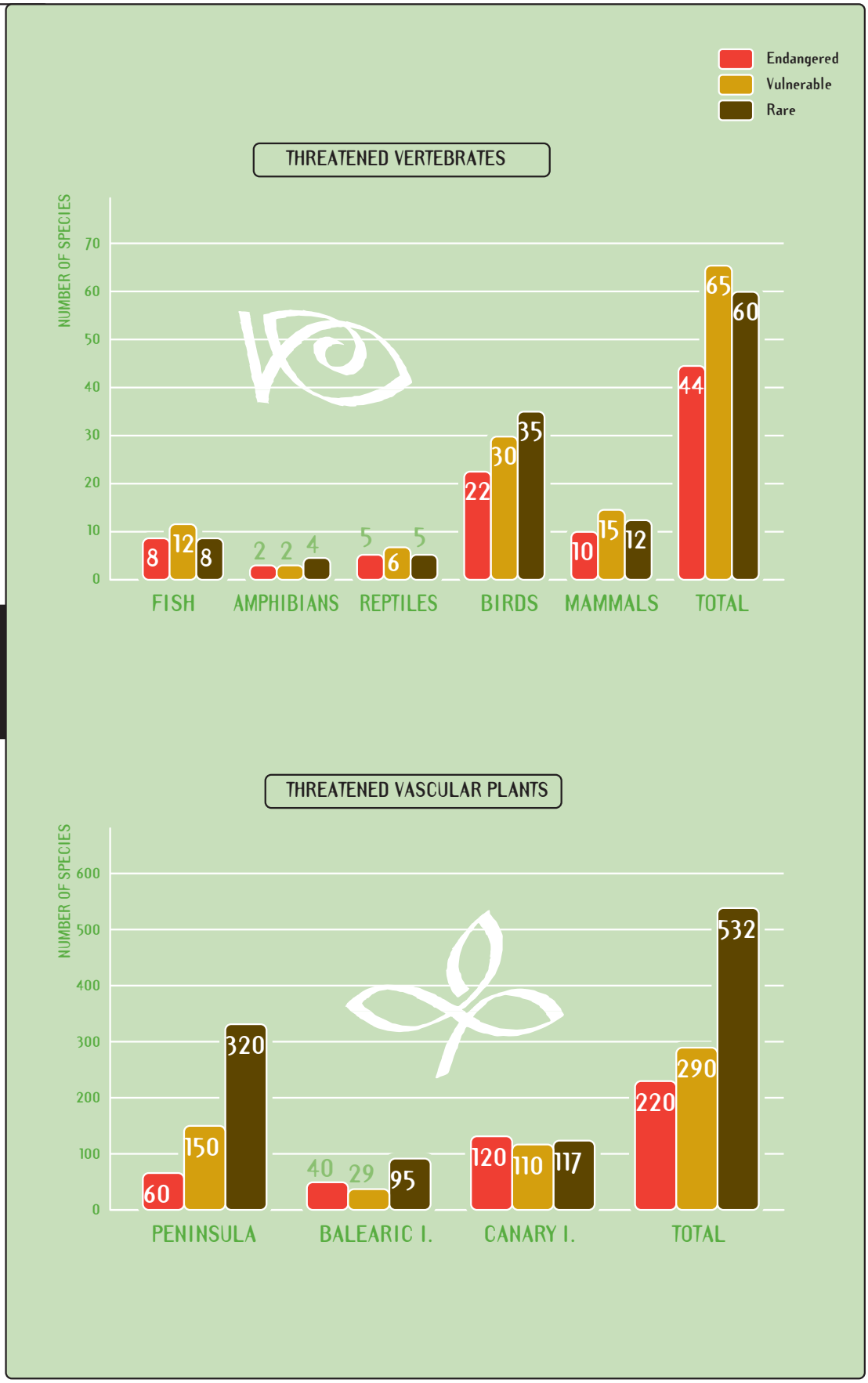
DIVERSITY = NUMBER OF SPECIES/LOGARITHM OF AREA

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL, ENVIRONMENT MINISTRY

The above data are particularly significant for Mediterranean countries, which, overall, host the greatest species diversity. France, the largest Community country, has a much lower species diversity than Spain, Greece or Italy. Similarly, Spain stands out considerably from all other countries, even those in the Mediterranean area, as its diversity of vascular plants is far greater with more than 8,000 species (60% of all vascular plants on the continent).

However, the real conservation status of these features of biological diversity is another matter. Although the legal mechanisms that have been developed in recent years at international, national and regional level are important, they are still insufficient to ensure the conservation of

FIGURE 5 THREATENED VERTEBRATES AND VASCULAR PLANTS



SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL, ENVIRONMENT MINISTRY

Spain's heritage or they are not applied with sufficient rigour. Furthermore, the scientific knowledge needed to carry them out is still incomplete although it is much broader than the knowledge applied in practice.

The World Conservation Union has established seven categories to indicate the degree of threat affecting any individual species. The first two, "extinct" and "endangered", are the most serious as they mean that a species has already become extinct or is on the way to going extinct. The "vulnerable" category is assigned to species subject to important risks, and "rare" applies to species not found in very large numbers. The remaining categories are "insufficiently known", "indeterminate" and "not threatened".

Table 7 and Figure 5 show the state of vascular flora and vertebrates in Spain in this respect. There is a huge lack of knowledge regarding the situation of species from other groups, except for a small number of species that have been studied because they appear on the lists of Community regulations or in international agreements.

TABLE 7 CONSERVATION STATUS OF SPANISH FLORA & FAUNA (IUCN CATEGORIES)

SPECIES	INSUFFICIENT KNOWLEDGE		RARE	ENDANGERED		TOTAL
	NOT ENDANGERED	INDETERMINATE	VULNERABLE	EXTINCT		
MAMMALS	59	14	8	12	14	9	1+1E?	118
BIRDS	246	22	9	34	29	23	3+2E?	368
REPTILES	40	0	1	4	6	4	1 E?	56
AMPHIBIANS	20	0	0	3	1	1	0	25
FRESHWATER FISH	41	1	1	6	12	6	1 E?	68
PLANTS: PENINSULA	5,920	10	35	335	143	55	2	6,500
PLANTS: CANARY IS.	1,399	26	5	122	119	127	1	1,799
PLANTS: BALEARIC IS.	1,364	0	0	83	24	27	2	1,500

E?: UNCERTAIN EXTINCTION OF SPECIES

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL, ENVIRONMENT MINISTRY

Spain is the Community member country with the largest number of threatened vascular plants. The figures indicate that approximately 12% of the taxa are included in the categories "extinct", "endangered", "vulnerable" or "rare". This percentage drops to 8% if only Peninsular and Balearic flora are taken into consideration.

The figures on vertebrates show that 26% of Spanish species fall within the categories "endangered", "vulnerable" or "rare". Vertebrates are the group with the largest amount of available information. The new World Conservation Union categories, approved in 1996, are now applied and are thus not discussed in detail here. However, according to the new categories, 20 mammal species, 10 birds, 3 reptiles, 3 amphibians and 10 fish species, accounting for 7.2% of total vertebrate species, are classed as "endangered" (which in this case would correspond to the categories "critically endangered", "endangered" and "vulnerable"). These new categories must be applied to the remaining taxonomic groups as soon as possible. The

factors that have given rise to these threat situations in the different vertebrate groups are basically the introduction of exotic species and overfishing of continental fish, loss and degradation of laying sites and large-scale catching of amphibians, habitat destruction in the case of reptiles, more intensive farming methods and direct persecution as regards birds, and population fragmentation, direct persecution and use of pesticides in the case of mammals. Overall, alteration and loss of natural habitats may be considered to be the greatest threats to conserving all these species.

Game and fishery species are a special case. Article 33.1 of Act 4/1989 on the Conservation of Natural Areas and Wild Flora and Fauna stipulates that hunting and fishing in some continental waters can only be carried out on species that are specified in the regulations, and that such specification can never apply to listed species. Based on the above article, Royal Decree 1095/1989 specifies the list of species liable to capture, as well as the norms to protect them. This list includes 12 mammal species, 38 birds, 25 fish species and one invertebrate, the crawfish. Four other species could be hunted if expressly stipulated in regional government regulations. Some of those species are not part of native Spanish fauna, but, in general, occur in large numbers, have very broad distribution ranges and for which enough data and monitoring of their demographic situations exist. Nevertheless, debate about the conservation status of some of them arose almost at the same time as the aforementioned royal decree was published, and has continued to the present. Such is the case of the turtledove, red-crested pochard and a few others.

However, Constitutional Court Ruling 102/1995 on the appeal concerning the unconstitutionality of several aspects of Act 4/1989 declared null, inter alia, the first additional provision of the royal decree, in which some articles of the royal decree itself were designated as basic state legislation. As a result, pursuant to that ruling, regional governments are responsible for establishing the lists of game and fishery species, except for those on the national or regional endangered species lists.

At present, this matter is governed by the regulations on game species and close season orders published annually by the regional governments, by which the species, hunting seasons and capture restrictions, etc. are different in each one of them. The annual publication of these orders is an important conservation instrument, as a species that may be caught one year may cease to be so according to the subsequent order following the detection of a conservation problem in its populations, or it may be caught in one autonomous region where its numbers can withstand the pressure, but not in another where it is in a worse situation.

Moreover, hunting and fishery development plans may be very suitable tools to control the state of such populations, providing for the actions needed to make implementation of these activities sustainable.

Twelve mammal species and 43 bird species are currently liable to be hunted in one or other of the autonomous regions. As regards birds, at European Union level, Directive 79/409 on the Conservation of Wild Birds stipulates the species that are liable to be hunted. Every year contradictions arise concerning species included in that directive and those appearing in the close season orders; for example, partridge or starling. Such contradictions are the subject of repeated complaints to the European Commission for failure to comply with the stipulations of the directive.

Act 40/1997 partially adapted the legal ordinance to the European Union's Birds Directive, leaving the matter of applying the exceptions in the hands of the autonomous regions.

In Spain, the economic scope of the hunting sector is such that it is profitable to carry out actions like introducing animals or birds from allochthonous populations or subspecies for hunting purposes. Despite being forbidden by law across the board, this kind of action is causing a serious problem due to the hybridisation of introduced fauna with native populations, thereby leading to a loss of the genetic diversity apposite to each territory.

Some regions have begun to make approval of hunting studies or the granting of hunting permits for hunting reserves conditional upon the release of specimens with specific genetic characteristics, which might help to palliate the problem. Certain groups in the sector have begun to request the introduction of management criteria that would foster the survival and release of specimens that are genetically close to local populations of the respective species.

As regards continental fishing, there is even greater diversity in regulations. Each region establishes a series of species that are off-limits due to their bad situation; they are species that are generally included on the National Endangered Species List, with a few exceptions, such as the lamprey and the native river crab. From the conservation standpoint, there is a marked discrepancy as regards the salmon; it is an outstanding species from the sporting point of view, but several groups consider that it should be included on the Endangered Species List.

MARINE SPECIES 2.2.2

Study of the marine environment in the different regions has been very uneven, and, therefore, what is known about that environment is equally so.

In the benthic system, and in relation to fauna, a gradient in knowledge seems to exist, ranging from greater to lesser as one moves from the communities of the inshore waters near the coast, consisting of relatively large organisms of the epifauna, to the infauna of the depths of the open sea. The intertidal ecosystems are among the best-known ecosystems on the Iberian Peninsula. Records exist from the beginning of the last century. The communities of the hard bottom marine inshore waters are possibly the best known, especially those of the Mediterranean. A similar gradient exists in the pelagic system, ranging from the macro-meso-microplankton to the picoplankton and nannoplankton, and from inshore to open sea.

Data on organisms that have traditionally been consumed or are consumed as food or have other commercially valuable uses are very complete. There is also ample knowledge about the biology of species that are not of direct commercial interest, but which are important in the ecosystems where they occur. Some species of algae, phanerogams, sponges, anthozoa and polychaeta, for example, are interesting as bioindicators in studies of the impact of pollution on populations.

Table 8 shows the numbers of species in the groups making up the benthic flora of the Spanish coasts, and Table 9 indicates the marine invertebrates found in Spanish waters.

Most of the world's large groups of marine invertebrates are represented in the Spanish marine environment. There is a total of over 7,000 species, of which about 500 are planktonic, around 50 nektonic (all cephalopods) and the rest benthic. It is noteworthy that around 70% of benthic invertebrates present some larval phase or stage of their life cycle as part of the plankton. This means that for varying periods of time such representatives of one system are found in the other, and as a result the level of biological diversity of both is high.

TABLE 8 BENTHIC FLORA OF SPANISH COASTS

GROUP	MEDITERRANEAN	ATLANTIC COAST	CANARY I.
CYANOPHYCEAE	25 (60)	23 (90)	20 (50)
CHLOROPHYCEAE	130	115	99
RHODOPHYCEAE	420	360	308
PHEOPHYCEAE	125	140	93
DIATOMOPHYCEAE	300	270	-
XANTHOPHYCEAE	2	3	-
PRASINOPHYCEAE	3	1	-
MAGNOLIOPHYTA	4	3	3

NUMBERS IN BRACKETS SHOW CONVENTIONAL TREATMENT OF THE SAME GROUP

SOURCE: COMPILED BY T. GALLARDO

The greatest diversity of species has been recorded in the Straits of Gibraltar and the Alborán Sea. In this area, both typically Mediterranean and Atlantic species occur, as well as many components of North African fauna and some endemic species. Nevertheless, data on species richness on the Iberian Peninsular coasts is still skewed due, as has already been pointed out, to the fact that they are derived from the very different efforts devoted to each of the areas or regions.

One of the Barcelona Convention protocols on endangered species lists 3 phanerogams, 11 algae, 9 sponges, 3 cnidaria, 3 echinoderms, 1 bryozoa, 17 molluscs, 2 crustaceans, 15 fish, 6 reptiles, 15 birds and 19 cetaceans in the Mediterranean area. Over 70% of these species occur on the coasts of Spain.

However, the criteria for deciding on the situation of the species in the different categories almost always centres on the observation or estimation of macroscopic organisms, which can be easily determined and are subject to very clear and specific threats, whereas some processes such as pollution of coastal waters, which create unfavourable conditions for coastal ecosystem species and which represent a threat for many species of infauna and/or microscopic fauna, may pass unnoticed. Moreover, although some marine systems are far away or difficult to observe, as is the case of the bathyal system, they should be taken into account in the future given their fragility due to their limited energy input and their more strict trophic relationships as they may, for these reasons, lose species as yet undescribed.

Fishery species merit a separate mention. The strictly Spanish fishery species that hatch and develop within the first two hundred nautical miles of the exclusive economic zone should be separated from those breeding outside the limit, which are usually known by the name of the nearest country or geographical region (Falklands, Mauritania, etc.).

As regards the former, the Atlantic trawling fisheries geared to commercial demersal species such as dory, angler fish, Norway lobster, spinous spider crab, blue whiting, etc., are being fully exploited and the most characteristic species of them all, hake, is considered the most overfished. In the seine fisheries, given over to catching pelagic species, one must bear in mind that the variations in oceanographic conditions also have a great affect on population fluctuations. Worrying data have appeared regarding the sardine in recent years. What is more, Mediterranean fisheries withstand catches from over 5,000 boats, mostly of small tonnage. Catches are multispecific, as, unlike the previously mentioned fisheries, they are not geared to a specific species.

TABLE 9 SALTWATER INVERTEBRATES IN SPANISH WATERS

GROUP	DISTRIB.	HABITAT	SPECIES	NOTES
PORIFERA	Md	B	550	
CNIDARIA	Md	B/Pl	560 (530/30)	
CTENOPHORA	M	Pl	12	
PLATYHELMINTHES	MDT-P	B	200	Saltwater turbellaria have not been studied in Spain. Species number estimated.
NEMERTEA	Md	B	136	
GNATHOSTOMATA	M	B		Animal groups exclusively in interstitial environment. Analysis begun in Spain very recently. Estimated to contain 25 species.
GASTROTRICHS	Md	B		
KINORHYNCHS	M	B		
LORICIFERA	M	B		
TARDIGRADA	MDT	B		
NEMATODES	MDT-P	B	300	Little research done in saltwater environment. Species number estimated.
NEMATOMORPHS	MD-P			
ACANTHOCEPHALA	MDT-P		DE 5 A 10	Parasites, primarily fish. Species number estimated.
PRIAPULIDS	M	B	3	
ENTOPROCTS	Md	B	4	
ROTIFERA	mD	P	12	
SIPUNCULIDS	M	B	35	
ECHIURIDA	M	B	5	
ANNELIDA	MDT	B/Pl	900 (880/20)	
MOLLUSCS	MDT	B/Pl/N	2100 (2010/40/50)	
POGONOPHORS	M	B	2	
CHELICERAE	mdT	B	50	Approx. 20 species of saltwater mites; 30 pycnogonids.
CRUSTACEANS	Mdt-P	B/Pl	1400 (1050/350)	
PHORONIDEA	M	B	7	
ECTOPROCTS (BRYOZOA)	Md	B	280	
BRACHIOPODA	M	B	30	
ECHINODERMATA	M	B	275	
CHAETOGNATHA	M	B/Pl	13 (1/12)	
HEMICHORDATA	M	B	4	

Bs- benthic, PIS- planktonic, N- nektonic. M-saltwater, D- freshwater, T- land, Ps-parasite.
M- Exclusively saltwater group.
Md- Primarily saltwater, some species found in fresh water.
Mdt- Primarily saltwater, some species found in fresh water and on land.
MDT- In all environments (saltwater, freshwater, land)
mD- Primarily freshwater, but also saltwater.
mdT- Primarily land, with some aquatic species.
P- Exclusively parasites.

SOURCE: COMPILED BY J. TEMPLADO

The low yield of this kind of fishery is compensated by the high value of the product, a situation that helps maintain the current overfishing situation.

Outside the exclusive economic zone, the North and north-west African fisheries depend more on specific agreements reached with Mediterranean shoreline countries than on the real state of resource exploitation although research teams have not come up with any alarming data. Tuna fisheries, large migrant fisheries and cosmopolitan fisheries are quite well regulated by an international commission. The red tuna is in the worst situation, and scientific recommendations have been made to reduce catches in the next three-year period. The white tuna is close to the maximum recommended take levels. Among the tropical tuna (bigeye, yellow-fin and skipjack), the former is beginning to show signs of being overfished due to a recent fishing strategy which takes advantage of the juveniles' habitat of grouping together under floating objects. Measures have recently been taken to avoid this procedure. As regards swordfish, a recent drop in fishing yields and a reduction in size have been noted, leading to the conclusion that its populations will not be able to withstand the current catch rate.

However, catches are often not the only reason for the threatened situation of these species. Other factors connected with habitat alteration, such as estuary degradation, are involved.

GENETIC RESOURCES 2.3

In terms of biodiversity, those plants and domestic animals which have been artificially selected from among existing species and then subjected to special care in their breeding and progressive selection merit a special mention. Local varieties or breeds that are specially adapted to their specific environment or specific use are developed in this way. Their genes and the associated knowledge represent a store of the experience of generations of agriculturalists and livestock farmers, who are the managers of this genetic heritage. These resources are a source of genetic variability and useful characters that are impossible to recover if lost. They are of special economic and social interest because they are used directly to produce food for human consumption or raw materials for the food industry, as well as for forestry, industrial, pharmaceutical, medicinal, ornamental and recreational purposes. Likewise, the extremely important microbial strains, which are in many cases of direct industrial use in producing food, pharmaceutical products, etc. are in this category.

In recent decades, Spain has seen a rapid loss in and disappearance of plant varieties and livestock breeds making up the domestic biological heritage and in the know-how associated with its management. The varied and complex causes behind this phenomenon are mainly socio-economic. Homogenisation of patterns in the consumption of products derived from these components of biodiversity plays an important part.

In broader terms, however, it is understood to include not only microbial strains, livestock breeds and plant varieties that society uses in its productive sectors, but also others whose genetic material is stored in any form in case they may one day be useful. Moreover, this usefulness does not only refer to industrial or productive use, but also, for example, to the utilisation of genetic reserves to solve possible problems involving the conservation of threatened species and populations.

In this latter sense, it is very important to conserve germplasm from wild species in general and from those related with domestic species in particular. Access to genetic diversity has been enormously important in agrarian and productive activities in Spain as this genetic diversity is a

source of genes that have been selected from the point of view of productivity or resistance to pests, disease and adverse environmental conditions. This is similarly applicable to the conservation of wild species. There is a special need for institutions geared to ex-situ conservation of wild flora, and, as far as possible, wild fauna, and for them to be organised and co-ordinated in networks.

Germplasm identification has, logically, advanced more rapidly in cases of commercial or economic interest, which has led to the creation of inventories and germplasm banks. In addition to banks of domestic animals and cultivated species, there are also scientific collections of flora and fauna, zoos and botanical gardens, cryogenically preserved cell and tissue banks, banks of semen, embryos and oocytes, etc. It is also necessary to add the special case of the so-called Spanish Collection of Type Cultures, housed at the University of Valencia, with approximately 3,000 species and microbial strains, including actinomycetes, fungi and yeasts. The almost total lack of attention given to marine organisms from this perspective is worth noting.

Apart from this necessary ex-situ conservation, in-situ conservation has historically been the basic element in conserving domestic genetic resources and, as such, must be fostered with a view to their conservation in the future. The huge wealth of traditional knowledge that makes up an essential part of the information needed for agrosystems to function is linked with past selection and management. Conservation must, therefore, pay attention to management techniques as much as to the resources themselves.

CULTIVATED PLANTS 2.3.1

This section deals with a varied series of resources: resources under cultivation, resources exploited in the wild state by extraction, resources of ethnobotanical interest, wild resources of potential interest and, finally, traditional knowledge. The latter will be dealt with separately.

Phytogenetic resources for food and agriculture make up the biological base needed to guarantee world food resources and either contribute directly or indirectly to sustaining human life. They consist of traditional varieties and modern crops, and also wild plants related to cultivated ones and other species of wild plants used as food. This is the basic material that breeders use to produce new varieties and also the material that farmers sow in their fields. The genetic variability stored in this material is an insurance policy against environmental changes, as well as socio-economic and cultural changes. Its conservation and sustainable use are crucial.

TABLE 10 CULTIVARS OF SPANISH ORIGIN

GROUP	COMMERCIAL STRAIN	PROTECTED STRAIN
CEREALS	116	136
FODDER	8	0
OILY AND INDUSTRIAL	98	101
GRAIN LEGUMES	58	14
POTATO AND HORTICULTURAL SPECIES	152	63
TOTAL	432	314

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL, ENVIRONMENT MINISTRY

Although a large part of phytogenetic resources for food and agriculture are currently conserved ex situ, it should be borne in mind that natural ecosystems may contain significant reserves, both of wild species related to cultivated ones and of wild plants used for food. Therefore, it is also important not to overlook their conservation, and complete inventories need to be made available.

Ex-situ conservation is basically carried out in plant germplasm banks, in which seeds are normally kept at low temperatures and low humidity. The seeds of some crops are not susceptible to this treatment, either because they do not withstand the conditions (recalcitrant seeds) or because their principal means of reproduction is vegetative. In these cases, recourse can be had to other types of conservation, such as field germplasm banks or conservation in vitro.

Phytogenetic resources are conserved for possible use and that conservation allows for the future diversification of agriculture. Greater diversification increases resistance capacity to pests and diseases and at the same time reduces dependency on pesticides. Phytogenetic resources, however, are generally under-used. Among the obstacles that make their use difficult is the lack of information on the value and possible uses of the material, so the material contained in the germplasm banks needs to be better characterised and evaluated. Lack of communication between banks, breeders and the rest of the potential users also has an effect.

In any case, a large part of the potential held in germplasm banks does not have to be used right away, but can instead constitute a reserve of well-known characteristics for future utilisation, even in circumstances that are difficult to foresee at present.

However, at international level, most domestic genetic resources are conserved in situ by communities of rural and indigenous people and Indians, and since the FAO was founded, only a small part of them has been collected, with or without the consent of the traditional holders. There have been few results in real conservation terms and financial costs have been high, which in the case of certain banks has prevented the necessary conditions being met to maintain all the stored material. In-situ conservation must be considered a basic tool for preserving domestic genetic resources and, as such, must be promoted and fostered by adopting the required measures.

A register of commercial strains of cultivars (1987-1996) lists 432 as being of Spanish origin. Table 10 displays the number of these varieties by groups; however, the number of varieties is underestimated. When a crop is accepted on the register, the Administration includes ex officio the varieties that are being marketed; however, many native ones that are local or have hardly any commercial applications remain outside it. Many of the commercial varieties that come into being, perhaps the majority, are generated through research and are usually protected by registration. The number appears in the other column of the table.

Act 11/1971 on seeds and nursery plants and its implementation provisions (3767/1972) governing seeds and nursery plants establish the existence of public domain varieties (those not subject to plant holding rights) for which there is a List of Common Varieties which also includes non-commercial varieties and varieties not protected by holders rights. This list has not, however, received due attention and one of its main functions has been abandoned; namely, to protect genetic heritage and agricultural biodiversity. Bearing in mind the considerations and principles of the Strategy, it is important to recover the role of public domain varieties. Without the updating and reactivating of the list, it is difficult to talk about protection from the point of view of conservation and heritage recovery.

One of the basic causes of loss of agrodiversity is that, generally speaking, in conventional agriculture, the farmer's role in genetic selection and improvement of varieties and native breeds has been lost. Varieties adapted to the territory have gradually been replaced by varieties of greater commercial interest, and selection and improvement have almost exclusively become the function of seed marketing companies. The interest of the seed companies does not lie in promoting agrobiodiversity, but rather focuses on a few varieties. In this context, the lack of promotion of conservation, selection and traditional genetic improvement not only in the research carried out by public institutions, but also in the traditional function of agriculturalists and livestock farmers, becomes an obstacle to maintaining agrobiodiversity.

As regards crops that have disappeared, in the work published by the United Nations' Food and Agriculture Organisation called "Marginal Crops: another way of looking at 1492", there are countless examples of varieties of leguminous plants vetch, guijo, tito, títarro, galgana, peas, arum, alcarceña, sweet peas, horticultural varieties (chicory, golden thistle, cress, watercress, purslane, fennel, rocket, blite, salsify, sorrel), fruit trees (jujube, azarolo, pistachio, almezo, citron, myrtle, cereals (millets, escañas) and other industrial, cottage industry or grain varieties (flax, hemp, sesame, woad, sumac) that have been eliminated or marginated from the Spanish agricultural landscape. Along with them, many varieties of vine, barley, rye, apple, pear, green bean, tomato, etc. have disappeared or are in the process of doing so.

LIVESTOCK BREEDS 2.3.2

There are several reasons why we need to conserve existing genetic diversity in the different livestock species, manifested by the many breeds that people have exploited or are exploiting. Firstly, the livestock populations that were initially the most noteworthy in a specific productive specialisation are being subjected to intense selection programmes that tend to exhaust genetic variability; simultaneously, many breeds with a lesser degree of productive specialisation that produced high yields until a few years ago are now being displaced by the former. These breeds, although currently not very competitive on a productive level, constitute an important reserve of genetic variability, which it would be absolutely impossible to recover should it disappear. Secondly, local breeds more often present a greater degree of adaptation to unfavourable or extreme conditions, and so are the most suitable for rational pastoral exploitation of the areas where they are found. Moreover, they are capable of providing high quality food products and can be used to colonise new areas.

In accordance with the previous agreements, the United Nations' Food and Agriculture Organisation advocates orienting conservation programmes towards populations that are better adapted to specific environments due to their physiological and behavioural characteristics or resistance to disease and to genetically unique populations of productive, aesthetic or historical interest.

Many Spanish breeds are endangered. The "Official List of Spanish Livestock Breeds" covers breeds of cattle, sheep, goats, pigs and horses. Within these species, it differentiates between native breeds and Spanish breeds (both are displayed in Table 11) and indicates those which may be considered to be in a situation involving some degree of threat and, therefore, the subject of special protection.

The above list takes into account only breeds with genotypical and phenotypical characteristics great enough to be considered as such at national level; in other words, it does not include local phenotypical variations. The term "native breeds" is taken to mean those that originated in Spain. Within that group, "developing breeds" are those which in terms of numbers and

TABLE 11 LIST OF CATTLE, SHEEP, GOAT, PIG AND HORSE BREEDS

NATIVE BREEDS

SPONSORED BREEDS	CATTLE	Asturiana de los Valles, Avileña Negra Ibérica, Lidia, Morucha, Pirenaica, Retinta and Rubia Gallega.
	SHEEP	Castellana, Churra, Lacha, Carranzana, Manchega, Merina, Navarra, Rasa Aragonesa, Ripollesa and Segureña.
	GOATS	Agrupación Caprina Canaria, Malagueña, Murciana-Granadina and Verata.
	PIGS	Ibérica.
	HORSES	Horse: Española.
BREEDS UNDER SPECIAL PROTECTION	CATTLE	Albera, Alistana-Sanabresa, Asturiana de la Montaña, Berrenda en Negro, Berrenda en colorado, Betizu, Bruna de los Pirineos, Blanca Cacereña, Cachena, Caldelana, Canaria, Cárdena Andaluza, Frieiresa, Limiana, Mallorquina, Menorquina, Monchina, Mostrenca, Murciana-Levantina, Negra Andaluza, Pajuna, Palmera, Serrana Negra, Sayaguesa, Vianesa, Terreña and Tudanca.
	SHEEP	Alcarreña, Aranesa, Ansotana, Canaria, Cartera, Castellana (variedad negra), Colmenareña, Chamarita, Churra Lebrijana, Churra Tensina, Gallega, Guirra, Ibicenca, Maellana, Mallorquina, Manchega (variedad negra) Menorquina, Merina (variedad negra), Merina de Grazalema, Montesina, Ojalada, Ojinegra de Teruel, Palmera, Roja, Mallorquina, Roja Bilbilitana, Rubia del Molar, Sasi Ardi, Talaverana, Xalda and Xisqueta.
	GOATS	Agrupación de las Mesetas, Azpi Gorri, Blanca Andaluza o Serrana, Blanca Celtíbera, Bermeya, Del Guadarrama, Florida, Gallega, Ibicenca, Jurdana, Mallorquina, Moncayo, Negra Serrana, Pirenaica, Payoya and Retinta.
	PIGS	Negra Canaria, Celta, Chato, Murciano and Negra Mallorquina.
	HORSES	Horse: Asturcon, Burguete, Gallego de Monte, Hispano-Árabe, Hispano Bretón, Jaca Navarra, Losina, Mallorquina, Menorquina, Monchina and Pottoka. Ass: Andaluza, Asno de las Encarnaciones, Catalana, Mallorquina, Majortera and Zamorano-Leonés.

SPANISH BREEDS

CATTLE	Charolesa, Fleckvich, Frisona, Limusina and Parda.
SHEEP	Berrichon du Cher, Fleischschaf, Ile de France, Landschaff, Merino Precoz and Chamoise.
PIGS	Duroc, Hampshire, Landrace, Blanco Belga, Large White and Pietrain.
HORSES	Horse: Árabe, Pura Sangre Inglés and Trotador Mallorquín.

SOURCE: GOVERNMENT GAZETTE

organisation are expanding, while "protected breeds" are those that are declining or disappearing. "Spanish breeds" are those that have become a Spanish heritage as they have been exploited for over twenty years in Spain, with genealogy and monitoring of known production and with a number of registered breeders, thereby making it possible to develop a selection plan. As can be seen from the table, the number of threatened breeds is markedly higher than developing breeds for all species.

In addition to the information given in the List, there is one native breed of rabbit, six breeds of pigeons and 24 breeds of hen, a duck, a goose and two turkey breeds. In the specific case of hens, 75% of native breeds are threatened to some degree ("potentially endangered", "endangered" or "critically endangered") e.g. castellana negra, de cara blanca and codorniz, andaluza perdiz, Prat leonada and blanca, vasca roja, plateada and barrada, villafranquina roja y negra, leonesa azul and parda.

By way of example of certain extreme cases, the imminent extinction of some breeds, such as the Moncaina goat, Pyrenean ass or Extremadura black turkey, which barely exceed 50 individuals, is almost inevitable. The outlook is bleaker, however, when we take into account the fact that these breed relationships are very partial. The inventories are incomplete and do not take into consideration minor local differences.

There are two ways of conserving genetic material from livestock breeds: in situ conservation, based on an attempt to minimise loss of genetic material in live populations by maintaining flocks or herds in the area of origin of the breed that is to be conserved, and ex-situ conservation, based on cryoconservation of semen and embryos. Embryo conservation is only currently feasible in cows, sheep and rabbits, and more thorough research is required into cryoconservation of gametes and embryos in these and other species of domestic and wild mammals.

MICRO-ORGANISMS 2.3.3

In recent years, a great deal of progress has been made in the field of microbial ecology which has substantially altered our appreciation of the diversity of this area. These advances have also highlighted the paucity of knowledge in this field and the urgent need for programmes to facilitate research into this important heritage, both in pragmatic aspects, such as properties that facilitate the development of new technologies (biotechnology) and their defence (patents), as well as more academic areas such as furthering knowledge regarding origins and evolution.

Unusual habitats that have recently been described are being explored in order to ascertain the special nature of the characteristics of micro-organisms. In communities found at high temperatures and pressure in submarine volcanoes, for example, micro-organisms able to grow inside the porous matrices of rocks several kilometres deep using mineral energy sources, or in the refrigeration circuits of nuclear reactors, withstanding high doses of radiation, etc. Many of these micro-organisms will surprise us with their qualities, which will be associated with eminently applied aspects, including enzymes of industrial interest that operate at high temperatures or at acid or basic pH. Others are capable of solubilizing metals from low purity refractory minerals, producing biodegradable polymers, isolating metals of strategic interest, degrading recalcitrant contaminating products, producing biocides, energy or bioactive ingredients of pharmacological interest, etc.

In contrast, little public effort has been expended nationally or internationally on exploring microbial diversity, due, above all, to technical difficulties and lack of sensitivity towards the invisible.

Using new technologies, most of which are based on techniques involving analysis and sequencing of the genes responsible for synthesising nucleic acids, microbiologists have discovered over 20 evolutionary groups of micro-organisms, including bacteria, fungi, algae and protozoa, which are much more diverse than the classic eukaryotic systems. Moreover, recent evidence indicates that the greater part of microbial biodiversity has yet to be discovered. The micro-organisms deposited in the type collections do not represent the world's microbial biodiversity mainly due to the fact that the enrichment cultures that are used select micro-organisms which do not necessarily belong to the major populations present in the habitats.

Part of the microbiological revolution lies in the development of technologies that make it possible to evaluate the degree of biodiversity in different habitats. Nowadays, these methods are based on the analysis and sequencing of the genes involved in the expression of the nucleic acids of the transfer apparatus. The discovery of a DNA (dioxyribonucleic acid) polymerase from a thermophilous bacterium facilitated the development of PCR (polymerase chain reaction) techniques which, combined with sequencing techniques, make it possible to analyse the genetic diversity present in a habitat without needing to isolate the corresponding micro-organisms.

Knowledge of the properties of new micro-organisms will undoubtedly permit the development of new methodologies, which will facilitate better study and understanding of the phenomena associated with microbiological diversity. In this context, it is important to mention that knowledge of this biodiversity and control of its exploitation is Society's responsibility, and, therefore, of the governments representing it, as was duly highlighted at the Rio de Janeiro Summit. An imbalance in this sense may immerse a country in undesirable technological dependency, leaving it at the mercy of those who, being in possession of the appropriate technology, can isolate and exploit that biodiversity without recognising either the rights of the communities that possess them or the need to compensate them.

At national level, it is important to underline the total lack of co-ordination among the hesitant individual efforts carried out by institutions of the Consejo Superior de Investigaciones Científicas (Higher Council for Scientific Research) and different university departments. Pioneering work by the Spanish Collection of Type Cultures is housed in the Biology Faculty of the University of Valencia. The collection contains some 3,000 bacterial strains, including actinomycetes, fungi and yeasts, as well as industrially introduced organisms. The collection of the National Institute for Agricultural Research, with 1,500 lactic bacteria, around 150 grampositive and 250 gramnegative, all maintained at 80º below zero, is also worth mentioning. This diversity is extremely low and does not depend on a scientific policy oriented towards systematic study, but on personal initiatives. Besides this effort, there are those of several multinational pharmaceutical companies although the benefits in such cases are obviously directed only at the companies.

It is not possible to talk about threatened species in this field even though, as their evolutionary dynamics differ from the eukaryotes, some threatened species may be continually disappearing while new ones appear. However, this situation should not result in the matter being abandoned. A list of microbial diversity is of special interest for the preservation of the species isolated in the type collections in order to provide access to replicas for research into their properties and, above all, their potential applications.

2.3.4 MODIFIED LIVING ORGANISMS

The activities that involve the use, manipulation, field assays and marketing of modified organisms resulting from biotechnology in Spain are governed by Act 15/1994 of June 3 and its implementation provision, which was passed by Royal Decree 951/1997 of June 20. This act has

transposed two European Union directives: Directive 90/219 concerning confined utilisation of genetically modified micro-organisms, and Directive 90/220 on intentional release into the environment of genetically modified micro-organisms.

The Spanish legislation provides in its final provision for 'the creation of a National Biosecurity Commission comprising experts from the ministerial departments involved and the institutions related with this matter'. Similarly, it sets up a Collegiate Body responsible for marketing genetically modified organisms and for other research activities carried out by state centres working with such organisms. In accordance with Article 31 of the act, the regional governments are responsible for granting permits relating to confined utilisation, voluntary release and research and monitoring of these activities.

Spain has over 200 research centres working with these modified organisms in confinement, basically Types 1 and 2, and the high security biological installations are currently being registered (at present ten of Types 3 and 4).

Field research has primarily focused on obtaining new varieties of plants that are resistant to pesticides or which express resistance to diverse pests, such as corn resistant to the European corn borer or cotton resistant to Heliothis (cotton bollworm), and to a lesser extent in micro-organisms used to decontaminate soils. As for crops that have been tested, new varieties of corn and tomato stand out. In total, over 100 trials have been carried out in Spain since 1933. Although these trials have been distributed throughout the Peninsula, they are concentrated above all in the autonomous regions of Andalucía and Castilla y León.

At international level, and particularly in relation to the drawing up of a security protocol pursuant to Article 19.3 of the Convention on Biological Diversity, in July 1995 in Madrid, Spain hosted the meeting of experts to determine the need for and content of said protocol. Their report was approved by the second Conference of the Parties to the Convention (Jakarta, November 1995) and gave rise to Decision II/5, which established the mandate for the drawing up of the protocol.

ACCESS TO GENETIC RESOURCES 2.3.5

The Convention on Biological Diversity was not the first attempt to regulate the problem of access to genetic resources at international level. The International Commitment to Phytogenetic Resources was established under the FAO World System for the Conservation and Utilisation of Phytogenetic Resources, which was set up in 1983. The aim of this non-binding agreement between governments of signatory countries was to ensure the prospection, utilisation and availability of phytogenetic resources of current or future economic importance. The International Commitment is based on the premise that "phytogenetic resources are a world heritage and, therefore, their availability must not be restricted".

Nevertheless, the concept of genetic resources laid down in the Convention on Biological Diversity is considerably broader than the definition of the International Commitment. While the latter body understands as genetic resources only those that are of importance for agriculture and livestock farming, the text of the Convention on Biological Diversity defines them as "all genetic material of real or potential value".

The Convention on Biological Diversity has managed to stimulate the self-confidence of many countries as regards their own resources, foster an eagerness to preserve them from further foreign exploitation and promoted a demand based on shared benefits in the future use of those

resources by outsiders (and sometimes also by the countries themselves). It does so by attempting to create a framework for fair utilisation of resources by almost all users of the various components of biological diversity (industries, scientists, technicians, collectors, private individuals, governments), and by regulating continued access to those resources, to traditional knowledge or any other component of the world's biodiversity.

The new world framework appears at the moment to be determined by the terms of the Convention on Biological Diversity, by the World Action Plan on Phytogenetic Resources for Agriculture and Food adopted in Leipzig in 1996 and by the appearance in many countries of a broad series of new national laws and developing national strategies fostered by the terms of the Convention on Biological Diversity.

The new basic parameters follow directly from the Convention on Biological Diversity:

1.- National sovereignty. States are sovereign over their own genetic resources and it is incumbent upon their national governments to regulate access to genetic resources, which is subject to their own national legislation.

2. - Facilitating access. The contracting parties must facilitate access to genetic resources. However, Article 15 states that "Each contracting party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other contracting parties, and not to impose restrictions that run counter to the aims of this Convention". It can therefore be deduced that 1) this does not mean that the Convention on Biological Diversity makes it obligatory to facilitate access, as it even recognises the capacity to impose restrictions; 2) if an obligation can be considered to exist, it refers to the utilisation of genetic resources for "environmentally sound uses"; 3) some person or body must decide whether a use is environmentally sound, and action must be taken when use is not sound.

3.- Access on mutually agreed terms means that 1) access only occurs if there is prior informed consent on the part of the donor party; 2) access will be subject to a contractual formula between the government of the latter and the petitioner (individual institution, industry, government, etc.); in other words, via an access contract between the two unequal parties.

4.- Shared benefits. The access contract will make it possible for the donor party to participate in the process of research and technological development of the resource uses, as well as share the benefits should it be exploited commercially.

Four different reactions amongst the different countries, whether or not they are signatories to the Convention on Biological Diversity, can be differentiated.

1.- Those which are protective of their own resources and biological diversity, over which they feel they have sovereign rights. They have wanted to put a rapid brake on spoliation, exploitation or gratuitous removal, drastically limiting access to such resources. As was pointed out in the preceding paragraph, these include many countries rich in genetic resources situated in the tropical regions of America, Africa and Asia. It must also be stated that these countries' control of access to biological diversity not only involves the components of biological diversity, but also, very expressly, the traditional knowledge of local native people about their biodiversity.

2.- Those who are concerned about maintaining the level of access to biological diversity and genetic resources under the sovereignty of other countries, under pressure from industries, companies, researchers and other sectors of the economy, science and even the culture of their

own countries, strive to demonstrate that henceforth they will establish a system of shared benefits which is fair and equitable in the spirit of the Convention on Biological Diversity, and to develop methods and ways to gain access in keeping with the approach and framework of the new order imposed by the Convention on Biological Diversity. Many countries of the European Union are in this situation, above all those of Central Europe.

3.- Those that are barely concerned or not at all concerned about this problem because they think that in one way or another they will continue to have access to any genetic resource and component of the world's biological diversity wherever it may be. The United States appears to be the clearest example of this behaviour.

4.- Finally, those which, even though rich in genetic resources and biological diversity and required by their industries, companies, institutions and other economic, scientific and cultural interests to maintain access routes to the resources and biodiversity of other countries, seem not yet to have felt the need to react in the way of either of the first two groups. Almost all the Mediterranean countries, including Spain, are in this situation.

Spain participates in the two spheres of involvement in the problem of access to genetic resources. Moreover, most of its principal crops are of foreign origin (wheat, rice, beetroot, sunflower, maize, horticultural crops, citrus fruits, etc.) although adaptation to local conditions over centuries has given rise to varieties that are genetically unique and currently very valuable. The pharmaceutical industry, the large producers of ornamental plants in Catalunya and the Canary Islands, many craft industries (furniture, musical instruments), the cosmetic and perfume industries, etc. depend on continuous access to phytogenetic resources that come mainly from America, Asia and Africa. There is also an incipient biotechnology industry.

However, Spain, a country also rich in genetic resources, has acted as a permanent donor of biodiversity in very diverse directions and for many centuries. The Iberian Peninsula was the origin of many of the genes of the great Central European bulb industry as well as a large part of the agricultural varieties of the Old World, which are now grown in America. It is still a frequent donor of new resources as regards cosmetic and aromatic plants and plants for perfumes and dyes, ornamentals, etc. Spanish wild flora is the most diverse in all Europe, with the greatest number of endemic species. As far as agricultural genetic resources are concerned, despite the marked loss of its original germplasm, Spain also conserves a great heritage of local varieties and traditional uses.

Moreover, requests to research and exploit algae and other micro-organisms in protected natural areas are increasingly common. What is more, sometimes the request does not arise so much for the genetic wealth itself as for the supposedly ideal environment in which the micro-organism or organism lives (salt flats, arid or semi-arid zones, high mountain areas). Whether or not this occurs depends on both the environment being the ideal survival ecosystem for the species, which allows it to breed or be studied in ideal conditions, and on the adaptability (beyond DNA composition) of the seeds or specimens.

GENETIC RESOURCE PROTECTION SYSTEMS 2.3.6

Many species are sources of active ingredients used to manufacture insecticides, pharmaceutical and cosmetic products and foodstuffs. The technological processes involved in extraction and the products themselves, their mixtures and application, may be patented. The invention patent is a title granted by the State, which gives the person holding it the exclusive right to develop the invention for a period of 20 years. It currently constitutes the most commonly used system for protecting genetic resources.

The Spanish Office of Patents and Brand Names keeps a database with around 15 million patent documents explaining the technology and registered practical applications. Of this huge volume of patents, only a small portion corresponds to patents based on biotechnology or the utilisation of living natural resources, usually plants.

Out of a selection of 500 plant utilisation patents in 1995, only 14% were of Spanish origin. This percentage is much less in biotechnology patents: 12 Spanish ones compared with 339 granted that year. The Spanish Patents Office regularly publishes comprehensive information on all patents of Spanish origin and those of 18 Latin American countries.

Instead of promoting sustainable use of genetic resources and equitable distribution of benefits resulting from their utilisation, Intellectual property rights via patents involve a loss of agriculturalists' and livestock farmers' rights over the agrogenetic heritage. This role has been transferred almost exclusively to the holders of said rights. Similarly, the development of collective systems to protect genetic heritage and the inscription in said systems of agriculturalists' rights are not being appropriately fostered. Within this context, not only do agriculturalists and livestock farmers lose their basic role in conserving agrogenetic resources, they are also deprived of that function as they have to compete with the intellectual property rights. For this reason, mechanisms have been put into place to ensure farmers have unimpeded access to such resources. Although in its origins this access obeys notions of equitable redistribution, as farmers were the active trustees of the original knowledge of the patent, it is known by the unfortunate name of "Farmers' Privileges".

The Convention on Biological Diversity offers broader opportunities than those currently existing as regards these protection systems, and the search for alternatives from this perspective is underway.

TRADITIONAL KNOWLEDGE 2.4

Although the Convention on Biological Diversity does not recognise traditional knowledge or know-how as such, and, in fact, they do not strictly constitute biodiversity, the very close relationship in many cases between preserving that knowledge and maintaining a specific fraction of that biodiversity means that the former is regarded as a part of the latter. It is what has recently come to be known as the intangible or cultural component of biological diversity, or cultural biodiversity, which is understood as the whole of the interactions between people and the remaining components of biodiversity, and is of prime importance for conservation of part of the latter.

Spain's innumerable towns have a rich ethnobiological legacy that is the fruit of the crucible of ethnic and cultural groups that occupied them, of their antiquity, cultural mix, reciprocal influences, relationships with other cultures, and also of the significant biological diversity that the territories themselves present.

Their cultural, ethnic and linguistic diversity, as well as their complex biological and ecological nature, are expressed in countless forms of expression and components: in their architecture and rural landscapes, traditional crafts, varied gastronomy, diverse ways of making use of uncultivated countryside, pasture land and *dehesas* (savannah-like grassland with dispersed tree cover) or in traditional models of arable and livestock farming. The latter two range from the high mountain areas of the Pyrenees, Cantabrian mountains or Sierra Nevada to the coastal sands or volcanic terrain of the Canary Islands, with such original solutions as the terraces of the Alpujarras, the lagoons of Sanlúcar and the vineyards of La Geria in Lanzarote. Their techniques

for domesticating the Mediterranean woodland to make dehesas with high biological and ecological diversity, and their utilisation of mountain pastures, heath for bee-keeping, irrigation and water administration techniques (a system of *guías* in Sierra Nevada and water transportation via ditches and aqueducts in many other regions) are also expressions of long experience and a huge heritage in the management of biological diversity.

Over thousands of years, the Iberian peoples selected numerous cultivars of olive, vine, cereals, fruit trees and market garden crops, and domesticated and selected many breeds of horses, sheep, cattle, goats and pigs. However, in addition to all the above, these same local communities conserve an enormous ethnobiological heritage, especially ethnobotanical, thanks to knowledge of thousands of applications and uses in the conservation and preparation of wild and cultivated plant species, which are still employed in traditional medicine, for human food and for livestock, in curing skins, weaving fibres, and even in the most diverse expressions of rural architecture, ways of life, folklore and religious practice.

There is growing evidence of the wealth of Spain's ethnobotanical heritage, accompanied, unfortunately, by evidence of the rapidly intensifying process of a decline in traditional knowledge and the associated genetic resources. It is important to note that the loss of traditionally used species and strains is invariably accompanied by the loss of an enormous agricultural and ethnobotanical heritage concerning the techniques involved in their cultivation, usage, preparation and storage.

The richest wealth in this field occurs in ethnobotany. In Spain, there are more than 6,500 native vascular plant species, 2,500 of which have known uses according to information recently gathered by the Spanish Ethnobotanists' Group. In many parts of the world, pharmaceutical multinationals are struggling to gain access to this type of traditional knowledge.

3 CURRENT STATE OF CONSERVATION INSTRUMENTS

Given that the basic conservation problem is the deterioration or loss of natural resources and that, initially, any component of biological diversity may be regarded as a real or potential resource, the key means to ensuring that resources are conserved is their sustainable usage. The concept of sustainable usage should therefore impregnate every field of action that involves the use of natural resources.

For practical purposes, the instruments used by society to materialise this conservation may be grouped into social, scientific, economic, institutional, legislative and financial areas, all of which work horizontally in the sense of being indispensable for all of the sectors involved. They should all be articulated in a well-defined conservation policy that can be put into practice by efficient, coherent management. It must be stressed that such instruments are most effective when they work together, when designed as part of a plan and used to complement each other to resolve any specific environmental problem.

SOCIAL INSTRUMENTS 3.1

THE FUNCTION OF THESE INSTRUMENTS

One of the fundamental goals of this Strategy is to tackle the causes at grass-root level given that the ultimate reasons for environmental deterioration (and hence the need to design a strategy for the conservation and sustainable usage of biological diversity) is the repercussion of human action on nature. The basic requirement therefore consists of changing these actions by means of a change in human attitudes to the environment.

The basic instrument for a well-informed and sensitised society is education. The inclusion of these issues in the education system, the development of specific environmental education plans for all areas of society, along with public information and publicity campaigns aimed at encouraging public participation, are all fundamental aspects for such a change in attitudes, without which any advance along the path to conservation is impossible.

Social instruments can be powerful tools for change if they are used to encourage and improve public participation in projects aimed at achieving the goals of the Convention. In fact, the Convention on Biological Diversity emphasises the need for public participation in the design and activation of an environmental policy.

Social change is a transversal issue, while education and communication are transversal instruments. They should be recognised as being equivalent to legal and financial instruments, and be used in strategic combination with other policy instruments.

Emphasis on public participation is a consequence of the growing evidence that environment policies fail due to the lack of involvement by the target population. From the outset of environmental corrective action, planning and improvement, it is necessary to consult the affected population in order to avoid the erroneous process of undertaking action that might be perceived by the target population as being unnecessary.

The initial consultations prior to the start of the project provide valuable information about the level of public awareness, the level of social integration and the appreciation of the local context. These are essential stages for the avoidance of social conflicts as they set the basis for the opportunity to work together.

Decision-makers are beginning to accept that the “population” or the “general public” is not a homogeneous mass, but rather groups that differ in their perceptions, knowledge, attitudes, interests and agendas. Each group has different values and understandings of the importance of biological diversity for their everyday life and about the consequences of its loss.

Social instruments help to understand the way that the community and its constituent groups perceive the issues, and why people act as they do. Planning for the required actions should only begin after this initial survey of the affected population or populations.

In the current debate on sustainability, social instruments, when used as driving forces for environmental learning, have an impact on three areas: a.- Environmental awareness is determined by cultural contexts, visions, lifestyles and value judgements, all of which are acquired through education, communication, information, etc.; b.- Criteria and options for decisions concerning sustainable practices are the result of public debate and transparent communication of alternatives; and c.- Sustainable development cannot be based on the modification or manipulation of conduct. Instead, it must rely on reflection and pluralism that will help society to develop the appropriate skills to overcome the environmental crisis.

1.- Social research. The research work of projects aimed at protecting and improving biodiversity is usually focused on the biology of the affected area. Part of this research must be devoted to an in-depth analysis of the problems affecting the local society, in terms of their culture and their economic and social conditions.

The knowledge derived from previous social research provides an essential basis for the projects.

2.- Information. The utility of information goes beyond the mere dissemination of the general contents. Any attempt to change social habits in order to preserve biodiversity is a difficult challenge, and the paths to achieving sustainability are neither clear nor uniform. Thus, the alliances that must be forged involve having to work with many actors from different cultures and, it is true, distrust and resistance that are difficult to overcome.

One of the main tools for overcoming problems arising from the diversity of parties involved, interests, values and desires is to ensure from the outset that clear, simple and true information is distributed to all those involved or to those interested in the effects of the project.

Apart from the need to inform citizens affected by specific action, however, there is also general environmental information which must be available to the public by law. Thus, environmental information should be easily accessible in a useful format. The required information may cover three areas. The first one includes simply facilitating information from a given databank, and hence should be the responsibility of the bank holding it. However, such information facilitates a second area of information that can be obtained by interrelating two or more banks, i.e., information that is not directly obtained, but data produced by superimposing two or more layers from different sources. Furthermore, the increasing scope of computerised information systems facilitates the creation of a network of networks on biodiversity issues.

3.- Communication. Communication involves taking a further step in the use of social instruments. This is not just the provision of intelligible information, but the search for a response from the interlocutor as the only means of matching the message to the target so as to ensure that it is understood.

Communication is a process of social interaction that provides the capacity for understanding the key factors and their interdependence and to take on problems action competently.

If communication is to be efficient, it should be related to the needs of the recipient and forge bridges between the perceived social needs and the goals of the environmental projects. A

gradual approach is necessary, and sometimes it is more useful to design communications strategies with the local authorities or community leaders.

4.- Education. The type of education envisaged here is a social process that goes beyond the scope of the formal education system. This is integrated education because, in addition to its potential application to biodiversity problem-solving, it is an instrument with an enormous potential for the improvement of people's daily lives. In fact, the most sophisticated communication techniques will never resolve any problem if financial resources, social organisation, a group sense and a political commitment are lacking.

The education system does not require the prior acquisition of new knowledge, but rather the opportunity to take part in the community's environmental problem-solving process. In this process of recognising the immediate surroundings and feeling part of a community, conditions may arise in which the students themselves begin to demand more information about concepts and skills that will help them to understand and work on the problem-solving process.

Job training is a good opportunity to improve biodiversity, both within the education system and in professional training (technical schools, etc.). If an effort is made to integrate students into existing teams, their training will be directly related to the projects underway, thus achieving both the skills and the spirit required to move closer to sustainability.

5.- Participation. Participation is a fundamental strategy for the changes required for the conservation and sustainability of biological diversity. The social cohesion required to resolve the complicated problems, including biological, social, economic and political factors, can only be achieved through participation. Participation also requires a learning process, including a deeper democratisation with all that this implies.

The development of responsibilities for action thus requires a reinforcement of education in procedures and also in making those involved feel sufficiently enthusiastic to commit themselves to the action.

Probably the best way to achieve this is to propitiate direct participation in the environmental impact assessment process and in real projects aimed at environmental improvement that can provide evaluation criteria and training in decision-making, gratifying experiences in themselves.

Participation may thus reach its highest level in a scenario of nature management by private bodies. The idea of natural areas being managed by NGO's has recently begun to spread throughout the world, and in the near future we may expect it to be a much more common management model.

Value-adding for certain environmental resources should be a basic pillar of nature management as a means to achieving financial self-sufficiency, as well as other benefits. NGOs are also an important part of the participation process in the conservation and preservation of biological diversity.

In conclusion, social instruments in themselves cannot resolve environmental problems. In combination with the other instruments, however, they can produce substantial advances towards the Strategy goals. This is a question of processes, and we are faced with the dilemma

of knowing that as environmentalists, we are in a hurry, while as educators, we cannot rush. All the time "lost" in explaining, communicating, researching and participating is time gained in producing environmental projects that are accepted by the community and socially appreciated.

THE CURRENT SITUATION

Public sensitivity to nature-related issues has grown considerably in recent decades. Spanish surveys in 1986 revealed that 72% of the population considered the environment to be an urgent, immediate problem. Nevertheless, the record of action taken by associations in Spain is quite short, and responding to a survey is obviously one thing while taking an active part in the resolution of a problem is quite another. Participation in humanitarian or development aid associations has increased in recent years (13,000 in UNICEF, 105,000 in the Red Cross), but not in environmental issues, where membership remains quite low.

An estimated 500 NGOs are working in Spain in relation to nature protection issues, of which 300-400 are active. Ecologistas en Acción is the umbrella group for almost all of them, which together total approximately 25,000 members. Other organisations with comparable numbers, such as Greenpeace (40,000) and WWF-Spain (25,000), are essentially based on financial support. The real level of active involvement by the Spanish population in environmental issues through associations is thus still very low.

Some regional governments have established a special register for associations and foundations, which operates as a guarantor of legitimacy for the receipt of subsidies and channelling participation. On the basis of Article 6 of Act 4/1989, the Spanish Government provides grants to NGOs for private nature conservation activities.

In spite of the low numbers of activists and the groups' lack of a solid financial basis, partly due to the total absence of incentives under Spanish taxation law), NGOs have played a vital role in raising public awareness, and no national conservation strategy could even be contemplated without their involvement as fundamental members.

Another indirect indicator of the level of interest is the number of parliamentary questions relating to nature conservation (27 out of 225 or 12% in 1995 and 48 out of 234 or 20% in 1996).

Environmental education was formally included in the Spanish syllabus as a cross-curricular area in 1992 although informal cultural incentive programmes with an environment-related content underwent an upsurge in previous decades. This thrust has largely been due to the media and many of the teachers involved in the modernisation of the education programme, as well as several NGOs. The Education and Communication Committee of the International Union for Nature Conservation (IUCN) has been active in Spain and has provided several high quality programmes, including the Education for Biodiversity Programme in 1995.

While biodiversity stewardship is slowly becoming part of the university curriculum, it still generally lacks an applied approach, with very few biology departments offering conservation as a course subject. Part of the new environmental sciences degree has a more pragmatic focus in the plan drafted by individual universities in spite of the original concept presented by the Education Ministry and the University Council as a compendium of neither finalistic nor applied sciences.

The Environment Ministry's National Centre for Environmental Education, as well as the regional Environment Departments are all involved in public awareness-raising campaigns,

travelling exhibitions and specific environmental education campaigns. The Environment Ministry has also taken part in international-scale campaigns including the 1995 European Year of Nature Conservation promoted by the Council of Europe. In all of these programmes, biodiversity is taking on an increasingly well-defined role despite the apparent complexity of the concept.

Awareness of and demand for nature are definitely on the increase in Spain. Two good indicators are the increasing number of television programmes on flora and fauna and the growing number of visitors to national parks, which passed the 8 million mark in 1997. All such signs are positive and hopeful, but these parameters are only a measure of interest in or curiosity aroused by nature. If the lifestyle patterns of current society are to be changed so as to reverse the trend towards the destruction of nature, however, more than curiosity is required. An increase in interest in nature does not mean, for example, that consumption levels are not growing at an ever-increasing rate, to a point that they are starting to become incompatible with conservation.

From the perspective of information access, a large part of the services provided by the Nature Data Bank held by the Directorate-General of Nature Conservation at the Environment Secretariat General are now aimed at the general public. The number of requests for information has increased since the natural areas under regional government protection were included in the data bank following their inventory in the first quarter of 1998.

SCIENTIFIC INSTRUMENTS 3.2

THE FUNCTION OF SCIENTIFIC INSTRUMENTS

There is an unquestionable need for scientific research into the components of biological diversity, the processes affecting them and also a monitoring process for each one and its state of conservation. The sustainable usage of these components is also necessary through a reasonable, productive and efficient rate of exploitation. Indispensable tools for good resource management include component inventories and collection maintenance, the study of the qualities of these components, awareness of their state and the trends and processes responsible for them, the unravelling of the relationship between them and the emerging properties of the different forms in which they are grouped, the analysis of the best methods of usage and exploitation, etc., in brief, all research that may lead to an understanding of the elements and processes of nature.

Conservation must inevitably be based on science, and science must be placed at the service of conservation. In spite of their mutual need, however, the scientific and conservationist worlds do not always see eye to eye. Traditionally, scientists do not always respect the field of conservation because of its lack of systematisation, and scientific analysis is often arduous for conservation technicians due to the high state of development that has been achieved. The former frequently provide solutions that are quite distant from the real problems, often with a lack of connection between research areas and the real needs of the agents involved, while the latter prefer immediate action, often without the backing of the vital initial stage of study and analysis. As a result, scientists are accused of lacking commitment to the cause, and in turn they claim that conservation workers lack training.

THE CURRENT SITUATION

In Spain, there is a lack of a sufficiently serious scientific policy to resolve the need for information that must be provided in the field of biological diversity management. Science applied to

conservation requires ongoing support to promote and maintain high-quality teams of experts working in this field. Secondly, there is a need for study and diagnostic teams in the organisational structure of Spanish conservation authorities in order to eliminate the present distinction between research and management. The diagnosis of what is happening now appears to be the exclusive obligation of government research centres, pressured in turn by other types of requirements (high standard output of basic scientific research), and a total lack of decision-making capacity in biodiversity management. It could also be approached via the occasional, fleeting advisory services of certain companies or professionals who often lack basic information or quality on which to base their studies. In brief, there is no investment in applied science or in government organisation that could ensure the involvement of scientists in the day-to-day management of biological diversity. Spain therefore still requires a scientific policy for the management facet.

Conservation biology is a newly emerging field, as evidenced by the numerous scientific journals, conferences, textbooks and associations dealing with the issue, all seeking to develop the best basic instruments to manage biological diversity with the inclusion of useful principles and techniques from biology (population genetics, taxonomy, biogeography and ecology). The accumulation of knowledge and information about nature, its formation and the way it functions, is currently on the crest of a vigorous growth process.

An inventory of the existing species and habitats is the first basic step required to organise any concerted action to preserve Spain's biodiversity. This is stipulated in the text of the Convention, and rapid steps are being taken in this direction. There are numerous fauna and flora studies underway, and many Spanish experts are currently working on worldwide inventory programmes such as European Fauna, Diversitas, and systematic biology such as the initiative promoted by the European Science Foundation. Since 1980, the Spanish Research, Science and Technology Directorate-General has sponsored three nation-wide projects which together form what is known as the biodiversity programme for the Iberian Peninsula.

1.- Flora Iberica. Begun in 1980 under the supervision of the Royal Botanical Gardens of Madrid in conjunction with Coimbra University (Portugal) and the Conservatoire et Jardin Botaniques de la Ville de Genève (Switzerland). It is expected to conclude the publication of a set of volumes within ten years.

2.- Iberian Mycological Flora. Begun in 1989, it is also being co-ordinated by the Royal Botanical Gardens of Madrid. The database already has more than 90,000 entries.

3.- Iberian Fauna. Begun in 1988, with 38 universities and research centres working under the co-ordination of the National Museum of Natural Sciences. After reviewing just 17% of the expected material, the project has already described 19 new genera and 300 new species, as well as 330 species previously unknown on the Iberian Peninsula.

Several other large-scale projects are also refining knowledge of the distribution of Spain's natural heritage:

1.- Inventory of Spanish habitats. Parallel to the application of Directive 92/43/CEE on natural habitat and wild fauna and flora conservation, 250 experts throughout Spain have worked together to draw up a 1:50,000- scale map definition of the 160,000 zones where the habitat types listed in the Directive are found. The importance of this project goes beyond a mere list of areas in Spain that may be included in the Natura 2000 network. The project plans to continue with a permanently updated list of national habitats, including an inventory of other important habitats not covered in Appendix I of the Directive.

2.- National Forestry Inventory and Forestry Map of Spain. The Second National Forestry Inventory has recently been completed after ten years of work. It has involved the establishment of 90,000 geographic points where 30 forestry and ecological parameters are measured. The recently commenced Third Inventory will measure the same parameters at the same points for comparative purposes, ultimately leading to a thorough document on the current trends in Spanish forest ecosystems. To date, the Spanish Forestry Mapping project has completed 92 sheets on a 1:200,000 scale and 748 sheets out of 1,115 on a 1:50,000 scale. The Spanish Forestry Strategy describes the project's achievements and the policies that should be adopted.

3.- Nature Data Banks. Royal Decree 1894/1996, covering the basic organisation of the newly established Environment Ministry, stipulates that one of the functions to be covered by the Subdirectorate-General of Biodiversity Conservation is to produce and update the Nature Data Bank. This database, yet to be physically unified, should cover at least the information obtained from four initiatives developed to differing degrees by the Sub-directorate-General as well as in collaboration with several regional governments. a) Habitats Inventory. b) Flora and fauna species inventory, a collation of information from a wide range of inventories and studies conducted over recent decades, primarily by the Wildlife Area, as well as the species distribution atlas, currently under production. Individual regional governments have produced a massive volume of similar information. This should also be fed into the database. c) The Banding Office database, where all information gathered from tagged wild animals is managed to facilitate research into their migration habits and biology. d) The Hispanat project on natural areas, containing information on more than 1,200 areas of the country. This database includes all the networks of natural areas (Ramsar, wetlands, protected areas, Corine/Biotopes, MaB Reserves, geological points of interest, stretches of rivers, etc.). All of this information should be merged and updated as soon as possible in order to compile the database that must exist by law.

In spite of all this information, however, there is still an alarming lack of knowledge about the taxonomy and geographic distribution of many groups, which has unquestionable effects on the Strategy. There is also a need for standardised, integrated criteria on the measurement and evaluation of biodiversity and parameters.

Many of the above cases are not mere inventories, but also include ex-situ collections of specimens collected for research purposes or the potential individual needs. This is the case of zoos (very few of which comply with conservation requirements), fauna rehabilitation centres and botanical gardens, seed and wild plant banks, scientific collections, cell, micro-organism, semen, and embryo banks, etc., all going to make up a network with an enormous volume of information and material. Tables 12 and 13 list some of these centres.

The importance of these ex-situ conservation-oriented institutions and their organisation into networks to facilitate access to their data and promote complementary action is unquestionable. However, in general terms for almost all of these fields of action, there is a total lack of regulation or control, which seriously diminishes their efficiency and leads to a needless duplication of work. One of the causes is that these centres are not so much part of the strategic planning of the country's biodiversity as initiatives that are generally local and individualised.

The task lying ahead for those concerned with Spain's biodiversity involves knowing not only what exists, but also its current state. The best tools for this are the lists and red books that are usually compiled in taxonomic groups. Such lists indicate the categories of threat according to the results of research into the population size, trends and conservation status of each species.

TABLE 12 SEED BANKS

	LOCATION & INSTITUTE	SPECIMENS	SPECIALISATION
WILD PLANT AND SEED BANKS	BLANES (GIRONA): MARIMURTRA BOTANICAL GARDENS.	250	Medicinal species, Androcymbium
	CÓRDOBA: BOTANICAL GARDENS.	3,100	Flora of Andalucía, ethnobotanical species.
	LAS PALMAS (CANARY IS.) BOTANICAL GARDENS.	1,000	Endemic flora of the Canary Islands.
	MADRID: POLYTECHNIC UNIV.	8,000	Endangered & crossbred species.
	MADRID: BOTANICAL GARDENS.	1,800	Wild flora in genera.
	MALLORCA: BOTANICAL GARDENS.	350	Flora of the Balearic Islands.
	GUADALAJARA: SERRANILLO CENTRE FOR GENETIC IMPROVEMENT IN FORESTRY.	250	Forest species.
	QUART (VALENCIA).	500	Forest flora.
	VALENCIA: BOTANICAL GARDENS.	600	Endemic Ibero-levantine flora.
SEED BANKS & CULTIVATED SPECIES COLLECTIONS	ALAVA: AGRIC. DEPT. BASQUE GOV.	460	Potato.
	ASTURIAS: IEPA.	406	Beans, cider apple.
	BADAJOZ: SIA.	6,266	Lupinus, Trifolium, Medicago, cherry, fig.
	CÁDIZ: JERÉZ STATION.	2,218	Grape vine.
	CÓRDOBA: CIDA.	3,799	Vetch, chick-pea, garlic, olive.
	CUENCA: CIA.	486	Garlic, grain legumes.
	GIRONA: CATALUÑA GOV.	150	Apple, cherry, plum, pear, peach &, apricot.
	LA CORUÑA: CIA.	1,270	Corn, grasses.
	LA LAGUNA: CITA.	745	Argyranthemun, tropical fruit.
	LERIDA: IRTA.	1,060	Wheat, barley, Triticale.
	MADRID: CRF- INIA.	21,793	Wheat, barley, oats, rye, maize, legumes, grain, melon, tomato, green pepper.
	MADRID: CIDA.	495	Green pepper, peach, apricot, Euphorbia.
	MADRID: CIT-INIA.	271	Poplar, pine.
	MADRID: SGIA.	2,462	Grape vine.
	MÁLAGA: CIDA.	154	Strawberry.
	MÁLAGA: CSIC.	1,565	Melon, tomato, custard apple.
	MALLORCA: DPT. AG. PROD.	110	Almond, fig.
	MURCIA: CIDA.	495	Green pepper, peach, apricot.
	PONTEVEDRA: CIF.	370	Chestnut, walnut.
	PONTEVEDRA: CSIC.	2,621	Dactylis, beans, brussels sprouts, grape vine, grasses, cultivated Brassicas.
	SALAMANCA: SIA.	1,198	Lupinus, Trifolium, Medicago.
	SAN SEBASTIÁN: PROVINCIAL GOV.	3,057	Maize
	TARRAGONA: IRTA.	834	Apricot, almond, walnut, hazelnut, persimmon, pistachio.
	VALENCIA: ETSIA.	1,594	Green pepper, tomato, pumpkin, melon.
	VALENCIA: IVIA.	333	Citrus fruit.
	VALLADOLID: SIA.	1,300	Peas, beans.
	ZARAGOZA: SIA.	5,852	Green pepper, tomato, lettuce, beans, garlic, melon, pear, almond, cherry, peach, Populus.
	ZARAGOZA: CSIC.	41	Plum.

SOURCE: EDITORS

TABLE 13 CENTRES FOR FAUNA CONSERVATION AND CAPTIVE BREEDING

CENTRES FOR BREEDING ENDANGERED WILD FAUNA IN CAPTIVITY

IBERIAN LYNX & WHITE-HEADED DUCK. DOÑANA NATIONAL PARK (HUELVA)
IMPERIAL EAGLE. QUINTOS DE MORA (TOLEDO)
IMPERIAL EAGLE. SEVILLEJA DE LA JARA (TOLEDO)
BLUE CHAFFINCH. TAFIRA (GRAN CANARIA)
SPUR-THIGHED TORTOISE, SIERRA MARÍA - LOS VÉLEZ NATURE PARK (ALMERÍA)
BALEARIC TOAD (BALEARIC ISLANDS)
GALLINULE, MARBLED TEAL, CRESTED COOT & TERRESTRIAL TORTOISES. LA ALBUFERA (VALENCIA)
FARTET, SAMARUC & FRESHWATER TURTLE, EL PALMAR (VALENCIA)
HERMANN'S TORTOISE, LES PALMES DESERT (CASTELLÓN)
HUBARA BUSTARD. OLIVA (LAS PALMAS)
EL HIERRO GIANT LIZARD. LA GORRETA (SANTA CRUZ DE TENERIFE)

LIVESTOCK CONSERVATION

LOCATION & BODY	FIELD
MADRID, INIA.	CONSERVATION OF 19 NATIVE HEN BREEDS INCLUDING BLUE ANDALUSIAN
BADAJOZ, CERSYRA-INIA.	BOVINE CONSERVATION: (BLANCA CACARENA AND PALMERA). SEMEN BANKS AND FROZEN EMBRYO
ÁLAVA, PROVINCIAL GOV.	BOVINE CONSERVATION: SEMEN BANKS AND FROZEN EMBRYOS
LUGO, CERSYRA.	CATTLE HERD CONSERVATION (CACHENA, SAYAGUESA, ALISTANA) SEMEN AND EMBRYO BANKS
MADRID, INIA.	ANIMAL GERMPLASM BANKS WITH FROZEN SEMEN FROM SUCKLING SHEEP, PIGS & CATTLE
TOLEDO, CASTILLA-LA MANCHA, INIA.	CONSERVATION OF IBERIAN PIG BREEDS

SOURCE: EDITORS

This tool is indispensable for the design of any conservation plan, all the more so given that resources are scarce and generally distributed according to priorities. Red books on a species scale should be used to define such needs (see Table 14 for a list of those published in Spain). Although the same tools have not been used with natural habitats, they may well be included in the future.

The causes of the problems cannot normally be diagnosed by the taxonomic identity and space/time distribution of Spain's biological diversity alone. What is ultimately needed is a thorough knowledge of the processes involved, reflected in the third section of this book relating to the way that the natural units function, both at species and other organisational levels such as ecosystems. This requirement is also vital for good conservation or usage of a natural

TABLE 14 RED DATA LISTS PUBLISHED IN SPAIN

GROUP	SCOPE	PUBLICATION DATE
BUTTERFLIES	IBERIAN PENINSULA	1976. UPDATED 1985
ORTHOPTERA	IBERIAN PENINSULA	1985
VERTEBRATES	SPAIN	1986 UPDATED 1992
VASCULAR PLANTS	PENINSULAR SPAIN & BALEARIC IS.	1987
VASCULAR PLANTS	VALENCIA AUTONOMOUS REGION	1994
VASCULAR PLANTS	ANDALUCIA	1994
VASCULAR PLANTS	CANARY ISLANDS	1996
VASCULAR PLANTS	ARAGON	1997
LAND VERTEBRATES	CANARY ISLANDS	1992
MARINE FAUNA	CANARY ISLANDS	1992
BRYOPHYTES	IBERIAN PENINSULA	1994 (PORTUGAL)

SOURCE: EDITORS

asset. The vital need to study, quantify and place a value on the impact of our activities on the environment, for example, requires full knowledge of the way that this environment and its components work.

The EU Council established the Corine Programme in 1985 for the purpose of collating information on the state of the environment and conservation in the European Union. Under this programme, the Corine/Biotopes project is aimed at identifying and describing the areas worth conserving in each Member State of what was then the EEC. The co-ordinator and authority for the project was the former Spanish Institute for Nature Conservation (Icona), which designed the Hispanat project in co-operation with the regional governments, as well as on a national scale. Hispanat includes a detailed inventory of areas with natural values in Spain for the purpose of then making a reasoned selection of biotopes or locations and ensuring that the European inventory contains a accurate representation of the richness and diversity of Spain's natural heritage.

The EU Environment Directorate-General (DG XI) has recently been promoting Geographic Information Systems (GIS) for each biotope inventory in the Member States. The DG XI signed a contract with Icona in December 1993 to jointly produce the system for Spain's biotopes. The Biotopes/Hispanat GIS was brought up to date to include the geographic and analytic data on areas included in the two projects. As a result, it is now the most extensive geo-reference database on natural areas in Spain, although it has not been updated since 1996. One currently emerging issue with broad implications is the effective inclusion of information on nature conservation in the Environmental Information and Observation Network (EIONET) under the auspices of the European Environmental Agency, currently embracing 40 nodes on the pan-European level and 500 in individual Member States. The Subdirectorate-General on Environmental Quality is the Spanish Topic Centre between EIONET and the Agency, along with the current 19 designated Regional Topic Centres. The Network also includes other elements (research institutes, universities and national reference centres), and primarily aims to provide objective, reliable and comparable information on a European scale to facilitate the task of environmental protection.

It is also essential to establish indicators of the trends in the state of Spain's natural environment. Indicators facilitate the task of evaluating and monitoring the effects of specific plans

and actions on the components of biological diversity. Biodiversity is an ecological property, and thus its indicators are potentially useful for detecting changes in the basic functions and structures of certain ecosystems, which are caused in turn by external factors. This consideration provides biodiversity with a complementary interest. As well as being an important part of Spain's heritage to be preserved, it should become a recognised instrument for the task of optimising natural resource management.

As far as possible, these indicators should be identical to those established by EIONET and accepted by the Environmental Authorities Network, a body established to link environmental authorities to the preparation and implementation stages of the Structural Funds. They should also have the relatively simple format of objective estimation parameters, including an explicit characterisation of the space and time scales where they can be applied, as well as their target component and the process involved. Once sufficiently well tested, these indicators should be gradually applied to the activities and initiatives that can provide overall information about components of biodiversity, such as forestry inventories, mapping programmes, long-term monitoring programmes, programmes for monitoring corrective measures, etc., provided that they include the appropriate space/time scales. This objective should be given a high priority by the scientific community. Although several methods have already been designed, they should be co-ordinated in order to produce an objective measurement system.

ECONOMIC INSTRUMENTS 3.3

BACKGROUND

The Spanish nature conservation and environment policies were the subject of special attention in the 1980s and the 1990s during the extremely rapid growth process throughout the country, particularly following the transfer of responsibilities to the regional governments. The conservation initiatives and environmental control measures began to consolidate and converge into the current model, in which they are now integrated in a definitive joint, far-reaching environmental policy described by the previous OECD report on Spain as 'complete and modern'.

The Spanish Government's environmental priorities are to combat desertification and erosion, to manage water and wastes in an efficient manner, to improve the environmental quality of urban and coastal areas, and to preserve the country's biodiversity. With the exception of 1994, consolidated expenditure on this policy for the 1987-1994 period grew constantly by 2.66%-3.17%, consuming 0.73%-1.2% of the GDP. Of this expenditure, 11%-15% was covered by the Spanish Government and 85%-89% by the regional governments.

In spite of this growth in the environmental budget, there has been a steady decline in the amounts set aside for biodiversity and landscape protection, in contrast to natural resource usage and management, which have received more, rising from 0.8% to 4.2%. These figures should be used with caution, however, as the accounting system is not perfectly well adjusted to reflect these items.

Spain has also used the joint funding facilities of the European Union in many projects directly or indirectly linked to the protection, maintenance and study of biodiversity. Structural funds (e.g., EAGGF-Guidance wildlife, agri-environmental measures, etc.) have been used beneath their potential, while funds linked to the LIFE programme have been used more intensely. There has also been an under-utilisation of the mechanisms established by European Union Regulation

2078/192 of 20 June on farming methods compatible with environmental protection requirements and nature conservation (Royal Decree 928/1995 covering its applications in wetlands and SPAs; Royal Decree 51/1995 on organic farming, stimulation of native breeds and extensive agriculture, and Royal Decree 632/1995 encouraging compatible methods in the areas of influence around National Parks and other sensitive areas).

The institutionalisation of the Natura 2000 network will not herald the onset of an ad hoc fund (stipulated by Agenda 2000), although part of the funds that may be used in rural development might be used in its financing.

Socio-economic compensation may be a working instrument to supplement others. Certain populations are sometimes asked to forego activities without understanding or accepting the reasons. A typical case is that of people living in protected areas, who find that their possibilities of economic development are limited. Compensation that does not necessarily have to be monetary may be used in some of these cases. There is a broad range possibilities that should be explored in common agreement with the affected population. This should not, however, become the standard instrument because the restrictions imposed by conservation goals should become understood by the public in the same way as they comprehend other types of usage restriction.

Articles 18.2 (protected natural areas in general) and the new Article 22.4 of Act 4/1989 (drafted under Act 41/1997) approach these as general measures without questioning the ultimate productivity of such actions. Many regional governments have special rules on compensation for damage caused by wildlife, and even for those that do not, the State Council of Spain systematically acknowledges the right of governments to compensation for such damage. The dynamics of the Regional Development Plans is also focused towards this compensatory approach. In all cases, compensation co-ordination is still necessary both amongst regional governments and between protected areas and those that are not, given that the profound differences between them are unfair and, logically, poorly understood.

THE NEED FOR A CHANGE IN CONCEPTS

Market instruments are expected to play a fundamental role in environment conservation, particularly in natural resources. Thus, prices established for goods and services should include all costs, including environmental costs, obliging an in-depth analysis of the economic value of Spain's natural heritage.

Many components of Spain's biological diversity lie beyond the scope of normal markets and economic processes. Nevertheless, many industrial sectors and multi-sector activities have negative effects on biodiversity conservation. The intrinsic value of their components normally escapes the decision-making process, given that they tend to follow quantifiable criteria expressed in monetary terms. In order to achieve the goals of this Strategy, these values must not only be identified, but also presented in an appropriate form for inclusion in the decision-making processes.

Thus, heritage and direct usage values (biomass and food production, recreational, aesthetic and cultural values), as well as indirect usage values (protection and biogeochemical ecological functions) are all part of the value of biodiversity usage. Other types of hitherto ignored values relating to options, existence or survival should also be considered. These include values related to the conservation of the genetic heritage of species and ecosystems.

A strategy for the conservation and sustainable usage of biological diversity would obviously be enhanced considerably if the GDP were to include the social value of unmarketable goods. Market mechanisms cannot, however, determine the optimum volume of resources that the

natural system should transfer to the economic system in an ecologically sustainable manner. In addition, efficient resource allocation can only be achieved in the absence of external factors. When effects arise that are external to production and consumption (normally the case in a real economy), market failures appear and cancel out the efficiency of resource allocation, making a degree of public intervention necessary. Essentially, an excessive glorification of the market mechanisms in relation to the biodiversity issue appears to be scientifically unjustifiable and politically inadvisable.

Tentative studies have proposed an economic evaluation of such goods including, for example, the estimated per hectare cost of maintaining the Natura 2000 network (different from the intrinsic value of the habitat). On the other hand, we are yet to see simplified economic models that provide information about the positive or negative economic impact of a given zone on the economy of the surrounding area.

INSTITUTIONAL AND LEGAL INSTRUMENTS 3.4

Section 1 of this Strategy stresses the importance of making society as a whole feel responsible for the conservation and sustainable usage of natural resources, and of encouraging all areas of society and the economy to apply its principles in their respective fields. Governments, however, unquestionably have the greatest responsibility in this field, not due to a paternalistic concept, but because they control two basic tools that can set the pace that society must follow: their capacity to legislate and their top level management responsibilities.

For historical and democratic reasons, the 1978 Constitution of Spain adopted a decentralised political and administrative structure in which the country was divided into 17 Autonomous Regions, recently joined by the autonomous cities of Ceuta and Melilla. The regional parliaments were given broad powers that have been developed and consolidated over the last two decades. The other basic administrative factor is Spain's accession to the European Union in 1986.

The central government is responsible for basic national legislation (including environmental laws) and for the country's international obligations. The Autonomous Regions are able to develop basic laws, establish additional protection measures and are responsible for the management of their own natural resources. The obligations accepted by Spain under its adherence to the Convention on Biological Diversity are thus shared between the central and regional governments.

The national Environment Ministry, created in May 1996, groups a diverse range of environmental responsibilities which were previously dispersed amongst several ministries. The Environment Secretariat-General of the Ministry includes a Conservation Directorate-General, responsible for the Biodiversity Subdirectorate-General. This body is responsible for monitoring the Convention on Biological Diversity, and should therefore be responsible for the impulse required to implement the present Strategy. In other words, it should not only be responsible for the vital role of the Environment Ministry in the accomplishment of this Strategy due to the responsibilities directly entrusted to it, but on a more global scale it should be undertaking the task of promoting and monitoring the action plans put into practice on the basis of the Strategy.

At an internal level, the Conservation Directorate-General also covers the Subdirectorate-General for Forest Resources. The National Parks Autonomous Body, presided by the Environment Secretary-General, is also functionally dependent on the Conservation Directorate-General. This body is also responsible for drafting the initial report for environmental impact studies, but has little say in their subsequent analysis and even less in the final environmental impact declaration.

The Environmental Advisory Council, attached to the Environment Ministry, is formed by representatives from the central and regional governments, research bodies, trades unions, conservationist NGOs and social movements.

Other important aspects of the Convention on Biological Diversity are covered by other ministries such as the Ministry of Agriculture, Fisheries and Food (Spanish Oceanographic Institute, Marine Fisheries Secretariat-General, National Institute for Agricultural and Food Research and Technology), the Ministries for Education (Higher Council for Scientific Research), Industry and Energy (National Patents Office), Foreign Affairs (Spanish Agency for International Co-operation), Justice and Interior (Civil Guard Nature Protection Service).

The Agriculture Ministry is thus promoting the Programme for the conservation and utilisation of phytogenetic resources for agriculture and food. This programme essentially aims to prevent the loss of the genetic variety of native crop strains that have been abandoned, as well as to evaluate and document this material so as to facilitate its utilisation in improvement plans. The programme includes four-year action plans and provides annual grants for projects in the field. The collections of phytogenetic resources covered by the programme form its network of collections.

Regional government authorities are by no means uniform. They generally include an Office or Department which covers most of the environment and conservation-related responsibilities, with differing degrees of unification (e.g., Environment, Agriculture, Territorial Planning Departments). Some regional governments also have interdepartmental co-ordinating bodies, but in general, the situation and state of development of the regional units responsible for biodiversity and the groups of monitoring agents are anything but uniform.

There is a specific need to permit conservation policies to be developed through private associations and non-profit-making foundations. Governments should be able to participate jointly in private bodies that are funded to put certain aspects into practice. The European National and Nature Parks Association and the MaB Programme Committee, for example, fall within this category.

The main body responsible for intergovernmental co-ordination and concerted action between the national and regional governments is the Sector Environmental Conference, which consists of representatives of the Environment Ministry and Regional Government policy-makers responsible for the issue. The Sector Conference is responsible for the National Conservation and Biodiversity Committee. There is also a National Council for Nature Conservation (1989) which supervises co-ordination and co-operation on the matter between the central and regional governments and also sponsors specialist committees including the Protected Natural Areas, Wild Flora and Fauna and Wetlands Committees. The Committee under the Sector Conference and the National Council for Nature Conservation currently duplicate much of each other's work, largely because Act 4/1989, which establishes and regulates the latter committee, is yet to adapt to the

standard models for co-ordination between the State and the Autonomous Regions, formalised under the Common Administrative Procedure Act 30/1992 and the Public Administration Legal Framework.

In theory, this range of bodies no doubt covers all the present needs and possibilities for co-ordination and co-operation between governments on environmental matters, but in fact they are not as active or effective as one might wish. They hold few meetings, their agendas are too brief to cover the real demands, and thus ideally they should work in a much more on-going and effective manner.

The Wild Natural Areas, Fauna and Flora Conservation Act 4/1989 sets the legal framework for conservation and natural resource planning for the whole of Spain. It also establishes the distribution of responsibilities between the central and regional governments. Spain's regional governments have developed the general Act to widely varying degrees, and now there is a substantial range of territorial regulations on protected areas, species recovery, resource planning, etc. In 1995, much of this matter was revised by Constitutional Court sentence 102/1995, which vetoed the use of hunting laws for the purposes of species protection, obliged the co-management of National Parks and established other basic principles on conservation matters. Act 4/1989 includes very few of the Convention on Biological Diversity (1992) mandates. The need to adapt Spanish legislation to the Birds Directive led to Act 40/1997 on the decentralisation of bird capture in Autonomous Regions, while Act 41/1997 adapted the National Parks management framework to Constitutional Court sentence 102/1995.

Spanish national laws with a direct, specific effect on biodiversity conservation and other related issues include the following:

- Legislative Royal Decree 1302/1986 on environmental impact assessment and its Regulation enacted under Royal Decree 1131/1988.
- Royal Decree 439/1990 regulating the National Endangered Species List.
- Order of 23 April 1993 establishing the Phytogenetic Resources Conservation and Utilisation Programme.
- Royal Decree 224/1994 establishing the Environment Advisory Council, modified by Royal Decree 155/1997.
- Royal Decree 1997/1995 establishing measures to protect Spanish biodiversity through the conservation of natural habitats and wild fauna and flora.
- Royal Decree 1682/1997 updating the Official List of Spanish Livestock Breeds.
- Royal Decree 1193/1998, which modifies Royal Decree 1997/1995.
- Order 11 December 1998, which establishes the Spanish Animal Breeding and Germplasm Bank.

Many national laws also have direct conservation implications. They include:

- The 1957 Forestry Act and its 1962 Regulation.

- The 1970 Hunting Act, now a mere appendix due to the transfer of responsibilities to the regional governments.
- The 1971 Seeds and Nursery Plants Act.
- The 1976 Lands Act, now a mere supplement due to the transfer of responsibilities to the regional governments and its declaration as unconstitutional in 1992.
- The 1985 Water Act and its descriptive Regulations (notably Articles 103, 275 and 55 of the Public Water Domain Regulation, applicable to wetlands).
- The 1988 Coastal Act.
- The 1994 Biosecurity Act.
- The 1995 Royal Ways Act.
- The 1995 Freedom of Access to Environmental Information Act.

The 1995 Penal Code includes new environmental crimes, including crime against natural resources and the environment (Articles 325 and 331), and also mentions the protection of flora and fauna (Articles 332 to 337). In Spain, not only wilful harm to species and habitats can be considered a crime, but also the irrational exploitation of natural resources.

Spain is also subject to the main European Union Regulations with conservation repercussions, including:

- Directive 78/659 on the quality of inland waters requiring protection or improvement to become apt for fish life.
- Directive 79/409 on the conservation of wild birds.
- Directive 85/337 on the evaluation of the repercussions of certain public and private projects on the environment.
- Directive 90/313 on freedom of access to environmental information.
- Directive 92/43 on the conservation of natural habitats and of wild fauna and flora.
- Directive 97/11 amending Directive 85/337.
- Directive 97/49 amending Directive 79/409.
- Directive 97/62 amending Directive 92/43.
- Regulation 3528/86 on the protection of forests against air pollution.
- Regulation 4256/88 on the development and protection of forests in rural areas.

- Regulation 2078/92 on farming methods compatible with environment protection and nature conservation.

- Regulation 2080/92 establishing a Community assistance regime for forestry measures in agriculture.

- Regulation 1404/92 establishing a financial regime for the environment.

- Regulation 338/92 on the protection of wild fauna and flora species by means of the control of their sale.

- Regulation 2158/92 on the prevention of forest fires.

International agreements on conservation ratified by Spain include the following:

- *Ramsar Convention* (1971) on internationally important wetlands, especially as water bird habitats, ratified in 1982.

- *Paris Convention* (1972) on world heritage protection, ratified in 1975.

- *OSPAR Convention* (Oslo 1972, Paris 1974) on the protection of the North Atlantic (V protocol on biodiversity signed in 1998).

- *Washington Convention* (1973), on international trade in endangered species of fauna and flora, ratified in 1986. The Conservation Directorate-General, Environment Secretariat-General is the scientific authority while the Foreign Trade Directorate-General under the Economy and Taxation Ministry is the administrative authority (Royal Decree 1739/1997).

- *Barcelona Convention* (1976/1995) on the protection of the Mediterranean Sea, ratified in 1976. Ratification of the IV Protocol on Biodiversity is currently before Parliament.

- *Bonn Convention* (1979), on the conservation of migratory species of wild animals, ratified in 1985. This Convention covers the agreements on the conservation of migratory water birds from Africa and Eurasia (1995) and the conservation of whales in the Black Sea, the Mediterranean and the adjacent zone of the Atlantic Ocean (1996). The latter is still pending parliamentary ratification.

- *Bern Convention* (1979) on the conservation of wildlife and the natural environment in Europe, ratified in 1986.

- *UN Law of the Sea Convention* (1982) on the conservation, usage and administration of living resources, ratified in 1996.

- *Convention on Biological Diversity* (1992), ratified in 1993.

- *Convention on Desertification* (1994), ratified in 1996.

Other related agreements include:

- *International Commitment on Phytogenetic Resources for Agriculture and Food.* Non-binding.

- *World Action Plan on Phytogenetic Resources for Agriculture and Food,* (Leipzig, 1996), which derives from the above Commitment. Also non-binding.

One outstanding part of Spain's international co-operation on conservation is the Araucaria project which aims to establish a broad framework for the contribution by Spanish society to biological diversity conservation in Latin America. It includes biodiversity conservation, the human development of the indigenous populations and the strengthening of organisations and institutions as backing for these points. It is a broad action framework with room for quite different types of projects under the common philosophy of biodiversity conservation and sustainable development.

Two groups of laws are vital for the implementation of zonal and species conservation policies: the declaration of protected areas and lists of endangered species. These are cardinal points which, together with restrictions on hunting and possibly the regulation of river or marine ecosystems, in fact form the core of biodiversity legislation and are the responsibility of the regional governments, both in their design and their application.

PROTECTED NATURAL AREAS

The protection of natural areas is a good means of developing the concept of in-situ conservation defined as the maintenance of the functional processes responsible for biological diversity. Often, however, the public face of these areas is the only one that exists, leading to problems due to an excessive proliferation of infrastructures and saturation of visitors. It is inconsistent to protect the highest quality zones and then immediately saturate them with infrastructure aimed at increasing their capacity to receive visitors.

If public areas are to fulfil their purposes, they should include mechanisms that guarantee the involvement of the local populations. They should permit the preservation and encouragement of the economic instruments that are conducive to biological diversity, promote the economic benefits deriving from the protected areas and ensure that the effects of this management on the target diversity are monitored.

A superficial analysis of the Spanish network of protected natural areas reveals two main features: a heavy inter-regional imbalance in the number of declared areas (although obviously equality is not the aim given that the natural heritage need not necessarily be distributed uniformly), and the incomplete profile of the present network. Both features suggest that one priority should be the declaration of new areas to complement the currently protected areas, communities and ecosystems.

The declaration of protected natural areas has followed distinct patterns in the different Autonomous Regions. Tables 15 and 16 list the distribution of numbers of declared areas and the types of protection. Andalucía, with only 17% of Spain, is responsible for almost half of the almost 3 million hectares in the 524 areas listed as protected by the Environment Ministry Biodiversity Subdirectorate-General. In proportion to area, the Canary Islands Autonomous Region has the largest network and provides the best representation of the natural values of its territory. La Rioja, Galicia, Castilla y León, Castilla-La Mancha and Extremadura lie at the opposite extreme.

Overall, while the actual percentage of protected national land is similar to the European Union average, the number and distribution of Spanish areas that have hitherto been

declared are clearly insufficient, given the country's great natural wealth and biodiversity. The results of the Corine/Biotopes Project show that the present national network (5.8% of Spain's land area) barely covers one third of the areas that have been earmarked by the project as highly important (15% of Spain). This optimum figure of 15% should, moreover, be regarded as a default figure, given that the Corine/Biotopes Project only used biotic factors (habitats and species of flora and fauna) as criteria for choosing areas, and did not consider geomorphological or landscape values, both of which play an important role in any other national network of protected natural areas. Recently, however, Spain has presented the European Union with a list of areas proposed for the NATURA 2000 network which is close to or even slightly above the 15% mark.

The Spanish National Parks Network falls short in its fulfilment of the obligation to cover a representative sample of the key natural systems in the country and thus the first task should be to expand the list. Recently, Act 41/1997, amending Act 4/1989, established the important National Parks Network Management Plan, expected to provide a pattern for the Usage and Management Plans, and the Network Council as the common body to provide an independent network identity to all National Parks, which since the enactment of Law 41/1997 and Royal Decree 1760/1998 have begun to be managed jointly by the Spanish Government and the local Autonomous Regions.

TABLE 15 PROTECTED NATURAL AREAS

AUTONOMOUS REGION	NO	AREA (HA)	REGION SIZE (HA)	AREAS A % OF REGION
ANDALUCIA	83	1,479,208	8,726,800	16.95
ARAGON	27	102,489	4,765,000	2.15
ASTURIAS	19	107,870	1,056,500	10.21
BALEARIC IS.	6	17,601	501,400	3.51
CANARY IS.	145	301,162	724,200	40.40
CANTABRIA	5	35,783	528,900	6.77
CASTILLA Y LEÓN	12	270,541	9,419,300	2.87
CASTILLA-LA MANCHA	6	51,058	7,923,000	0.64
CATALUÑA	66	132,163	3,193,000	4.14
EXTREMADURA	4	35,592	4,160,200	0.86
GALICIA	7	23,153	2,943,400	0.79
MADRID	8	81,199	799,500	10.16
MURCIA	12	40,006	1,131,700	3.54
NAVARRA	100	34,004	1,042,100	3.26
BASQUE COUNTRY	10	69,905	726,100	9.63
LA RIOJA	1	23,640	503,400	4.70
VALENCIA	13	44,330	2,330,500	1.90
ASTURIAS/CANTABRIA/ CASTILLA Y LEON	1	64,660		
TOTAL	**525**	**2,914,364**	50,475,000	**5.77**

ALL AREAS IN HECTARES

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL. ENVIRONMENT MINISTRY

TABLE 16 PROTECTED NATURAL AREA (1)

TYPE OF PROTECTION	ANDALUCÍA	ARAGÓN	ASTURIAS	BALEARIC ISLANDS	CANARY ISLANDS	CANTABRIA	CASTILLA Y LEÓN	CASTILLA - LA MANCHA	CATALUÑA	EXTREMADURA	GALICIA	MADRID	MURCIA	NAVARRA	BASQUE COUNTRY	LA RIOJA	COMUNIDAD VALENCIANA	AST., CANT., CAST. LEÓN.	TOTALS
NATURAL MONUMENT (ACT 4/89, NATIONAL)	.	20	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	21
PROTECTED LANDSCAPE (ACT 4/89, NATIONAL)	.	1	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	6
PARK (ACT 4/89, NATIONAL)	.	2	.	3	.	1	.	1	.	1	2	1	.	.	.	1	.	.	12
N. P. IN SPANISH N. P. NETWORK (ACT 41/1997, NATIONAL)	1	1	.	1	4	.	.	2	.	.	.	.	.	.	.	.	.	1	10
NATURE RESERVE (ACT 4/89, NATIONAL)	28	1	.	1	.	1	.	1	.	1	.	1	1	.	.	.	.	.	35
NATURAL MONUMENT OF NATIONAL IMPORTANCE (R.O. 15-7-1927, NATIONAL**)	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
NATURE ZONE OF NATIONAL IMPORTANCE (ACT 15/75 , NATIONAL**)	.	.	.	.	.	.	.	.	3	.	.	1	.	.	.	.	.	.	4
NATURE PARK (ACT 15/1975, NATIONAL**)	.	1	.	1	.	3	.	1	.	1	2	.	.	.	.	.	.	.	9
NATURAL SITE OF NATIONAL IMPORTANCE (R.D.15-7-27/26-7-29, NATIONAL**)	1	1	.	.	.	.	2	1	.	.	3	1	.	.	.	.	.	.	9
OUTSTANDING TREE (ACT 16/1994, BASQUE COUNTRY)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
NATURAL RECREATIONAL AREA (ACT 9/1996, NAVARRA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
PROTECTED BIOTOPE (ACT 16/1994, BASQUE COUNTRY)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	4
CONSERVATION OF FLORA AND FAUNA ON THE SEABED (ACT 19/1990, CATALUÑA)		.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
NATURAL SITE (ACT 9/1996, NAVARRA)	.	.	.	.	.	.	.	.	.	.	.	.	.	26	.	.	.	.	26
NATURAL MONUMENT (ACT 11 /1994, VALENCIA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
NATURAL MONUMENT (ACT 12/1994, CANARY IS.)	.	.	.	.	51	.	.	.	.	.	.	.	.	.	.	.	.	.	51
NATURAL MONUMENT (ACT 5/1991, ASTURIAS)	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9
NATURAL MONUMENT (ACT 8/1991, CASTILLA Y LEÓN)	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	4
NATURAL MONUMENT (ACT 9/1996, NAVARRA)	.	.	.	.	.	.	.	.	.	.	.	.	.	31	.	.	.	.	31
PROTECTED LANDSCAPE (ACT 11/1994, VALENCIA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
PROTECTED LANDSCAPE (ACT 12/1994, CANARY IS.)	.	.	.	.	27	.	.	.	.	.	.	.	.	.	.	.	.	.	27
PROTECTED LANDSCAPE (ACT 5/1991, ASTURIAS)	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
PROTECTED LANDSCAPE (ACT 8/1991, CASTILLA Y LEÓN)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
PROTECTED LANDSCAPE (ACT 9/1996, NAVARRA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
NATURE ZONE (ACT 11/1994, VALENCIA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
NATURE ZONE (ACT 2/1989, ANDALUCÍA)	31	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	31
NATURE ZONE OF NATIONAL INTEREST (ACT 13/1985, CATALUÑA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
MUNICIPAL NATURE ZONE (ACT 11/1994, VALENCIA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
NATIONAL PARK (ACT 13/1985, CATALUÑA)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
NATURE PARK (ACT 11/1994, VALENCIA)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	9

TABLE 16 PROTECTED NATURAL AREA (2)

TYPE OF PROTECTION	ANDALUCÍA	ARAGÓN	ASTURIAS	BALEARIC ISLANDS	CANARY ISLANDS	CANTABRIA	CASTILLA Y LEÓN	CASTILLA - LA MANCHA	CATALONIA	EXTREMADURA	GALICIA	MADRID	MURCIA	NAVARRA	BASQUE COUNTRY	LA RIOJA	COMUNIDAD VALENCIANA	AST., CANT., CAST. LEÓN.	TOTALS
NATURE PARK (ACT 12/1994, CANARY IS.)					11														11
NATURE PARK, (ACT 13/1985, CATALUÑA)									7										7
NATURE PARK, (ACT 16/1994, BASQUE COUNTRY)															6				6
NATURE PARK, (ACT 2/1989, ANDALUCÍA)	22																		22
NATURE PARK, (ACT 5/1991, ASTURIAS)			2																2
NATURE PARK, (ACT 8/1991, CASTILLA Y LEÓN)							3												3
NATURE PARK, (ACT 9/1996, NAVARRA)														2					2
SUBURBAN PARK, (ACT 2/1989, ANDALUCÍA)																			0
REGIONAL PARK, (ACT 1/1985, MADRID)												2							2
REGIONAL PARK, (ACT 4/1992, MURCIA)													6						6
REGIONAL PARK, (ACT 8/1991, CASTILLA Y LEÓN)							2												2
RURAL PARK, (ACT 12/1994, CANARY IS.)					7														7
NATIONAL BIOLOGICAL RESERVE, (R.D. 3.128/82, ASTURIAS**)			1																1
INTEGRAL RESERVE, (ACT 9/1996, NAVARRA)														3					3
NATURE RESERVE, (ACT 11/1994, VALENCIA)																	3		3
NATURE RESERVE, (ACT 8/1991, CASTILLA Y LEÓN)							1												1
NATURE RESERVE, (ACT 9/1996, NAVARRA)														38					38
CONTRACTED NATURE RESERVE, (ACT 2/1989, ANDALUCÍA)																			0
SPECIAL NATURE RESERVE, (ACT 12/1994, CANARY IS.)					15														15
INTEGRAL NATURE RESERVE, (ACT 12/1994, CANARY IS.)					11														11
INTEGRAL NATURE RESERVE, (ACT 13/1985, CATALUÑA)									3										3
INTEGRAL NATURE RESERVE, (ACT 5/1991, ASTURIAS)																			0
PARTIAL NATURE RESERVE, (ACT 5/1991, ASTURIAS)			6																6
PARTIAL NATURE RESERVE, (ACT 13/1985, CATALUÑA)									51										51
SITE OF INTEREST, (ACT 11/1994, VALENCIA)																			0
SITE OF SCIENTIFIC INTEREST, (ACT 12/1994, CANARY IS.)					19														19
TOTALS	83	27	19	6	145	5	12	6	66	4	7	7	12	100	10	1	13	1	524

** PENDING RECLASSIFICATION

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL. ENVIRONMENT MINISTRY

In addition to those listed in Table 16, Spain also has other types of protected areas covered by regional and municipal legislation or specific policies (fishing, sea, hunting, forestry and urban planning regulations) along with others established under international laws.

The aim of the EU Birds Directive 79/409 is to conserve species in their wild state through the protection of their habitats and the administration and regulation of their exploitation. Member States must declare the most appropriate conservation areas as Special Protection Areas for Birds (SPAs). They must also take steps to prevent the pollution or deterioration of these habitats and any disturbance that might affect the birds. To date, 172 of such areas have been declared in Spain, forming one of the most congruent networks in the country although there is still yet to be any formal, official publicity on the existence or size of these SPAs (see Table 17). There are also 38 Spanish wetlands on the Ramsar list of internationally important wetlands. The objective of the Ramsar Convention is the effective conservation of wetlands through the application of appropriate protection and restoration measures, while taking into account other planning measures for specific sectors (Table 18).

Spanish biosphere reserves are declared under the UNESCO Man and Biosphere programme (MaB). These areas are gaining ground as a form of protection. Their purpose is to respond in practice to the increasingly urgent need to reconcile the conservation of biological diversity with the desire for economic and social development and the maintenance of the associated cultural values. Spain currently has 15 Biosphere Reserves covering a total area of 965,772 hectares (Table 19).

TABLE 17 SPECIAL PROTECTION AREAS FOR BIRDS (SPAs)

REGION	NUMBER	AREA (HA)
ANDALUCÍA	22	986,130
ARAGÓN	7	167,440
ASTURIAS	3	43,756
ASTURIAS-CASTILLA Y LEÓN	1	16,925
ASTURIAS-GALICIA	1	1,740
BALEARIC IS.	16	61,240
CANARY IS.	27	161,492
CANTABRIA	1	7,087
CASTILLA Y LEÓN	11	187,670
CASTILLA-LA MANCHA	26	976,533
CATALUÑA	6	61,888
MELILLA	1	50
EXTREMADURA	6	190,639
GALICIA	3	5,934
LA RIOJA	6	161,040
MADRID	7	178,371
NAVARRA	15	71,913
BASQUE COUNTRY	1	23,000
VALENCIA	9	33,103
TOTAL	169	3,335,951

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL. ENVIRONMENT MINISTRY

TABLE 18 RAMSAR WETLANDS

AUTONOMOUS REGION	NAME OF AREA	AREA (HA)
ANDALUCÍA	CABO DE GATA SALT MARSHES	300
	ADRA COASTAL LAGOON	75
	CÁDIZ LAGOONS: DE MEDINA & SALADA	158
	SOUTHERN CÓRDOBA LAKES: ZÓÑAR, RINCÓN & AMARGA	86
	ODIEL MARSHES	7,185
	DOÑANA NATIONAL PARK	50,720
	FUENTEDEPIEDRA LAKE	1,364
	CORDOBILLA & MALPASILLO RESERVOIRS	1,972
ARAGÓN	CHIPRANA LAKES	162
	GALLOCANTA LAKE	6,720
BALEARIC IS.	IBIZA & FORMENTERA SALT MARSHES	1,640
	S'ALBUFERA, MALLORCA	1,700
CANTABRIA	SANTOÑA & NOJA MARSHES	6,907
CASTILLA-LA MANCHA	TABLAS DE DAIMIEL NATIONAL PARK	1,928
	DE LA VEGA/ PUEBLO LAKE	34
	ALCÁZAR DE SAN JUAN LAKES	240
	PRADO LAKE	52
	MANJAVACAS LAKE	231
CASTILLA Y LEÓN	VILLAFÁFILA LAKES	2,854
CATALUÑA	AIGUAMOLLS DE L'EMPORDA	4,784
	EBRO DELTA	7,736
EXTREMADURA	ORELLANA RESERVOIR	5,500
GALICIA	ORTIGUEIRA & LADRIDO ESTUARIES	2,920
	CORRUBEDO BEACH, DUNE & LAGOON COMPLEX	550
	VALDOVIÑO LAKE & BEACH	
	UMIA-GROVE, LA LANZADA, PUNTA CARREIRÓN & LAKE BODEIRA INTERTIDAL COMPLEX	255 2,561
GALICIA/ASTURIAS	EO OR RIBADEO ESTUARY	1,740
MURCIA	MAR MENOR	14,933
NAVARRA	PITILLAS LAKE	215
	LAS CAÑAS RESERVOIR	101
BASQUE COUNTRY	LAGUARDIA LAKES (PRAO DE LA PAUL, CARRALOGROÑO, & CARRAVALSECA)	42
	MUNDAKA-GUERNIKA ESTUARY	945
VALENCIA	HONDO RESERVOIR	2,387
	LA MATA-TORREVIEJA SALT MARSHES	3,693
	SANTA POLA SALT MARSHES	2,496
	PRAT DE CABANES-TORREBLANCA	812
	L'ALBUFERA, VALENCIA	21,000
	PEGO-OLIVA MARSHES	1,290
TOTAL		158,288

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL. ENVIRONMENT MINISTRY

TABLE 19 MAB BIOSPHERE RESERVES

NAME	AREA (HA)	YEAR DECLARED
GRAZALEMA	32,210	1977
ORDESA-VIÑAMALA	51,396	1977
MONTSENY	17,372	1978
DOÑANA	77,260	1980
LA MANCHA WETLANDS	25,000	1980
SIERRAS DE CAZORLA Y SEGURA	190,000	1983
ODIEL MARSHES	8,728	1983
LOS TILES	13,931	1983
URDAIBAI	22,500	1984
SIERRA NEVADA	190,000	1986
UPPER MANZANARES BASIN	46,728	1992
MENORCA ISLAND	68,905	1993
LANZAROTE ISLAND	90,460	1993
SIERRA DE LAS NIEVES & ENVIRONS	93,930	1995
CABO DE GATA	50,000	1997
TOTAL: 15 BIOSPHERE RESERVES	978,420	

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL. ENVIRONMENT MINISTRY

The marine reserves established under the fishing legislation (Ministerial Order 11 May 1982) are an effective form of protection for many coastal species and habitats. Some regional governments have also established other types of reserve such as Nature Parks (including a marine reserve), Underwater Park, Marine Reserve, Marine and Fisheries Reserve, Marine Protection Zone and Off-limits to Fishing Zones. The national Marine-Terrestrial National Parks Act 4/1989 (Cabrera Island is the only one to have been declared) opened the way to the possibility of such reserves, while the Autonomous National Parks Body manages Chafarinas Island as a National Hunting Reserve. Table 20 shows the areas in Spanish territorial waters listed as protected in April 1998. With more than 1,5000 km2 of protected waters, heads the European list in this respect.

ENDANGERED SPECIES LISTS

Until the passage of Act 4/1989, Spanish fauna only received indirect protection under hunting and fishing laws. The Endangered Species List was established under this new legislation and was developed under Royal Decree 439/1990, with four categories for related species of flora and fauna. The list includes 526 regions, shown in groups and categories in Table 21. Eight Autonomous Regions have also completed or nearly completed their own regional lists, some of which include distinct categories from the national lists.

If a species or population is included in the National List, measures must be drafted for the return of the species or populations to a favourable state. In the case of endangered species, the regional governments where the species are found must design and publish recovery plans, normally with Decree status, including the co-ordination and financial measures required to set the plan in motion (Table 22). Under Royal Decree 439/1990, the National Nature Protection Commission is empowered to add Guiding Criteria to recovery plans for

TABLE 20 PROTECTED MARINE AREA

NAME	TYPE	DECLARED	LOCATION	AREA (KM²)
PALMA BAY	FISHING RESERVE	1982	BALEARIC ISL	20.00
DETABARCA ISLAND	MARINE RESERVE	1986	ALICANTE	14.00
SONABIA POINT (MOURO ISLAND)	FISHING RESERVE	1986	CANTABRIA	1.00
MARO (CERRO GORDO)	NATURAL AREA	1989	GRANADA	12.20
MEDAS ISLANDS	MARINE RESERVE	1990	GERONA	5.50
COLUMBRETES ISLANDS	MARINE RESERVE	1990	CASTELLÓN	44.00
CABRERA ARCHIPELAGO	MARINE/LAND NATIONAL PARK	1991	BALEARES	87.00
CAPE NEGRE	MARINE RESERVE	1993	GERONA	0.50
CAPE SAN ANTONIO	MARINE RESERVE	1993	ALICANTE	2.50
CAPE DE PALOS (HORMIGAS ISLANDS)	MARINE RESERVE	1995	MURCIA	18.90
GRACIOSA ISLAND (ISLETS NORTH OF LANZAROTE)	MARINE RESERVE	1995	LANZAROTE (CANARY IS.)	707.00
CABO DE GATA (NIJAR)	MARINE RESERVE	1995	ALMERÍA	120.00
IBIZA SALT FLATS (FORMENTERA & FREUS)	NATURE RESERVE	1995	BALEARIC IS.	
RESTINGA POINT & LAS CALMAS SEA	MARINE RESERVE	1996	EL HIERRO IS. (CANARY IS.)	7.50
ALBORÁN ISLAND	MARINE RESERVE	1997	ALBORÁN SEA	4.30
ALBORÁN ISLAND	FISHING RESERVE	1997	ALBORÁN SEA	490.0

SOURCE: COMPILED BY J. CORRAL

TABLE 21 NATIONAL ENDANGERED SPECIES LIST

GROUP/CATEGORY	THREATENED	SENSITIVE TO HABITAT DISTURBANCE	VULNERABLE	SPECIAL IMPORTANCE
VASCULAR PLANTS	55 + 64	.	.	5
INVERTEBRATES	1 + 8	+ 1	.	.
FISH	2	.	+ 1	5
AMPHIBIANS	1	.	.	20
REPTILES	1	+ 1	.	40
BIRDS	11 + 4	+ 3	+ 4	268 + 1 - 9
MAMMALS	4	.	+ 4	35 - 2
TOTAL	**75 + 76**	**+ 5**	**+ 9**	**373 - 10**

BASIC NUMBERS INDICATE NUMBER OF SPECIES INITIALLY LISTED, TOGETHER WITH SUBSEQUENT ADDITIONS AND REMOVALS

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL. ENVIRONMENT MINISTRY

species or groups of species with an inter-regional presence. Conservation Plans are also envisaged for vulnerable species, along with habitat conservation plans for those that are sensitive to habitat disturbance.

Recovery plans are important instruments for ensuring commitment to the management of the most seriously endangered species. Little progress has been made on their development and application in comparison with the potential scope of the Act. There are currently 149 species listed as threatened and hence requiring such plans. Considering that almost all are distributed over more than one Autonomous Region, there should be many more recovery plans in operation than the current 14 (Table 22). Although the lack of a recovery plan does not necessarily mean that action is not being taken on behalf of the species, the law nevertheless obliges them to be drafted as a basic step towards the co-ordination and improved effectiveness of these actions.

The National Livestock Breeds List discussed in Section 2.2.3.2 has a different purpose from the Endangered Species List. It not only includes endangered breeds, but also aims to provide a thorough list of existing species. The inclusion of an endangered species on the list is no guarantee of its conservation. If the list is to be a legislative tool for conservation, there should be a specific conservation programme for each endangered species, taking into consideration the numbers remaining and their characteristics, with a focus on the prevention of the loss of genetic variability.

TABLE 22 RECOVERY PLANS FOR ENDANGERED SPECIES

COMMON NAME	SCIENTIFIC NAME	AUTONOMOUS REGION
NONE: DIOSCORIACEAE PLANT	*Borderea chouardii*	ARAGÓN (1994)
WHITE-HEADED DUCK	*Oxyura leucocephala*	CASTILLA-LA MANCHA (1995)
BEARDED VULTURE	*Gypaetus barbatus*	CATALUÑA (1994), ARAGÓN (1995), NAVARRA (1995)
BLACK STORK	*Ciconia nigra*	CASTILLA Y LEÓN (1995)
BROWN BEAR	*Ursus arctos*	CASTILLA Y LEÓN (1989), CANTABRIA (1989), ASTURIAS (1991), GALICIA (1992), NAVARRA (1996)
PYRENEAN IBEX	*Capra pyrenaica*	ARAGÓN (1993)

SOURCE: NATURE CONSERVATION DIRECTORATE-GENERAL. ENVIRONMENT MINISTRY

4 PROCESSES AFFECTING BIODIVERSITY BY ACTIVITY SECTOR

Since people first appeared on the Earth, they have used natural resources as just another component of the biosphere, causing alterations to the biological diversity of their surroundings. From the very beginnings of agriculture until the huge operations carried out nowadays in tropical forests or the high levels of energy consumption and intensive industrial processes, the human race has gradually and increasingly altered the face of the Earth. The repercussions on biological diversity have for the most part been negative, directly or indirectly affecting each and every one of its main component parts: habitats, species and genes.

Development models exclusively based on productivist criteria, and a lack of foresight, along with scarce knowledge and lack of suitable assessment of the effects on biological diversity at times when society lacked information and awareness of this problem constitute the axis from which the growing number of negative effects on biodiversity conservation and economic activity radiate.

These factors pervade the main sectors of economic and social activity, which are, in the last instance, directly or indirectly responsible for the different negative impacts on biological diversity. Designing effective measures for the conservation and sustainable use of biodiversity requires, firstly, the identification of both the processes having negative or positive effects and the sectors with activity that entails such processes.

Table 23 summarises the sectors, processes and negative effects that the former two have on biodiversity conservation as identified during the participative process to draft this strategy. Further details by sector are given in Annexes I to XII. They seek to serve as an initial indicative guide for drafting sector plans, which are referred to in Part Three of this strategy. Those sector plans must establish, in the greatest detail that the existing information allows, the processes in each specific sector, what effects they have on biological diversity and what measures are needed to avoid those effects. The plans must also order them according to seriousness with the aim of prioritising measures. The third part of this strategy sets out the bases for drafting and monitoring the plans, the guidelines that must serve as a guide for drawing them up and a few more specific measures, which should be implemented urgently.

TABLE 23 PROCESSES THAT MAY HAVE A NEGATIVE EFFECT ON BIODIVERSITY CONSERVATION (1)

SECTORS	PROCESSES	EFFECTS
AGRICULTURE AND LIVESTOCK FARMING	- Changes in land use - Removal of plant cover - Wetland drainage - Intensive agriculture and livestock farming - Soil and water pollution - Overuse of water resources - Land overuse - Loss of productive capacity in soil - Direct mortality of animals and plants - Overgrazing - Soil erosion - Disappearance of native varieties and breeds - Loss of traditional knowledge and management techniques	- Population decrease - Disappearance of species - Loss of genetic diversity - Disappearance of breeds and varieties - Population fragmentation - Fragmentation, modification and destruction of habitats and ecosystems - Loss of landscape diversity
FORESTRY	- Changes in land use - Changes in vegetation cover - More intensive forest production - Forest fires - Introduction of exotic species and genomes into the natural environment - Resource overuse - Facilitate vehicle access to natural areas - **Atmospheric pollution - **Recreational Activities	- Disappearance of species at local and regional levels - Population reduction - Loss of genetic diversity - Population fragmentation - Fragmentation, modification and destruction of habitats and ecosystems - Loss of landscape diversity
FISHING AND AQUACULTURE	- Resource overuse - Mortality of species not liable to be fished - Transformation of marine inshore waters - **Water pollution - **Alteration to coastal environments, - **Recreational activities - Introduction of exotic species and genomes and pathogenic agents into the natural environment	- Population reduction - Disappearance of species at local and regional levels - Loss of genetic diversity - Population fragmentation - Fragmentation, modification and destruction of habitats and ecosystems - Loss of landscape diversity
HUNTING AND FISHING	- Mortality of animal species - Installation of game fencing - Introduction of exotic species and genomes - Genetic pollution - Excessive livestock load of game and fishing species - Overuse of resources - Use of non-selective mechanisms to eradicate species	- Population reduction - Population fragmentation - Extinction of species and subspecies - Loss of genetic diversity - Movement of species due to competition with introduced species - Fragmentation of and alteration to habitats and ecosystem functioning

** THE ASTERISKS INDICATE PROCESSES THAT AFFECT THE MARKED SECTOR, BUT WHICH MAINLY ORIGINATE IN OTHER SECTORS

TABLE 23 PROCESSES THAT MAY HAVE A NEGATIVE EFFECT ON BIODIVERSITY CONSERVATION (2)

SECTORS	PROCESSES	EFFECTS
LAND PLANNING AND TOWN PLANNING	– Changes in land use – Consumption of "natural" land – Alterations to relief – Urban and industrial build-up – High impact infrastructures – Uncontrolled urban development – Construction of infrastructures and other high impact features – Lack of overall regard for environmental values and biodiversity outside built-up areas: residues, waste, etc. – Degradation of peri-urban areas – Suburbanization of the countryside, including the surroundings of very valuable natural areas – Vehicle access to natural areas	– Population movement and fragmentation – Local disappearance of species and subspecies – Loss of biodiversity – Fragmentation, alteration and destruction of habitats and ecosystems – Scenic impacts on landscape – Loss of landscape diversity
TRANSPORT	– Broad-scope and high-impact infrastructures – Increasing occupation of natural land – Alterations to relief – Alterations to the atmosphere – Air, soil, water and acoustic pollution – Overuse of non-renewable resources – Risks arising from transport of hazardous materials – Destruction of the ozone layer – Global warming – Climatic change	– Reduction in population numbers – Population fragmentation – Loss of genetic diversity – Fragmentation, alteration and destruction of habitats and ecosystems – Landscape impact
WATER POLICY	– Changes in land use and land conversion – Overuse of water – Reduction in quality due to pollution, salinization and other phenomena – Pipelines, especially the interbasin type – Reservoir eutrophication – High-impact infrastructures – Wetland drainage – Alterations to river systems, including the course and relief of the beds – Uncontrolled extraction of gravel etc., which leads to overuse of resources – Usurpation of Public Water Domain – Insufficient control of activities in the Public Water Domain – Mortality of animal species – Introduction of alien species and genomes	– Population reduction – Local and regional extinction of species and subspecies – Population fragmentation – Genetic contamination – Loss of biodiversity – Fragmentation of and modification to habitats and ecosystems – Movement of species due to competition with introduced species – Impact on landscape – Loss of landscape diversity

TABLE 23 PROCESSES THAT MAY HAVE A NEGATIVE EFFECT ON BIODIVERSITY CONSERVATION (2)

SECTORS	PROCESSES	EFFECTS
HEALTH	– Overuse of biological resources – Pollution from effluent and solid waste – Genetic contamination	– Population decrease – Local and regional extinctions of species and subspecies – Loss of genetic diversity
TRADE	– Resource overuse – Imbalance between supply and demand for renewable resources – Trade in endangered species – Trade as a potential threat – Import (and possible release of alien species and varieties) – Poaching induced by high prices	– Reduction in population – Extinction of species and subspecies – Population fragmentation – Loss of genetic diversity – Fragmentation, alteration and destruction of habitats and ecosystems
ENERGY	– Installation of infrastructures: reservoirs, electric power lines, wind power sites – Overuse of non-renewable resources – Air, soil and water pollution (including thermal contamination) – Release of radioactivity – Solid waste production	– Population reduction – Population fragmentation – Loss of genetic diversity – Population fragmentation – Fragmentation, alteration and destruction of habitats and ecosystems – High impact on landscape – Loss of landscape diversity
TOURISM	– Changes in land use – High impact urban development – Spread of urban sites in the countryside – Exceeding ecosystem carrying capacity – Water pollution – Waste generation – Behaviours incompatible with biodiversity conservation – Resource overuse	– Population reduction – Population fragmentation – Local extinction of species and subspecies – Loss of genetic diversity – Fragmentation, modification and destruction of habitats and ecosystems – High impact on landscape – Loss of landscape diversity
INDUSTRY	– Changes in land use – Air, soil, water and acoustic pollution – Overuse of resources – High impact infrastructures and installations – Alterations to relief, including river systems – Waste generation, including toxic and hazardous waste – Increasing introduction into the natural environment of substances that it cannot assimilate – Low level of re-use and recycling – Introduction of exotic species and genomes into the natural environment (specialist industry) – Destruction of the ozone layer – Global warming – Climatic change	– Population reduction – Disappearance of species and subspecies – Population fragmentation – Loss of genetic diversity – Fragmentation of and alteration to habitats and ecosystems – High impact on landscape – Loss of landscape diversity

SOURCE: EDITORS

5 PERIODIC UPDATING OF THE BREAKDOWN

The breakdown is the result of the analysis of the situation that existed when this strategy was drafted. Given the dynamic character of biological processes and their administrative repercussions, the situation undergoes constant change. This does not invalidate the breakdown's informative character; it simply reflects the starting point when the lines of work and activities to change that situation are drawn up, especially as regards reducing, halting and, ideally, reversing the processes that have a negative effect on the conservation and sustainable use of biological diversity.

The breakdown is, therefore, an overall indicator of strategy implementation and of the results of the mechanisms that the latter must generate: sector plans, regional strategies and even local strategies, etc. Thus, it is planned to review and update on an ongoing basis the information contained in the breakdown -and everything considered relevant at any time- and periodically formalise it in the form of a specific document. Receipt of and search for information must be ongoing, to the extent that changes are ongoing. As the aforementioned formalisation cannot be ongoing, a two-year period is proposed. This means that every two years it will be possible, on an overall basis and with greater certainty in some aspects than in others and regardless of other monitoring mechanisms, to assess in what way the proposals that inspired this strategy are being fulfilled and to what extent the objectives that were set are being achieved.

Periodic updating of the breakdown must be just as collective a task as were the drafting and editing of this strategy, in the same way that implementation and practical operation of the strategy will have to be throughout the country. A team integrated in the Technical Monitoring Unit will be responsible for collecting and processing the data. Its members will also draft and make public the breakdown updates within the aforementioned deadlines. The whole of Spanish society should take part in the ongoing updating of the data. To do so, the organisational system adopted by the unit will be given the requisite publicity. The unit should be set up immediately.

This updating will, in the end, be the basic pillar for the reorientation of the strategy that will probably be necessary over time, especially in certain sectors or particular aspects, given the different rates at which changes and achievements of proposed strategy actions take place.