

The PEIN does identify a total of 144 areas whose combined surface amounts to almost 655.000 hectares, which represents nearly 21% of the surface of Catalonia. The protected natural areas are associated with a special protection plan, by means of which rules and regulations are established for the protection and the regulation of the territory. In 2001, 112 of the said areas already have plans (in 12 of the cases they are plans previous to the PEIN's date of approval; 51 have been finally approved and the processing of 49 is at an advanced stage).

The methodological quality of the PEIN's design and launch process does provide a very interesting framework for other regions around us. The challenges to be overcome so that it can be efficaciously implemented, related, to a great extent, to the necessary political and social backing and to the provision of human and material resources, were made clear in a symposium organised in 1998 to reflect on how the PEIN was working five years after its approval. Since this is not a end - oriented plan aimed at a particular objective, but the start of a process which develops in the context of environmental management and territorial organization, it is necessary to assume that conflicts will appear with other sectorial policies and that coordination mechanisms are to be prepared to help to solve these problems.

Information sources: Catalanian Government, 1996; Pintó and Vila, 1998; Mallarach, 1998b.

6.2. The situation in Andalusia

The Andalusian region has a natural heritage of great relative importance in the national and in the European context. Its geographical situation between the Mediterranean Sea and the Atlantic Ocean, and between the continents of Europe and Africa, has contributed to create a rural culture which, up to very recent times, has known how to keep a high biological and landscape diversity in the territory.

This rural culture, based on a balanced exploitation of the resources, has given rise to a heterogeneous landscape in the Andalusian territory, where mixed systems of forestry and pasture and traditional agricultural practices have made it possible for a remarkable wealth of species, biological communities and

ecosystems to persist, as a result of the spatial and temporal mosaics remaining linked, in the manner of a spatial grid, by hedgerows, groves and island forests, among others.

Having said that, the Andalusian territory is nowadays undergoing a process of temporary changes in which the exchange of views is becoming relevant between the traditional and the contemporary exploitations and productive processes. The situation inherited from the nineteen-sixties economic boom, in which the market conditions of traditional products were altered, which resulted in the gradual abandonment of the rural world's traditional activities, the successive cattle crises resulting from the African swine fever or from the recent spongiform encephalopathy, an agrarian policy in favour of the development of intensive production techniques, and a large expansion of communications infrastructures in the whole of the rural environment, have triggered off an important process of simplification of the Andalusian landscape. The main implication of these gradual standardization of the landscape is being translated into a gradual loss of biological diversity and of the habitats which the traditional rural culture had itself created and kept over the centuries (Díaz Pineda, 1998).

In its current situation, the Andalusian territory is fast evolving towards a nature desert into which cultural landscapes are integrated in an unconnected manner, where, in spite of a growing fragmentation, it still remains a relative diversity of ecosystems, biological species and cultures; however, within the said landscapes the survival of ecological processes is under threat as a result of the gradual isolation thereof.

However, the new trends included in the framework of conservation policies in Andalusia, in keeping with the rich cultural heritage of this territory, which has the highest number of protected areas to be found anywhere in Europe, lead us to believe that it is possible to reverse the atomization trend of the preserved areas, and to successfully combine the social, economic and cultural connectivity with the connectivity of ecological processes. In this regard, the best opportunities can be found in the materialization of the strategy of the Andalusian Network of Natural Protected Areas (hereinafter to be called RENPA) and in that of the new plans and programmes concerning the organization of the territory and the conservation of the natural environment with a regional and sub-regional scope, as well as in the implementation of the new conservation-related guidelines in the national and European context.

6.2.1. The RENPA Strategy. Towards a systemic management of the Andalusian protected territory

Since 1989, when the initial inventory of protected areas in the Andalusian territory was approved (Act 2/89), new elements have been gradually incorporated into it in order to create a network consisting of 127 areas which, under different protection concepts (Figure 6.2.1), occupies almost 19% of the region's surface.

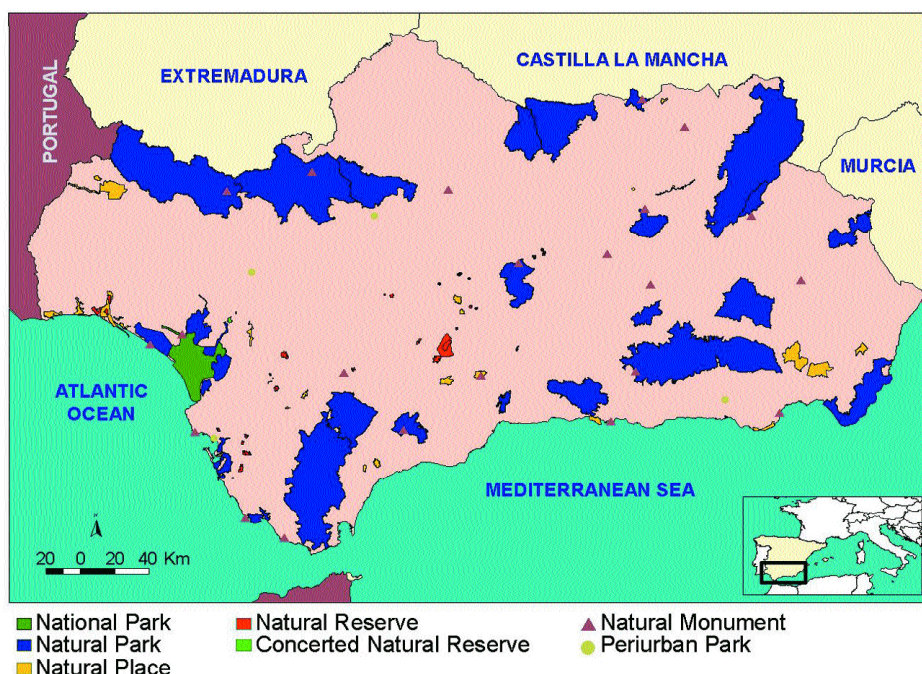


Figure 6.2.1. Natural areas included in the RENPA, according to the protection categories as included in the Act 2/89, enacted on the eighteenth of July, by virtue of which the inventory is approved of the Andalusian Natural Protected Areas, and additional provisions are laid down for their protection.

Originally, the Network of Natural Protected Areas was characterised by the unitary management of its constituent elements, without envisaging the concept of network or system. However, the current importance and complexity of the Andalusian protected heritage, together with the new conceptual trends prevailing in the international scene in matters pertaining to the conservation and the management of protected areas, have boosted and favoured the development of a new strategy, the RENPA Strategy, focused on the establishment of an ecological

and economic network that may be managed and planned at a systemic level, and in which, in addition to the protected areas themselves, the linkages among them be taken into consideration as well as the social, economic and environmental matrix into which they are integrated.

In this context, the RENPA does envisage the rational organization of a part of the Andalusian territory with a view to achieving the preservation of their systems, in the land and in the sea, and the sustainable development of large areas. The network is defined as the combination of the protected areas and their connections, being organised in a functional-mesh structure, to which other protected areas can be connected in the future, and whose management is carried out in an unitary and integrated manner.

The devising of this Strategy has been based, from a conceptual standpoint, on the discipline of Landscape Ecology, by putting forward a management model going beyond the boundaries of the protected areas, and being based on the knowledge of key ecological processes which bring about the operation of protected or protectable natural systems.

To structure the Strategy and to achieve the said process, the following stages have been established and are currently being put into effect:

- Previous stage: Communication and divulgement of the strategic process
- Stage I: RENPA Diagnosis
- Stage II: Development and implementation of the conceptual weft
- Stage III: Demonstration projects

Among the reference documents which have been used in the development and implementation of the conceptual weft, the Action Plan prepared by Europarc-España for Spain's natural protected areas becomes specially relevant (2002). In this document, in which the need is highlighted to integrate the protected areas into the planning of the territory as a whole, as well as the need to include elements aimed at achieving territorial connectivity, a series of recommendations are put forward to attain an efficient system for the conservation of protected areas. Along this line, the RENPA strategy has accepted a large part of these recommendations in its methodological approach, and diverse relevant actions have been dealt with, with a view to their being materialized at a future stage in the appropriate action plan. On the other hand, the RENPA diagnosis is based on a SWOT analysis of the current situation of the Andalusian protected heritage in relation to its planning, resources, administrative

operation, management and populating. Such a diagnosis, which uses the eco-regionalization of the Andalusian territory as a starting point, aims at acting as a point of reference for the preparation of the plans concerning the regulation and the management of the Network as a whole, as well as at establishing a solid frame of reference for the future assessment of the general trends of the Network and of the different types of natural areas which make it up.

In the framework of this Strategy, the Andalusian Wetland Plan (PAH) also adheres to the management of ecosystems as a conceptual web. Its operational end is that of preventing and preserving the ecological integrity of the wetlands, as well as to try and restore it in all those cases in which it has been degraded or destroyed. It acknowledges, on the one hand, that the contribution made by the biodiversity to the operation of the wetlands not only derives from the number of species being present, but also from the ecological role played by each one of them and, on the other hand, from the need to directly or indirectly manage these ecosystems, at different spatial and temporal scales. From the management standpoint, the PAH envisages three fundamental levels of reference: the network and the wetland complex, the wetland in conjunction with its superficial or underground basin and the lesser-rank ecosystems within the wetland (macrophyte prairie, sandy bottoms, helophyte belt, etc) (Figure 6.2.2). The Wetland Complex includes the whole of the wetlands which, being conditioned by their morphogenetic characterization, do operate as a system. The Wetland Network would be made up of knots (wetlands) and linkages being defined by the biological flow established by aquatic birds. From the standpoint of the PAH the migratory flows and the movements of the aquatic birds are important not only for the conservation of their populations, but also for that of other groups of organisms, as well as for the keeping of the ecological integrity of some ecological types of wetlands. In that way, the wetlands sharing these biological flows cease to be discrete units to become part of a network.

On the other hand, and set within the framework of the RENPA Strategy, the Action Plan for the Andalusian Marine Protected Areas, is based on the acknowledgement of the spatial heterogeneousness of the marine habitats and on the need to preserve the structure and functionality of the ecosystems in their entirety, by means of the interconnection of the marine protected areas within networks having an eco-regional scope.

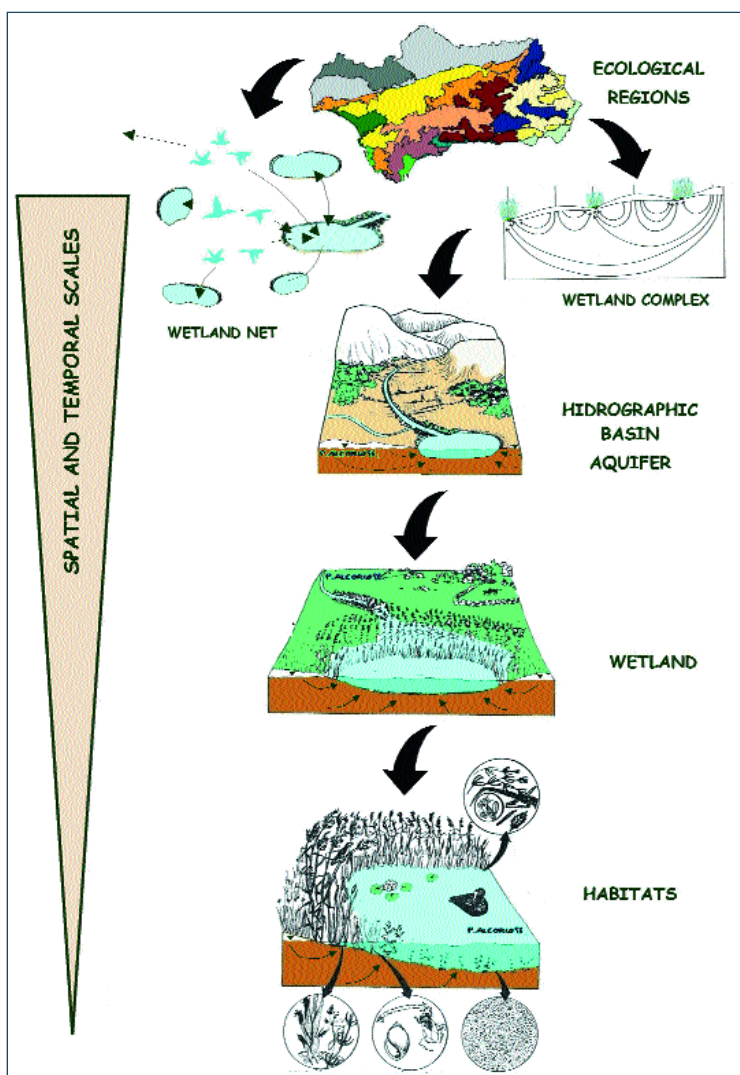


Figure 6.2.2. Hierarchy of the interdependent analysis and management units under consideration in the PAH. Starting from a large scale related to a certain homogeneous biophysical unit within the ecological regionalization of Andalusia, the most detailed one, either at the habitat or microhabitat level, is reached. Between these ends the Action Plan does develop management measures at the level of Network, Complex, Basin and Basin Fold. Depending on the ecological type of wetland and on the problem to be dealt with one or more levels of action are considered.

6.2.2. Opportunities for the territorial integration of the Andalusian protected areas. The territorial Organization plans of a regional and sub-regional scope.

One of the key aspects of the systemic management of the protected heritage, as it has already been explained above, is the integration of the protected areas into the planning of the territory. In this regard, the new territorial model envisaged in the Andalusian Territory Organization Plan (POTA) provides one of the best chances to achieve the said integration. Such model takes into consideration the web of ecological relations which define the territory and, accordingly, incorporates the ecological basis as a necessary point of reference for the whole of the strategies concerning the territorial articulation, the economic integration and the sustainability of the social and economic development. Among others, it envisages as a strategic action the configuration of a Regional Protection System (SPR) of natural and cultural resources of territorial interest, by means of the integration of the protection elements into coherent and interconnected networks. The SPR would consist of the Andalusian Network of Natural Protected Areas, the future Special Conservation Zones of the Natura 2000 Network, the Special Protection Non-Developable Grounds being delimited both by the municipal Urban Planning and by the Special Plans for the Protection of the Physical Environment and some milieus of cultural interest. Its final goal is the creation in the Andalusian territory of an integrated system of ecological, cultural and recreational relations. These interrelations and connections are being tried to be developed through ecological and cultural corridors by using, specially, the river courses and the livestock ways. In this regard, the materialization of the POTA will become, in the medium term, one of the greatest strengths in the improvement of the connectivity between protected areas, and between these and the ecologically non-neuter matrix into which they are integrated, as well as in the establishment of buffer zones around the protected areas of Andalusia. On the other hand, the Organization Plans being sub-regional in scope, some of which are already in the information stage such as the one for Doñana or the one concerning the Bay of Cadiz, include among their general objectives the preservation of areas having environmental, landscape and cultural values, and guarantee the exploitation of the existing potentialities in keeping with the objectives set in the Plans for the Regulation of Natural Resources and in the Ruling Plans for the Use and the Management of protected natural areas in their territorial environment.

6.2.3. New potentialities to improve the RENPA's connectivity.

In achieving a protected-area planning system, which is just as important as the taking into consideration of the very conservation core-areas and the permeability with the surrounding environmental matrix, it is indispensable to favour the connectivity among the different elements which configure the conservation network.

The idea of creating a Network of Ecological Corridors in Andalusia, as a tool to achieve the integration of the protected areas from the administrative and natural standpoint, starts to be developed coinciding with the new conservationist concept which rates the interconnection among protected areas one of the more efficacious measures for the preservation of the protected values. The web of royal cattle tracks, ways and paths which make up the Andalusian Network of Livestock Ways, measuring 24.015 Km including neither the broken stretches, nor those overlapping infrastructures, nor those being a part of population centres, are one of the elements of the territory having the greatest potentialities to articulate and configure this network of spatial connectors linking the areas belonging to the RENPA.

The ecological function of the livestock ways has been widely highlighted in the basic legislation and in the Andalusian Rules and Regulations developing it. Both corpora juris, refer to livestock ways as essential elements for the migration, the geographical distribution and the genetic exchange of wild species. In that regard, the Plan for the Organization and Recovery of Andalusian Livestock Ways, approved in March 2001, does envisage the ecological use among the three types of complementary uses put forward, giving these routes a basic role as corridors for the dispersal of the fauna and flora throughout administratively consolidated natural protected areas. Within this context, 4.899 Km of livestock ways have been classified as having an ecological use in Andalusian, and a series of routes have been established based on the network of livestock ways linking either areas of broken distribution of emblematic species or well-preserved natural areas, among which the RENPA areas and the areas put forward by the Andalusian Regional Government as Sites of Community Importance are included.

Among the main initiatives which are being put into effect to provide these landscape elements with an ecological functionality the *Dos Bahías Green Corridor* (88.5 Km) stands out, consisting of 12 livestock ways, in which revegetating works are being carried out in the margins as well as landscape

restoration works in the most degraded stretches. Its main objective is that of acting as a territorial link between the *Bahía de Cádiz* and the *Los Alcornocales* natural parks, on the one hand, and the *Marismas del Río Palmones* Natural Area on the other hand, both from a natural and a social and economic standpoint.

Although the real functionality of the livestock ways as linear corridors is far from clear in highly transformed Mediterranean environments, such as Andalusia, in which, in the majority of cases, the small width of the edge vegetation does not allow the dispersal of the biological components throughout distant protected areas, the ecological functions deriving from their reticular nature provide the territory with natural maturity and quality (Gómez Sal, 2001). In this context, the continued existence within the Network of elements of relict dots of natural vegetation, and the coincidence with other natural elements of the landscape, linear and broken, provide the landscape with heterogeneity and connectivity.

In conjunction with the Plan for the Organization and Recovery of Andalusian Livestock Ways, the Andalusian government has launched other initiatives aimed at enhancing the diversity of the rural landscape and, accordingly, to improve the weft of links between natural and naturalized. Among these initiatives the setting in motion must be highlighted, jointly with the Andalusian Committee for Ecological Agriculture, of one of the objectives envisaged in the Andalusian Forestal Plan (1989), namely, the diversification of rural landscape through the conservation and the recovery of forestal enclaves in agricultural areas. The measures undertaken to restore and keep the natural heritage being represented by the natural elements which traditionally were integrated into the agrarian matrix, hedgerows, copses, groves and island forests, have been dealt with by directly involving the owners of agricultural land. In this regard, the Andalusian government is acting in a capacity as an advisory management body, by supplying the specimens of vegetation and the necessary technical advice for the diversification of cultivation fields.

The ecological connectivity in the framework of the *Guadamar Green Corridor Project*

The *Guadamar Green Corridor Project*, promoted by the Andalusian Government as a response to the accident which happened in 1998 in the Aznalcóllar mines (Andalusian Government, 2001), aims, on the one hand, at restoring the ecological functionality and the dynamic equilibrium of the hydrological system in the basin of the River Guadamar from an ecosystemic approach, and , on the other hand, at trying and improving the standard of living of the basin's inhabitants.

The project, developed by taking as a starting point the bases established in the *Guadamar Green Corridor Strategy*, is aimed, among other objectives, at the re-establishment of the natural connectivity which the river and its basin used to provide between Sierra Morena and the Doñana coastal region. It is being articulated through the very river course, and it incorporates into its design other territorial connectivity elements such as hedgerows, livestock ways and ditches, which increase the vectorial flows of matter and energy between the coastal region and the mountains. In the final analysis, it is the project's goal to become a tool for the development of the RENPA, and to act as a showcase project on the integrated planning of Mediterranean basins that can be exported to other river systems in the region.

Four major lines of work are being used for its development: i) Monitoring, control and redress of pollution; ii) Design of the Ecological Corridor; iii) Ecological restoration and iv) Integration into the natural and human systems. The development of each one of these lines is carried out by taking as a starting point specific action programmes based on the results achieved through the Green Corridor Research Programme (PICOVER). On the one hand, from the start of the project a monitoring programme has been established for each of the alignments as an assessment tool of the effectiveness of the measures undertaken and as an instrument to modify and adapt the specific objectives and the methodological procedures according to the information generated in the process.

The restoration of key processes, which are determining factors of the Green Corridor's ecological integrity, has been set to take place in two stages. A first stage of active restoration, in which man-made elements having a negative influence on the hydrological and geomorphological features of the

basin environment have been eliminated; and a second stage, based on the passive restoration of the ecological processes by means of an adaptable management model.

The actions undertaken have been focused, on the main, on the *Entremuros* marshland, belonging to the Doñana Natural Park and affected by the accumulation, which took place over several months, of the acid waters from the mine's spillage, and on the banks and the alluvial plains which were affected by the polluting sludge.

For the restoration of the marshland ecosystems the situation as it was in the early fifties was established as a frame of reference, prior to the regularization of the river and to the agricultural transformation of the valley. The works, which were finished in March 2001, have made it possible to recover its character of floodable marshland and have facilitated the natural re-colonization of the characteristic biological component of these coastal ecosystems.

For the restoration of the alluvial plain ecosystems the recovery of the dynamic equilibrium of the river system has been taken as a point of reference, by giving priority to the re-establishment of the area's morphological reconstruction processes.

In the design of the Ecological Corridor (De Lucio et al., 2000; 2002), one of the key aspects which have been taken into account is the heterogeneity of the landscape and the possibilities of connecting the different ecosystems of the environment at a basin level. In the first stage the identification and characterization has taken place of the landscape's linear components being potentially functional as ecological corridors for the focal species laid down in the *Guadamar Green Corridor* Project. A second step has consisted in analysing the spatial structure of these elements within the landscape, by estimating the density, the dispersal, the fragmentation and the structural connectivity. Later on, by means of the assessment of the different organization patterns of the linear elements in the structure and the functionality of the landscape, spatial models of functional connectivity have been made, by comparing alternative scenarios. On the basis of the results obtained, it has been possible to prioritize the sectors and the linear elements being of the greatest interest due to their location at sensitive landscape spots, thus guaranteeing a spatial continuity in the dispersal

and the mobility of the species under consideration and in the ecological processes between the mountains and the coastal region, through the Guadiamar river basin, and along the agricultural mosaic. Among the most relevant results, extrapolable in the Mediterranean context, the importance of the scale factor stands out in the design of ecological corridors, as does the importance of the restoration of the natural vegetation patches associated with the agrarian matrix in the increase of the landscape's permeability, determining to a great extent the functionality and location of the dispersal routes.

The final goal of this action is the keeping of the ecological connectivity at the level of basin by taking as a starting point the establishment of a green corridor to act as a refuge for wild species, to link the different habitats and to diversify the landscape. The final efficaciousness will depend on the greater or lesser connectivity achieved between the different patches of the landscape, which are functional from an ecological standpoint.

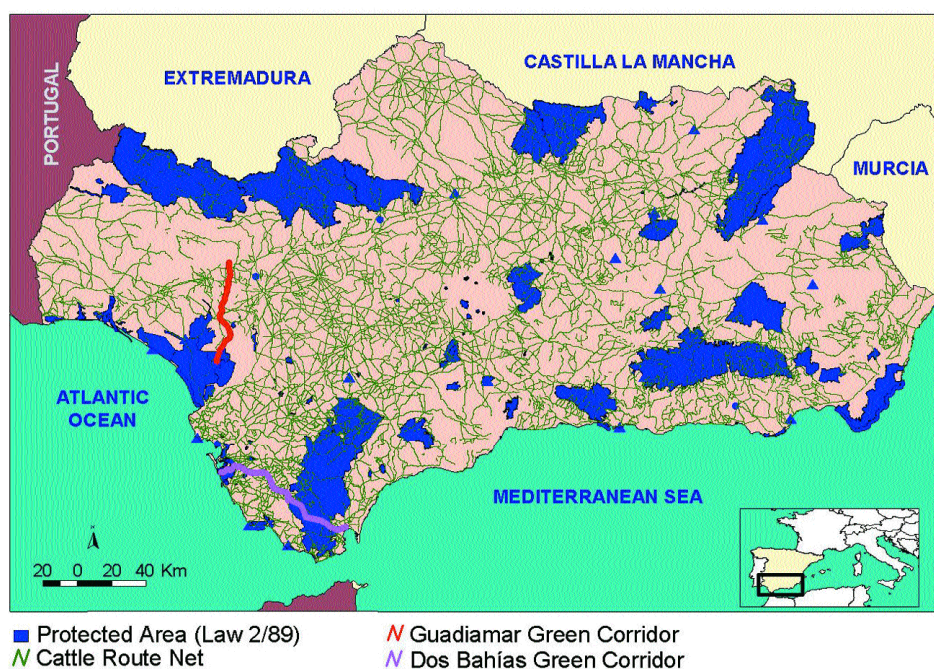


Figure 6.2.3. In view of the high density and the territorial distribution of Cattle Tracks, Ways and Paths making up the Andalusian Network of Livestock Ways, these landscape elements may play a relevant role as spatial connectivity enhancers among the RENPA's protected areas.

6.2.4. Integration of the RENPA into the international conservation networks

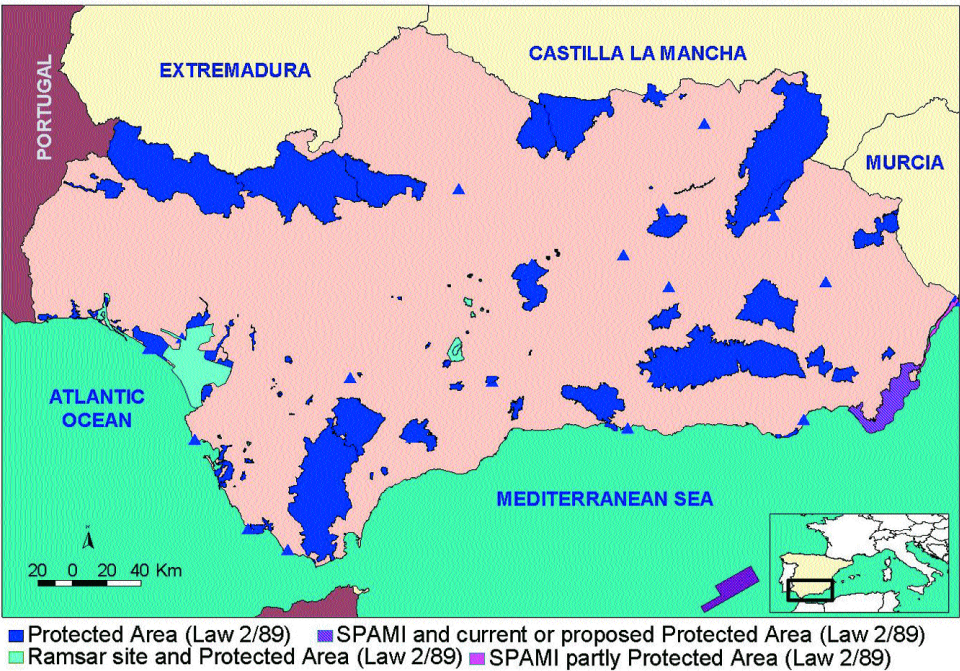
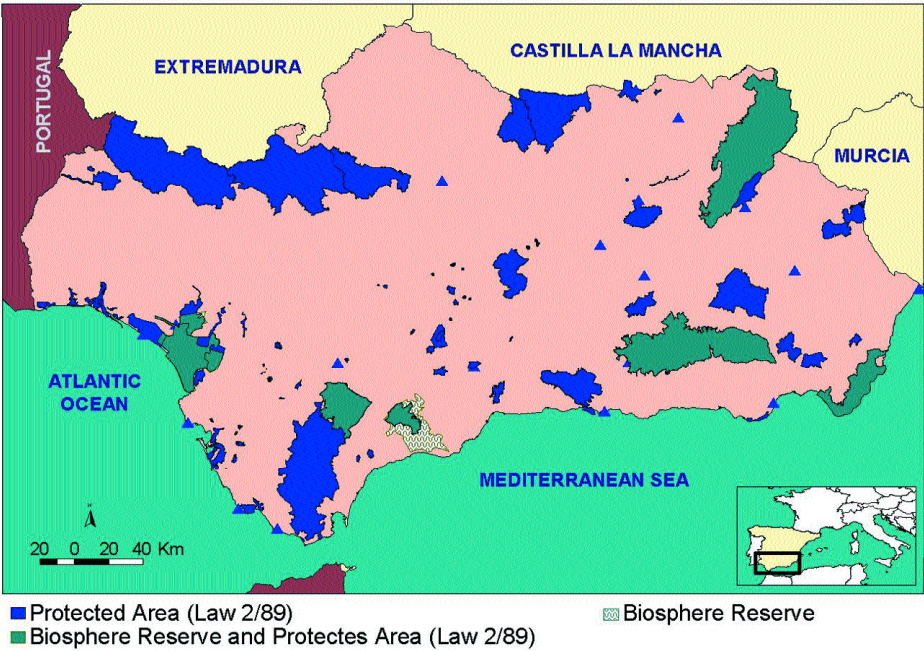
The Andalusian Network of Biosphere Reserves, examples of best human practices in the territory, the Specially Protected Areas of Mediterranean Importance located in Andalusia, the Important Birds Areas, as well as the regional proposal of Sites of Community Importance show, as a whole, a great spatial coherence with the current Andalusian Network of Natural Protected Areas. This fact makes it possible to integrate the elements of the different international conservation networks into RENPA's general protection, planning and management outline.

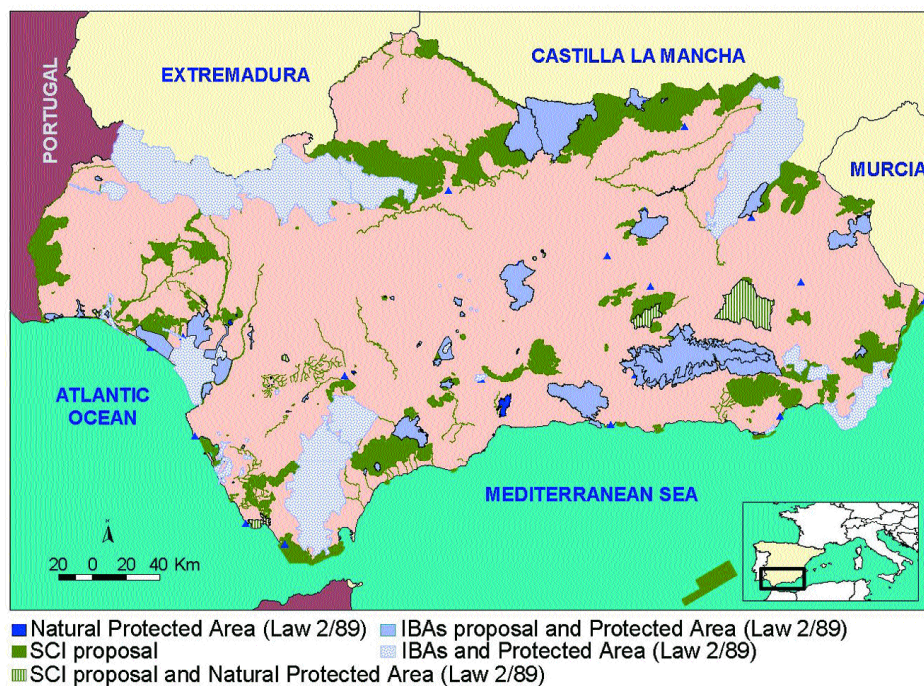
On the one hand, out of the seven areas having been designated Biosphere Reserves by UNESCO (590.341 hectares), two also meet the criteria to be

designated National Park and Natural Park; four are located to a large extent within areas classified as Natural Parks, and one of them, the Odiel Marshland, is a Natural Area. Likewise, the Cabo de Gata-Níjar Natural Park and the Marine Bottoms of Eastern Almería, two of the three Andalusian areas included in the SPAMI list, partake, either partially or entirely, of some of the legal protection concepts envisaged in the Act 2/89. The Isle of Alborán, the third SPAMI element in Andalusia, will be, besides, presently designated as protected area in accordance with the Natural Area concept. The same can be said of the areas designated or proposed as Important Birds Areas, which are included in their entirety in administratively consolidated protected areas.

On the other hand, 99.4% of protected areas in Andalusia are included in the current proposal for Sites of Community Importance put forward by the Andalusian Government in January 2001, only a RENPA surface of 12.398 hectares having been excluded.

In terms of surface, the Andalusian proposal for SCI covers 28.7% of the region, including 193 areas and a surface of 2.586.667 hectares, of which 84.178 belong to marine zones, and in which proposal 62% of the territory is currently covered by some protection concept such as territories not being affected by infrastructures or agricultural crops, 84% belonging to afforested and natural areas and 6,8% to wet areas and water surface.





Figures 6.2.4; 6.2.5. and 6.2.6. The high degree of territorial coherence existing between the protected natural areas pursuant to Act 2/89 and the Andalusian areas included in the different international conservation networks, favours the integration of the latter into the RENPA's general protection, planning and management outline.