# ENVIRONMENTAL SERVICES IN THE BIOSPHERE RESERVES IN SPAIN

## INTRODUCTION

This publication examines the status of the provision of environmental services by the Biosphere Reserves in Spain. It summarizes the specific analysis performed on 24 biosphere reserves in 11 autonomous communities: Andalusia, Aragon, Asturias, Balearic Islands, Castile and Leon, Catalonia, Euskadi, Madrid, Navarra and La Rioja.

The book is a compilation of the environmental services provided by Spanish Biosphere Reserves in 11 different regions. The work is a collaboration between the Ministry of Environment and Rural and Marine Affairs, through the National Parks Autonomous Body, and several universities in the Spanish territory

In the Madrid Action Plan-MAP-(2008) guidance document for the development of the MAB Program, developed the concepts of biosphere reserves as "laboratories for sustainability." This process is essential to deepen the knowledge of the goods and services we are receiving from the media.

The GPA was adopted by the International Coordinating Council in February 2008, at the World Congress of Biosphere Reserves, and identifies three emerging challenges of global reach, which have made it necessary for the MAB Programme to adapt and change to to respond effectively to these new challenges. Among these challenges is mentioned, the accelerated loss of cultural and biological diversity and its unintended consequences on the ability of ecosystems to continue providing essential services for the welfare of humanity.

With regard to this problem is indicated in the Plan that the Millennium Ecosystem Assessment has articulated and described the services provided by ecosystems so that it has obtained the widespread acceptance of public and private sectors and civil society organizations. He adds that the essence of biosphere reserves as places of sustainable development can be seen as the effort to design and develop a combination of site-specific ecosystem services (supporting, provisioning, regulating and cultural). "

Some of the services provided by ecosystems have increased, as the food supply (crops, livestock, fisheries and industrial production), but others have declined

dramatically in the last 50 years, as the use of wood for fuel, fiber agriculture or natural natural foods (Millennium Ecosystem Assessment, 2005; Pergams & Zaradic, 2008). The decrease in services regulation is particularly important because a direct impact on other ecosystem services (Bennet & Balvanera, 2007). The loss of biodiversity reduces management options and increases the vulnerability of ecosystem services. Another major gap is the lack of theories and models that anticipate thresholds that, once exceeded, cause irreversible changes or collapse of services (Millennium Ecosystem Assessment, 2005). It is also necessary to know the thresholds for persistent and massive changes in social-ecological systems, the factors that control the likelihood of such changes and emerging indicators of such changes .... Therefore, the challenge is to understand the dynamics of ecosystem services and human welfare, both of which interact locally and globally

Biosphere Reserves, *"have been designed to respond to one of the essential questions facing the world today: how to reconcile the conservation of biological diversity, the search for economic and social development, and maintenance associated cultural values "(UNESCO,* 1996). Thus, while in the Reserves for environmental services and conservation can serve as a support for a new development model, on the other reserve, the dynamics of conflict raises important development with the conservation of such services. For this reason, in the first case, the conservation objectives can be made active by the local population and administration while in the second recurrent demands faced in redefining the roles, boundaries and objectives of the Reserve and its area of influence.

INTERNATIONAL REFERENCES

MAB: the vision that inspires the MAB Programme encourages spatial models in which ecosystem services go to be at the heart of development plans to promote. Many of these services have traditionally derived direct benefits for the residents of the territory, giving them the opportunity to develop traditional economic activities such as livestock, hill farming, forestry, forestry, fishing, etc..

The MAB program, when to value the land and life of the communities that inhabit it, is twofold: first, strengthening the identity and esteem of those communities and on the other hand, foster appreciation of these territories , its people and the fruits of their labor in the society at large, mostly urban character.

Highlight as central references on this subject the Millennium Ecosystem Assessment (MEA, 2005) and the Economics of Ecosystems and Biodiversity (TEEB, 2009). It is necessary to assume the guidance of the *Convention on Biological Diversity* (CBD, 1992) that requires moving the traditional models of *"resource management"* new approaches *"ecosystem management",* assuming ethical principles of *sustainability and equity.*

The TEEB promotes the assessment of *ecosystem services* in *biophysical* or *sociological,* beyond *economic and monetary* assessment, identifying and assessing from different criteria, *ecological, socio-cultural* and *financial performance.*

## ENVIRONMENTAL SERVICES

Ecosystem services were defined in the Millennium Ecosystem Millennium UN as "benefits that humans obtain from ecosystems" (MA, 2003).

We will analyze the functions and services provided by ecosystems of these two reserves, considering those proposed by the Millennium Ecosystem Assessment: Roles and Regulatory Services, Production, and Cultural Rights, based in each case the most significant. In the Study *Ecosystem Assessment (MA,* 2005) are classified into four types of services:

> 1) supply (food, water, energy), 2) regulation (such as water purification and climate regulation), 3) cultural services (education, leisure) and 4) support services that keep all other services (nutrient cycling, soil formation).

Ecosystems are natural capital that is necessary to retain to provide services such as climate regulation, carbon sequestration, soil fertility, pollination, filtering pollutants, providing clean water, flood control, recreation and aesthetic and spiritual values . These ecosystem services have an impact on the prosperity of human society, and not only its economy but also the health, social relations, freedom or safety. It is necessary to develop tests for the study and application of ecosystem services that allow the definition of areas relevant to the provision of ecosystem services.

In many cases these services, as they have been parceled out and appropriate, have been privatized, which leads us today to manage, largely through market relations. This has happened, in fact, energy, wood and earth, and so on. In such cases, we try

to introduce public policy and regulatory criteria that permit limit or condition these relationships and induce market prospects for sustainability in the general interest of society as a whole and for future generations.

The important thing, beyond the methodological challenges and the usefulness of monetary value, is to recognize that, from the standpoint of economic analysis, ecosystems function as any form of capital (generate a flow of services over time and capital stock can be kept intact if the services are consumed in a sustainable manner). The contributions of Hein et al. (2005) and Farber et al. (2006) agree on a classification that includes three basic types of services, in line with the proposal of the Millennium Ecosystem Assessment (MEA, 2003): provisioning services, regulating and cultural. This initiative of the United Nations Program for Environment also proposes a fourth type of services called "support", which corresponds in part to the primary value of life support from Turner et al. (2000).

VALUATION OF ENVIRONMENTAL SERVICES

The first step in assessing the natural environment is the definition and determination of environmental units homogeneous in terms of the factors evaluated. S olo inventoried BD, the CO2 is based on the literature, if investigate leisure. Divide the territory into environmental units (by type of habitat, land use gralmente) and assign a qualitative estimated 1 to 4 for their support SA (BD), regulation (CO2) and cultural (leisure). The natural forests and gallery are worth 4, mature hardwood plantations a value of 3 coniferous and a value of 2. Eucalyptus plantations planted in dense populations exclude any other species, so its value is 1. To all the young forest plantations, whether hardwood or softwood, are assigned a value of 1 due to its low number of species. The meadows and marsh communities have value 4.

There is an overlap in the spatial location of the highest values of biodiversity and some services such as recreational use, which coincide in 98% of its surface. Ie, 98% more area for recreational use value is within the area of greatest biodiversity value. The overlap of biodiversity in the regulation of the hydrological cycle is also very high at 70.3%, while with carbon storage is lower (13%).

Since consistency in *environmental economics,* the focus is on *"internalize"* the intangibles in monetary values, conceptualized as *"externalities."* This kind of approach just leading to decision criteria based on *cost-benefit analysis* the traditional once *internalized* environmental intangibles. In the case of *environmental economics,*

the logic of the *market* is determining just decisions, to the extent that is assumed to be adequate to optimize the utility of available goods, including goods and ecosystem services. However, since the *green economy,* it is argued that markets do not understand, nor the principle of *sustainability* and other ethical principles such as *equity.*

The problems of what is valued as an ecosystem service and from what measures or criteria are valued those services, add the question of who should be valued. More and more the idea grows that the valuation of these services must be a social value and not just a technical assessment.

The inertial and recovery capacity of ecosystems against critical changes, linked to the health of these ecosystems, makes good ecological status in reference to require application of the precautionary principle. In any case, to define and parameterize the *good ecological* ecosystem continues to be a social construction that society should do, every time, with the available knowledge. It is designing and decide what we mean profiles should be retained. Having established the environmental, open space efficient alternatives to ensure the objectives in question, to finish selecting the cheapest option (lowest cost).

Definitely one of the fields in which the valuation of *ecosystem services* is more urgent water management and aquatic ecosystems. The new Water Framework Directive (WFD), adopted in 2000, clearly assumes the *principle of sustainability,* so that the central objective of the Act is to restore and preserve the *"good ecological status'* of aquatic ecosystems (rivers, lakes wetlands, etc.) and the *"good status"* of the aquifers. DMA emerges even in a new legal principle: the *"principle of non-deterioration" ("Non Deterioration Principle").* The WFD establishes the need for change, traditional *resource management models,* new and more complex models of *ecosystem management.* As is understood that the forests can not be managed as mere lumber yards, the WFD requires an understanding of rivers as *living ecosystems* and not simply.

The complexity of the problem .... The final solution, so pragmatic and effective, the key lies in *the planning methodology.* Such planning should be done within the watershed (marking), as a territory in which nature operates, both the continental water cycle, such as aquatic life and ecosystems connected banks, deltas and offshore industries. To do this, the WFD requires the responsible authorities the definition of the different water bodies, such as specific habitats. Second, it must identify water bodies

and similar habitats in *good ecological status,* so that they become the reference target. In a third step must be evaluated current *ecological status* for each body of water.

The direct beneficiaries of these services are the farmers and ranchers who conduct their activity in this area and thereby contribute to the maintenance of existing natural resources. It also benefits the whole society, especially the tourism sector, for the maintenance of these ecosystems provides information services aesthetic, recreational, scientific, and so on. The valuation of these services has been made on the basis of existing literature and knowledge technicians working environment in this reserve.

MOUNTAIN

Some of the most relevant services related to the aquatic ecosystems of the Reserve are:

- The provision of regulated water course for irrigation and hydroelectricity.

- The provision of high quality water for urban uses.

- Minimizing the rate of silting of reservoirs.

- Providing natural landscape values and tourism projections.

Grasslands, called ports (ports Pyrenees in some publications) were summer grazing of large herds of sheep and worked with fire to promote grassland. The areas of the Valley of the Moon and Sil rivers, being flat areas have been a place of settlement of towns and farms where they are located meadows.

WETLANDS

The marsh also serves as a natural buffer, absorbing and dissipating storm surge flooding, and the Atlantic countryside which helps to maintain the drainage network. The hedges that delineate the various parcels comprising strengthen soil structure and stability by helping to regulate surface runoff and promoting infiltration. Wetlands provide a service for livestock watering

VEGETATION

The process of advancement of natural vegetation, forest and scrub. This process becomes a guarantee for the control of: a) the flood (the cover is an excellent water regulator, which intercepts rainfall and consumes a portion of available water and soil promotes high infiltration capacity and delay that moderate peak flows) (Garcia Ruiz *et al.,* 2008), also on the erosion and declining species

PRAIRIE

The traditional areas of grassland are increasingly valued for the benefits they generate new fronts, unthinkable a few years ago. We refer in particular to water management and risk management of forest fires. The provision of food services for livestock fields generated by just producing other benefits, such as to provide a vegetative cover that prevents erosion with minimal water loss, or reduce vulnerability to risk of fire, for example.

The continuation of such uses will have much to do with the maintenance and preservation of much of this diversity, because as has been observed in recent times, the abandonment of grazing cattle in the mountain passes of the area brings disappearance of the rich pastures of the territory being invaded by shrub communities dominated by gorse, juniper, broom, broom, heather, or heather, depending on the location and substrate of these grasslands.

The removal of shrubs and trees for the pasture has resulted in a decrease in the drainage capacity of soils, to enhance surface runoff processes. These processes are readily observable in the spring with the thaw, when it is frequent to form streams that pass between the pastures and farms causing soil erosion phenomena. This phenomenon is enhanced by the existing steep slopes in the region.

Large amount of manure to high mountain meadows. The herd has been on the one hand because of the loss of soil and other natural productivity maintainer of them. Currently, this sheep has been lost and there are few farms that remain in the clouds, mostly cattle and horses, do not use as a pasture and allow further growth of shrub species. Therefore, it is restarting the process of generation of soils, but instead is being lost from the mountain pasture productivity.

FOREST

The growth process of forested areas at the expense of grassland areas leads to increased biomass and thus of evapotranspiration. Data on evapotranspiration growth

explain Pyrenean headwaters streamflow reductions ranging between 15% and 30% over the last three decades. T he case studies on the subject estimated an increase of only 5-10% woody vegetation cover. The vegetation absorbs atmospheric moisture, the leaves being cold causes condensation and a droplet of water falling to the ground.

Paradoxically, the increase of forest areas experienced in the past occurred as a result of increased financial returns from this activity, but the abandonment of agricultural activity and the absence of alternative income. In the emerging model of local development, forest values are less associated with the traditional uses of environmental services provided by the conservation, such as CO2 capture, protection of water sources, support for biodiversity or the provision of recreational opportunities and landscape that give value to other economic activities such as rural tourism and environmental education.

SOIL

The vegetation plays a relatively important role in soil formation, first by the obvious contribution of organic matter, but also should be noted that the vegetation cover favors chemical weathering effects of the substrate and with it their transformation in soil (Sala , 2004) ... The average annual production in cork oak *(Quercus suber)* of Polell, from 1995 to 2008 was 468g/m2, 550g/m2 ... beech, oak stony 492g/m2, ilex oak 458 g/m2.

No data on nutrient inputs to the ground by this mechanism. However, they obtained information is available in neighboring Sierra Demand. Here, Santa Regina and Tarazona (2000) have been recorded in forest of beech *(Fagus sylvatica)* 39.8 kg ha-1 yr-1 of N, 0.3 kg ha-1 yr-1 of P, 16.5 kg ha -1 years K-1, 26 kg ha-1 yr-1 for Ca and 4.9 kg ha-1 yr-1 Mg. The same authors give values for *Pinus sylvestris* of 46.3 kg ha-1 yr-1 of N, 0.2 kg ha-1 yr-1 of P, 8.6 kg ha-1 yr-1 K, 19, 7 kg ha-1 yr-1 Ca and 2.9 kg ha-1 yr-1 Mg. The data do not have to be very different from the Reserve.

EROSION

It would therefore be to calculate the volume of erosion avoided annually in the territory of the reserve, resulting in that these materials do not end up Medium reservoir silting. This annual reduction in m3/year, should be multiplied by the opportunity cost of irrigation water, which in this case would be the incremental value generated by the Monegros irrigation compared to dryland, the order of 0.1 € / m3. Now, the annual loss should be extended to a period when less than 50 years, applying the appropriate

discount rate, which could be 3%, to estimate the cost impact avoided updated in half a century.

For Hall (1996) to the ground cover of the MBR, it is observed that the erosion and soil loss is approximately of 1,454 mg of soil / year for the entire surface of the MBR. If the surface of the RBM was found devoid of vegetation, soil loss values reach 2368 Mg per year.

Monterey pine *(Pinus radiata)* covers almost half the area of the reserve and its management (fell) causes a significant loss of soil (values of 140 t / ha on steeper slopes) and nutrients by erosion, due to surface runoff (Edessa *et al.,* 1998). This also leads to increased sediment inputs that exacerbate the risk of flooding and accelerate the silting of rivers and the estuary.

At present, the recolonization of slopes by natural vegetation and afforestation limit sediment production and the size of the source areas of sediment. A soil loss must be added the loss of high landscape value of terraced fields environments. The terraced fields correspond to a highly humanized landscape, which crumbles easily with the passage of time. Today it is impossible to guarantee the survival of this landscape, especially in the steeper slopes, but it is important to know how and how quickly evolve, and identify areas that can be stored without special additional effort.

DUNES AND BEACHES:

These systems are extremely vulnerable to erosion, and balance depends on having a positive balance between the contributions of sediment erosion and leakage. Marine ecosystems, in particular *Posidonia oceanica,* are the main sources of sediment, mostly of organic origin, given that there is Menorca continental inputs from rivers.

On the other hand, vegetation that colonized the dunes is primarily responsible for the stability of the system. The loss of the dunes accelerates the decline of the beaches combined with wind erosion, marine erosion. The presence of a cushion cover the retreat of the beach caused by sea level rise is occurring due to global warming (about 1 mm per year in the Mediterranean). A comparison of aerial photographs taken over 50 years apart, revealed that the decline of the beaches is very general, and more intense on the beach with intense tourist use. Some beaches have receded more than 50 meters, and are at risk of extinction threatening to turn to the farm tourism, which loses its most prized resource. The situation is dramatic, the government decided to

carry out restoration projects that capture the sand screens more than a dozen beaches. Also designed new strategies of public use of the same to take into account the conservation of vegetation of the dunes, and modified systems clean beaches to reduce its impact. The cost of these actions can be a good economic indicator of the service could have dune ecosystems as if they had respected his integrity. The OBSAM calculated that in a day of good weather in August may have some 20,000 people lying in the sand. This implies that, on a summer day, more than 10% of people who are on the island are crowded on a surface which has less than 0.05% of the island soil. "

MARINE

*Posidonia* meadows are crucial to the genesis and stability of the beaches. Indeed, this ecosystem is very rich in invertebrates and algae covered shell or fitted with limestone, which are the source of carbonate particles that end up landing on the seabed and, ultimately, in the form of sand beaches. On the other hand, also have a dissipating effect of wave energy by offering some protection to the adjoining beaches from erosion. Other services that have been mentioned in relation to the meadows of *Posidonia oceanica* are:

- Recruitment of juvenile fish species with commercial interests.

- Sequestration of large amounts of carbon in its rhizomes given the low rate of decomposition that necromass has stored.

- Generate an underwater landscape a great attraction for recreational diving.

BIODIVERSITY

Mature forests have an important role in preserving biodiversity. In mature trees sit multitude of plants, lichens, mosses and ferns, which, in turn, create new habitats for other organisms. It is also noted that biodiversity can be applied in this area as an indicator of some of the ecosystem services studied. In this paper only lists inventory of biodiversity. There is an overlap in the spatial location of the highest values of biodiversity and some services such as recreational use, which coincide in 98% of its surface. Ie, 98% more area for recreational use value is within the area of greatest biodiversity value. The overlap of biodiversity in the regulation of the hydrological cycle is also very high at 70.3%, while with carbon storage is lower (13%) ALO, which indicates clearly to protect critical areas

Thus, this refuge and breeding function involves the **maintenance of biodiversity and maintenance of commercial species.** And just in the clouds, this service has a special interest in the catalog of species listed in various catalogs and regulations, and the presence of species of commercial value, as are all game species.

## SOCIAL ISSUES

### TRADITIONAL USES

In Rioja, d rom the eighteenth century was the expansion of agricultural land who kept alive the cause of deforestation (Moreno Fernández, 1994). The cultivated area was expanded to feed a population that peaked in the last decades of the nineteenth century. Recognized and permitted uses are those who have traditionally been conducted in this area: dry farming year and time, ranching and hunting. Table 1 shows the distribution of land use in the Reserve.

In the Canaries, the majoreros have had more than a water culture, a culture of managing water scarcity. They have developed large and varied collection systems this resource that are already part of cultural heritage: *art,* Maret, *topsail* s, *Natera* and *chains.*

### DEPOPULATION

The system of subsistence remains little changed until the late nineteenth century. Thereafter, the loss of the profitability of the work carried out in areas of countryside and mountains, coupled with industrial growth and economic development of flat areas and urban areas has led to the depopulation and an aging areas mountain, a dynamic that has slowed in recent years due to tourism development and the phenomenon of second homes. This situation leads to a change in environmental services, where services for the provision of goods and natural resources have lost their dominant role for cultural and recreational services.

The whole system of management, organization and use of territory for many centuries, began to crumble from the early twentieth century and with great intensity between the fifties and sixties of last century. The transition from an economy of sufficiency or exchanges reduced to a much more dynamic and meant that spatially extensive mountain areas could not compete with other more suitable for the new

economic situation. In this context, numerous villages in the Biosphere Reserve emptied and all the people lost population, sometimes up to 80% of the population quota.

A key concern for the Reserve are the functions that cover and land use have on the regulation of runoff. The vegetation cover, especially forest, water is an excellent regulator. In the Biosphere Reserve have been in the past 60 years important changes with respect to land cover and land use, who have had their impact on the functioning of runoff. Especially important has been the abandonment of agricultural land, increase in area of scrub and forest (Arnáez *et al.,* 2008).

In recent years there has been a decline in the number of farms, due to the progressive abandonment of the countryside and the withdrawal of older people. In many cases, the abandonment of these farms has led to increased surface others, due to its acquisition by other farmers: high mountain grasslands have traditionally been grazed by migratory herds of sheep and merino churra race, while valleys that have served as fodder for cattle bred Friesian alpine brown. Grazing is the main cause of the varied flora existing configuration in the meadows, the meadows and mountain pastures, as it promotes the regeneration and regrowth of many herbaceous species whose conservation depends directly on this.

The main problem with this is the bureaucratization of the forest exploitation, which the older population and aging of the region is unable to assimilate. On the other hand, the population has failed to collect the mountain as a resource that offers the services of supply of raw materials and substrate, but rather as a nuisance. This has led to an abandonment of traditional uses of these ecosystems.

HUNTING

The hunting management seeks to maximize productivity and sustainable hunting use (6 individuos/100ha boar), remaining as one of the highest in the areas of the network of observatories. In the Biosphere Reserve are currently about 70 hectares for the production of truffles and more than 20 producers. In all the Biosphere Reserves of Castile and Leon (except in Picos de Europa) is a hunting and fishing use more or less important. There are numerous hunting grounds, minor and major, and fisheries and game reserves. Hunting and fishing well managed, can help correct maintenance of the mountains and rivers as well as species that live in them, and are a major tourist attraction, which can help the development of these regions.

## CATTLE

The stocking density, ie the relationship between the number of livestock units and use surface acres of the farm livestock, is higher in the beef sector (0.3), followed by sheep (0.2) and the goat (0.05) (Bartholomew, Milan and Plaixats, 2002). Livestock censuses have also fallen since the mid-twentieth century. In the late seventeenth century, the sheep population of the area exceeded 300,000 head, which mostly migrate towards Extremadura and the Valley of Alcudia, in La Mancha. Currently, the census reaches only 31,360 sheep heads (2007), a cabin that hardly accounts for 10% of the traditional cottage. ... Cattle partially replaced sheep and goats. He began his progression in the seventies of the twentieth century, reaching its highest census in the eighties .... natural resources of the reserve could feed almost 23,000 Livestock Units (LU), a cabin nearly triple the current (8292 LU)

The maintenance of natural vegetation and irrigated arable land is a very important activity for the prevention of erosion and should be a priority in the management of the Reserve. Thus, agricultural and livestock activities are of great importance in preserving the environmental values of Bardenas, including the maintenance of soil, but also can produce serious changes when done improperly.

The most important revenue source for the production goat farms

milk, while the meat is a smaller percentage. The main destination of production is the manufacture of cheese with denomination of origin majorero. This was achieved in 1996, establishing itself as the first Spanish goat cheese to obtain the designation. 10% of total cheese production (232 182 kg in 2007) is not intended to market the Canary Islands, especially the U.S., Britain and Germany.

## AGRICULTURE

Agriculture once a year and practiced in the Bardenas in favor dryland organic waste processing by the sheep, which also extends to plant residues on irrigated land. This practice of dry farming allows balanced control of nutrients, as cattle supplies nutrients to the soil during soil rest.

Although there are highly specialized crops such as cherry or olive slopes, it is noteworthy that gradually made less productive crops in terraces are being abandoned. These farms are not currently profitable in increasingly tech agriculture, where trade

competition is growing. A challenge for the Reserve in the future replacement of these terraced fields by woody vegetation, since maintenance is essential to prevent erosion.

MARINE GENETIC RESOURCES

In the marine environment, the existence of natural predators lime urchin *(Diadema antillarum),* such as the drum spiny *(Chilomycterus reticulatus),* the Pejeperro *(Bodianus scrofa),* the rocker sama *(Pagrus charioteer),* or various types of roosters ( *Balistidae Fam)* and bream *(Diplodus* sp.) allowed a slow process of destruction of fisheries resources and ecosystem alteration largest archipelago, with a direct impact on the island economy. Its role in biological control is notable in areas where there has been an overuse of roosterfish, the presence of this sea urchin has manifested itself in virulent form. (I have it in marine tb)

TOURISM

Ecosystem services related to the regulation and production functions are critical for tourism, for its ability to regulate the climate and in the genesis and maintenance of the beaches, or potable water supply. However, the function is related to the information where ecosystem services are the foundation of the industry and the economy, that natural ecosystems are the scenarios that appeal to tourists when choosing your holiday destination . Related intangible aspects of nature are central to tourism, even if it is a sun and beach tourism. The services that ecosystems are obtained at the present time have little to do with those of decades ago. The value of these services varies according to the socioeconomic realities of the times, especially if the analysis is done at a particular instant, like a photograph of a moment. As our economy is now based on tourism and in agriculture (Photo 3), related services and regulatory functions are essential information, while providing services related to the production function, have an importance less.

The tourism industry is based on the "exploitation" of environmental resources, primarily from the beaches and landscapes. The conservation of the natural environment, and especially the coast, is critical to maintaining the tourism industry. These beaches, in turn, depend on the regulatory processes of the ecosystem, particularly in the formation of sediment from the beaches and their protection against erosion. In some cases involving underwater ecosystems, such as *Posidonia oceanica,* in others fixed terrestrial vegetation and dune systems form. The beach erosion is emerging as a major threat to the economy of the islands, precisely because

of the failure of some of the regulatory processes of ecosystems: alteration of the *Posidonia meadows,* destruction of dune vegetation, all combined with a sea level rise caused by global warming.

In La Palma, the various studies of expectations, more than 85% of foreign visitors choose this destination for its natural attractions. In this line, the Biosphere Reserve has been certified for Responsible Tourism Destination. Much of the accommodation offered in La Palma match the profile of rural houses. In Fuerteventura the excellent beaches and wind have made the island a mecca for water sports on waves, such as windsurfing, kite surfing and other variants, are celebrated here as the World Championship series. Pop-up activities are related, among others, whale watching, diving, bird watching, geological routes and night.

At the *University of Zaragoza* have developed several studies to estimate the recreational value of the *National Park Ordesa* applying these methodologies. Specifically, the methodology of *"Cost of Trip"* interprets the travel and stay of tourists as a way to pay for enjoying the natural area in question. *"With respect to the measure of the value of recreational use of National Park Ordesa and Monte Perdido, we have estimated that between 568 million pesetas for hikers and 22,000 million pesetas for vacationers who spend their holidays in PNOMP environment. This can give us an idea of the magnitude of the great social benefits as only one of the functions of this natural space ... "(Alvarez,* 2000).

In Montseny the number of visitors fluctuates over time, although in recent years have seen an increase reaching the peak numbers in 2007 with 643,160 visitors. The evaluation of the importance of environmental units as places for leisure is made by consulting different groups to which they are asked to assess the environmental units on a scale of 1 to 4, depending on your preferences. To do this, there have been 50 surveys of people linked to the territory.

The growth of tourist accommodation and recreational facilities are developing these resources. The transport facilities in recent years has meant that much of the population to leave the region and learn about other regions, and realize the value that has scenic in the region of Bahia,

WATER

Ordesa flows are collected in two large reservoirs, Medium Grade, downstream, which can store 900 million cubic meters, used for irrigation *Irrigation System* in *the High Aragon (RR.AA)* and hydropower. near the Ordesa National Park, it was decided to depopulate the valley of the river Ara to build a large hydroelectric dam, the reservoir of Janov

The Axis of Ebro, which contains a population of nearly 1 million people (main city Zaragoza), has the problem of the Middle Ebro flows are of poor quality. This allows dispose of around 100 million cubic meters of high quality water needed to cover the supply of those million people. The cost of this water desalobrar water for 400 Micro-Siemens/cm would cost around 0.25 € / m3. Therefore, 100 million m3/year have an opportunity cost of € 25 million ... a small reservoir in Marraco (out of the river Gallego) would store winter water outside the irrigation season, derived from the so-called *Embrace of Tardienta* in RRAA System. With this, the channels could be used without competing with irrigation. Both the cost of depreciation and management of these new infrastructures, such as costs RRAA System tariff, should be deducted from the 25 million €.

The projection in monetary value of this service regulated water supply for irrigation is possible from the time studies are available that determine the increase in value added produced compared to rainfed irrigation. Currently the incremental value Monegros would stand about 0.1 € / m3.

On the other hand, in this case, the phenomenon of evapotranspiration of vegetation cover creates a *"dis-service"* in regard to the provision of water for irrigation or other uses. Let's say that the green cover on the one hand, prevents soil erosion, facilitates the infiltration into the aquifers and contributes significantly to generate a function of natural flow regulation is essential to deliver irrigation flows (and other uses); but on the other hand, the vegetation and evapotranspiration consumes a considerable volume of water, as several authors have studied.

Mouth water, until 2009 when there was no legal obligation to chlorinate water for consumption, we used the water in these aquifers directly for consumption, normal being analytical in these waters, without the presence of biological or chemical contamination (reports Neighborhood Boards).

CARBON:

To carry out annual quantifying carbon fixation in the MBR, is proposed to consider an analysis of land cover and carbon stocks and carbon fixed annually by plant communities. The carbon balance and its potential to act as a sink, depends on two essential processes that are part of the activity of organisms, photosynthesis and respiration. The difference between the rate of photosynthesis and respiration, also called net production rate will be equivalent to the capacity to fix atmospheric carbon annually and will provide a quantitative value of environmental services that they perform annually.

Oak forests of the most important, with more than half of the total area (53.73%), followed by beech (11.12%) and various scrub communities (8.24%). The rest covers and plant communities are a relatively small percentage (0.1-3%).

As a general reference data, we can say that in all of Catalonia forests accumulate about 97.5 million Mg1, where 70% corresponds to the aerial parts (trunk, branches and leaves) and 30% to the underground (thick roots) (Grace, 2009). The average forest setting of Catalonia annually is 1.34 Mg C / ha / year (Grace, 2009). The more carbon species *Pinus radiata* is fixed (5.42 Mg C / ha / year) and the least *Quercus suber* (0.78 Mg C / ha / year). Overall, the forests of Catalonia set annually 1.5 million Mg of carbon (Grace, 2009). Considering that the average carbon dioxide emissions attributed to a resident in Catalonia is 10 mg of carbon dioxide per year (Environment and Housing, 2008) shows that the average annual per hectare setting of the ground cover of the RBM contributes to fix annually more than half of the emissions generated by a half its inhabitants.

According to a study by the Ministry of Tourism, Environment and Regional Policy of the Government of La Rioja (2010), forest area in La Rioja totalling more than 300,000 hectares, set annually 1.27 million metric tons of CO2, capturing, then 31% of emissions. From a simple calculation, one can conclude that the Biosphere Reserve, which is covered by 103,000 hectares of forest area (forest and bush) will absorb 10.5% of total greenhouse gases emitted by the Autonomous Community of La Rioja.

In 2008, 820,116 tonnes of Menorca CO2 emitted, or 8.9 tons per person surveyed (7.9 t / person in fact), while in Spain (2007) emissions were 7.7 tons CO2/persona in 9.7 Germany and the U.S. of 19.1 (source: IAE International Energy Agency). The only approach available is a study on Menorca's Ecological Footprint (acres of forest

needed to absorb the CO2 that causes our energy consumption), which uses a fixed value of 4.58 tonnes CO2 / ha.year to forest ecosystems of the island ... .. The current balance would, therefore, negative, and that our ecosystems are currently only make up approximately 36.4% of direct emissions of CO2 from Menorca. Most carbon sequestration occurs in ecosystems dominated by woody vegetation: oaks, pines, bushes, but a significant 30% corresponds to the meadows of *Posidonia oceanica* (these estimates should be confirmed with experimental data and field accurate measurement of the area occupied by *Posidonia oceanica).*

CONCLUSIONS

In general stresses that no single case study and has worked in their valuation Ordesa, Montseny and Urdaibai

Most social issues are addressed, other environmental, other biological, some cheap .. no legal means no need to practice yet. Nobody talks about agri subsidies. It warns the novelty of the subject, and systematic differences in concepts of what are environmental services between different authors.

There is an overlap in the spatial location of the highest values of biodiversity and some services such as recreational use, which coincide in 98% of its surface. Ie, 98% more area for recreational use value is within the area of greatest biodiversity value. The overlap of biodiversity in the regulation of the hydrological cycle is also very high at 70.3%, while with carbon storage is lower (13%) ALO, which indicates clearly to protect critical areas. The results obtained in the distribution in the territory

of the potential services of ecosystems, can lead to restrict certain activities in areas identified as priorities for ecosystem services, and establishing mitigation and ecological regeneration.

BIOSPHERE RESERVES

These are, above all, by strong anthropogenic influence that characterizes the landscape. Approximately 50% of its surface can be considered *highly diverse agroecosystems.* In the marine sector has made great efforts to study beaked whales. He worked for ten years in a reintroduction project of the loggerhead turtle, a species listed "endangered" Red List.

We recommend:

- Encourage the establishment of population in the territory. This seems essential to promote productive activities that are compatible with environmental conservation.
- Controlling the overall expansion of scrub succession, which implies an increase in genesis and spread of fires, lost pastoral resources and standardization and simplification of the landscape.
- Find ways of bringing together the extensive livestock for productive, environmental and social.
- Select terraced areas to maintain its scenic, aesthetic and didactic.
- The assessment of ecosystem services in Biosphere Reserves must be a priority line of research and experimentation in the coming years.

Biosphere Reserves should be authentic and active schools laboratories of sustainability in a broader context of overflow of the life cycles of the Biosphere.