

Ecosystemas e Bem-Estar Humano

Portuguese assessment
of the **Millennium Ecosystem Assessment**

Executive Summary



MILLENNIUM ECOSYSTEM ASSESSMENT

What was the Millennium Ecosystem Assessment?

The *Millennium Ecosystem Assessment* (MA) was launched in 2001 by the United Nations Secretary-General. The objective of the MA was to assess the consequences of ecosystem changes for human well-being and to establish a scientific basis to enhance the management and sustainability of Earth's ecosystems.

The MA was designed to meet the scientific needs of Convention on Biological Diversity, Convention to Combat Desertification and the Ramsar Convention on Wetlands. The MA is a multi-scale assessment, consisting of interconnected assessments at the global, sub-global and local levels. The Portuguese assessment was one of the 18 sub-global approved assessments.

The Portuguese Assessment (ptMA)

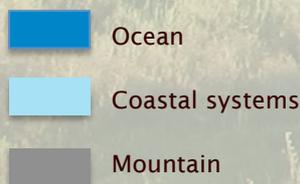
The ptMA was led by the Centro de Biologia Ambiental, and involved a research team involving more than sixty scientists from the natural, economic and social sciences. It aimed to respond to the needs of a group of users representing different sectors of the society, including national and local government, non-governmental organizations, agriculture and industry.

The ptMA assessed the condition and recent trends of biodiversity and ecosystem services in Portugal, identified the main drivers of change, and analyzed the available policy responses and scenarios for the next 50 years, following the conceptual framework of the MA.

The ptMA is a multi-scale assessment, undertaken at the national level, and with case studies at the basin and local levels.

Case studies of ptMA:

- (1) Mondego basin;
- (2) Castro Verde;
- (3) Sistelo;
- (4) Ranch of Ribeira Abaixo;
- (5) Quinta da França.



Ecosystems provide services like food, wood, carbon sequestration, water regulation and leisure.

Human well-being depends on the good functioning of ecosystem services.



What is the relationship between ecosystems and human well-being?

Ecosystems services are the benefits that people obtain from ecosystems. They can be classified in provisioning, regulating, supporting and cultural services. Provisioning services include food production, wood and fibers; regulating services include processes like weather and disease regulation; supporting services comprise soil formation and nutrient cycle, and cultural services include aesthetic and spiritual values. Biodiversity supports all ecosystem services.

Human well-being depends on ecosystem services

Changes in ecosystems and their services directly and indirectly affect human well-being in its individual, social, material and spiritual components. Ecosystem degradation tends to harm rural populations more directly than urban populations and has its most direct and severe impact on poor people.

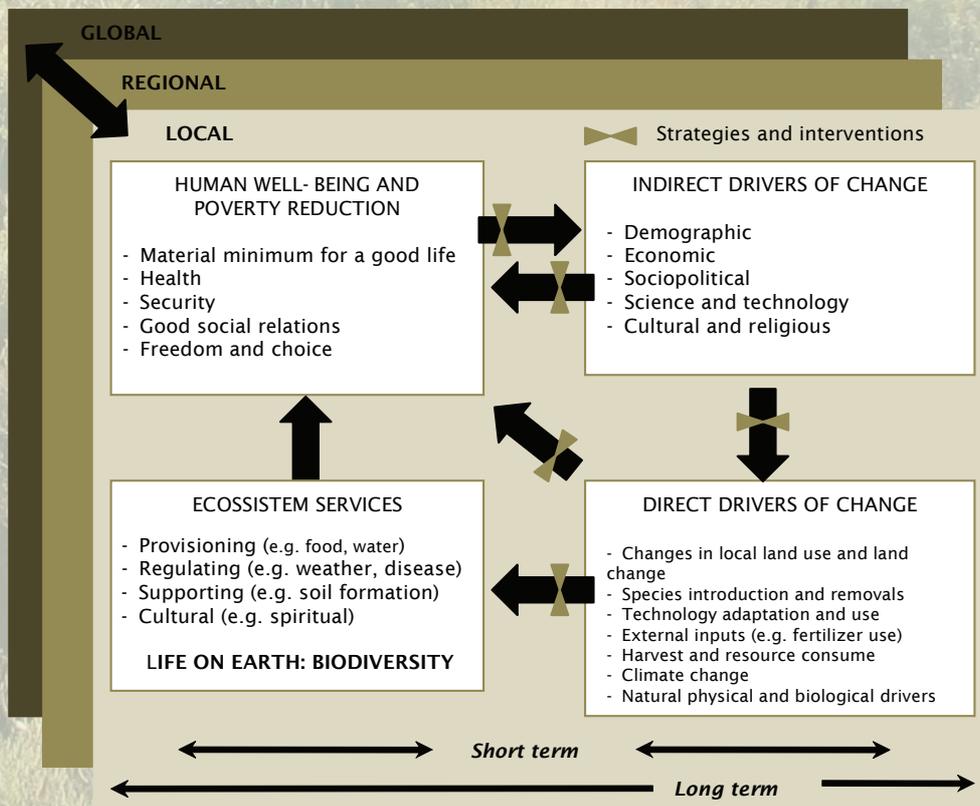
MA has shown that in the last 50 years, humans

have changed ecosystems more rapidly and extensively than in any other period in human history. These changes are being driven by an increasing demand of food, water, wood and fuel, induced by demographic and economic growth.

Gains in productivity delivered by provisioning services brought benefits for human well-being, but they were made at the expense of biodiversity loss and the degradation of supporting and regulating services, putting in jeopardy the sustainability of provisioning services.

Understanding processes is essential

The MA conceptual framework describes the dynamic interaction between people and ecosystems and assesses how factors that indirectly affect ecosystems (e.g. lifestyles) can lead to changes in factors that directly affect ecosystems (e.g. land use). Changes in ecosystems will affect ecosystem services and consequently human well-being.



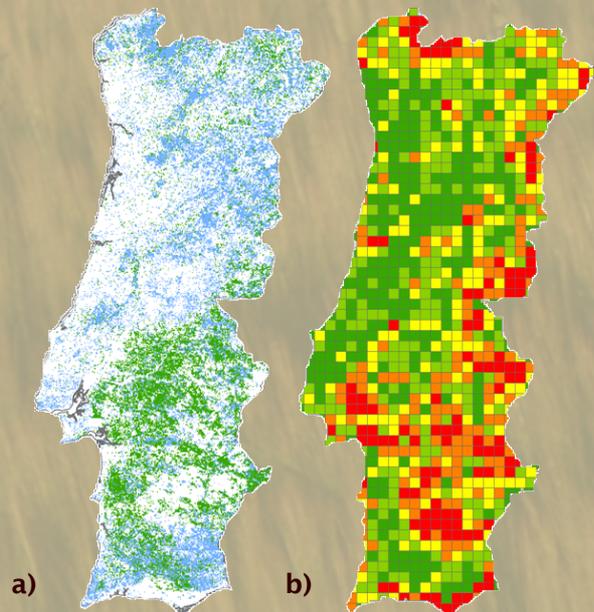
Conceptual framework of the Millennium Ecosystem Assessment.

What were the changes of Portuguese ecosystems?

Human induced changes on Portuguese ecosystems began thousands of years ago. The progressive dominance of ecosystems by human populations, mainly to improve food production, led to the decline of forests and of several species of large mammals. By the end of the XIX century, only 10% of the Portuguese territory was covered by forest and there were serious erosion problems in mountains. In order to mitigate these problems and to increase forest products, the Portuguese government fostered several forestation campaigns mainly with maritime pine. Simultaneously, the increasing demand of cork and Alentejano pork Alentejano led to the increase in the area of cork oak and holm. By the middle of the XX century the forested land had tripled.

In the last 50 years, significant changes in Portuguese ecosystems, driven by profound economic changes, have been observed. The economy grew more than six times, the number of farmers decreased by more than 60% and the agricultural area was reduced by 40%. Agricultural intensification and forestation with eucalyptus monoculture took place, with negative effects on biodiversity and regulating services. Portuguese rivers have experienced dramatic changes as a result of pollutants from agriculture and industry, and the construction of dams. In the islands, the problem with invasive alien species has worsened and the pressure on coastal ecosystems has increased. In many ecosystems the level of over-hunting and over-fishing persisted or even worsened.

The most important areas for biodiversity are areas where native habitats or endangered and rare species occur. (a) Vegetation in native habitat: forest stands (green), shrub and herbaceous (blue), (b) Total number of threatened species of amphibians, reptiles and birds. The warm colors correspond to a greater number of species of importance for conservation.



What is the state/condition of biodiversity in Portugal?

Biodiversity in Portugal includes more than 3000 species of vascular plants, about 400 species of vertebrates, and an unknown number of invertebrate species. In the Azores and Madeira there are more than 1700 species of endemic organisms, i.e., only exist in that part of the world and nowhere else.

Currently 30% of terrestrial vertebrate species and 70% of freshwater and migratory fish species are threatened. Natural forests in the north of the country have a fragmented distribution, but in the south, cork oak and holm oak forests (Montado), an agro-forestry system similar to

natural forest in the region, are relatively in good condition. The national system of protected areas and the Natura 2000 network cover some of the most important areas for biodiversity. Other response options to protect biodiversity include supporting natural forest regeneration on abandoned agricultural land, the partial conversion of monospecific forests to biodiverse forests, using agricultural practices that promote biodiversity, controlling invasive species, protecting the integrity of freshwater systems, controlling the sources of water pollution and the expansion of protected areas system.

What is the condition of ecosystem services in Portugal? Which options exist to respond to current problems?

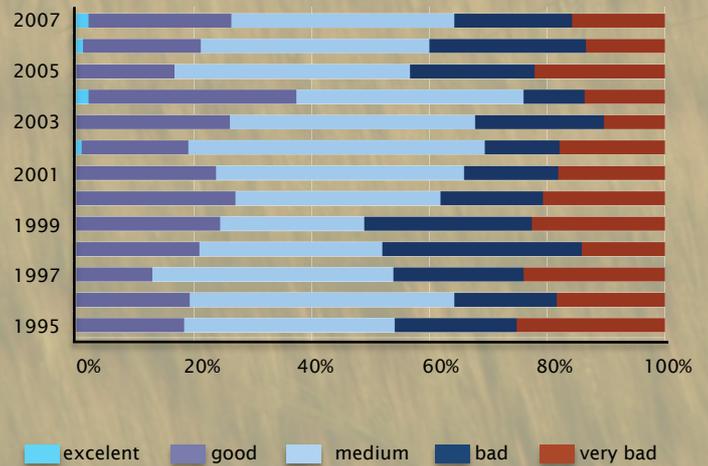
We have been attaining gains in provisioning services in detriment of regulation, cultural and supporting services. This happens because decision processes only consider the economic value of provisioning services and disregard the value of regulating, cultural and supporting services. However, recent economic analyses have shown that the economic value of this last group of services is at least so high than the value of provisioning services.

Soil protection, water cycle regulations and water quality

The assessment of the condition of water quality as shown that 40% of superficial waters are in bad or very bad condition. Subsoil aquifers face threats to water quality due to pollution caused by agriculture and saline intrusion. However, in the last years coastal zones have presented improvements in the quality of bathing water. Available options to increase ecosystems' capacity to regulate water quality and the water cycle include: a stronger control of pollution sources from agriculture and livestock production, and an integrated management of water resources. Portugal is the European country with the higher risk of irreversible soil degradation by erosion. Soil degradation implies the reduction of the soils' capacity to retain water, thus increasing the risk of floods, among other impacts. The adoption of agricultural practices that involve low soil mobilization is one of the possible responses to this problem.

Water production

The levels of water production by the Portuguese ecosystems fulfil the current demand. Less than 10% of the annual precipitation is used. There is, however, a large spatial and temporal variability on the availability of water resources, most precipitation occurs in the north of the country between October and March. In 2000 the market value of water supply was of 2 thousand million €/year, which is equivalent to about 2% of the Portuguese economy. Nearly $\frac{3}{4}$ of the water use is for the agricultural sector and more than half of the water comes from subsoil aquifers. Some aquifers are overexploited, which leads to the reduction of the water level and to situations of saline intrusion in coastal areas.



Water quality in rivers between 1995 and 2007, according to a generic indicator based on uses.

Montados are agro-forestry systems that provide a large range of ecosystem services and support much biodiversity.



The maintenance of extensive agricultural practices favours the occurrence of threatened species, such as the great bustard and the little bustard.



Food production

The Portuguese food production is under 30% of the demand levels. Some of products from which we are net importers include soya, maize, wheat and meat. The production per unit of area has increased during the last 20 years due to the abandonment of marginal areas and the intensification of production. There was also a substitution of annual crops by permanent pastures. Nowadays, the agricultural and the fisheries sectors represent about 3% and 0.3% of the Portuguese economy (the food industry represents an additional 20%). Most of the stocks in Portugal are overexploited and the total catch has diminished during the last 25 years. The future of this service depends, among other measures, on the certification and valorisation of farmland products and on the adoption of more sustainable fishing practices and fishing quotes.

Production of wood and cork

Portugal is the world leader of cork production, being responsible for 54% of the world production, and is also an important exporter of wood pulp. The forestry sector is responsible for 10% of the national exportations and provides job to 228 000 people, representing about 3% of the Portuguese economy. About half of the Portuguese productive forest is managed for wood production (mainly maritime pine and eucalypt), the other half is managed for the production of cork and livestock (mainly cork oak and holm oak). The main threats to wood and cork production include the infection by the pine wood nematode, the decline of holm oak and cork oak, forest fires and the reduction of the price of forest commodities.

Carbon sequestration

Forest expansion has favoured carbon sequestration in forest biomass in the last decades. Montados, eucalypt plantations and pine plantations present values of net productivity, during tree growing, of 1-5 t CO₂/ha/year, 15-32 t CO₂/ha/year and 15-26 t CO₂/ha/year respectively. In agricultural land, carbon sequestration in the soil can be obtained through the implementation of direct seeding of annual crops and of permanent sown biodiverse and rich in leguminous species pastures. Carbon sequestration through direct seeding reaches values of about 8 t CO₂/ha/year and 2 t CO₂/ha/year, with and without permanence of litter, respectively. The potential carbon sequestration unit by sown biodiverse pastures is of 5 t CO₂/ha/year in average.

Tourism and recreation

The demand for rural and natural areas for tourism and recreation has been increasing. Nature tourism, which includes activities such as hiking, canoeing, and bird watching, is referred as a primary motivation by 6% of tourists in Portugal. The archipelagos of the Azores (36%) and Madeira (20%) are the regions where this activity is most important. Tourism and recreation constitute an exceptional way of promoting existent resources and of revitalizing local socio-economic structures. Contingent valuation studies suggest that the Portuguese attribute a significant value to landscapes and to biodiversity protection.

Urban development and the alteration of the coastline are threatening the good functioning of coastal ecosystems.



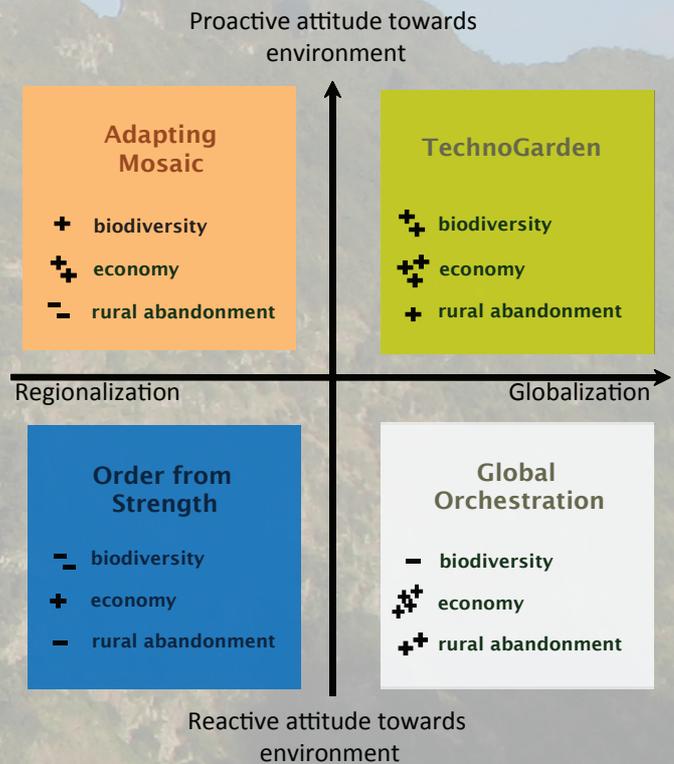
Fisheries overexploitation is currently the main threat to marine biodiversity.



What are the possible futures for the Portuguese ecosystems?

The environmental problems taking place in the next decades will only be minimized if society decides to act proactively. The actual tendency to increase provisioning services while causing the degradation of regulating and cultural services will only be halted if society recognizes the negative consequences of this option for human well-being. According to the most favourable scenario economical growth will be based on scientific and technologic investment and on the acknowledgment and development of new markets directed to a wide range of ecosystem

services. On the most negative scenario Portugal will experience a retreat from the levels of economical development observed in other EU countries, and the aggravation of the problems associated with agricultural intensification and with forest fires. The scenarios illustrate ways of minimizing problems through governmental intervention (by implementing laws and regulations), through initiatives lead by the private sector and civil society, and through scientific and technological development.



The scenarios developed by the MA were established along two axis: globalization vs. regionalization; public attitude towards environment. The ptMA adapted those scenarios to the Portuguese reality, there were added regional details and the feasibility of global scenarios were tested at the regional scale.

Mountain ecosystems are essential for the provisioning of freshwater.



Promoting the expansion of native forest is a response towards the protection of biodiversity and ecosystem services.



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Part I: General Concepts and Methodological Approach

1. Conceptual framework of the *Millennium Ecosystem Assessment*

2. Portuguese Sub-Global Assessment

Henrique M. Pereira, Tiago Domingos, Vânia Proença, Luís Vicente e Patrícia Rodrigues

3. Drivers of ecosystem change

Tiago Domingos, Eugénio Sequeira, Manuela Magalhães, Tatiana Valada, Luís Vicente, Humberto Martins e Margarida Ferreira

4. Socioecological scenarios for Portugal

Henrique M. Pereira, Rui Mota, Margarida Ferreira e Inês Gomes

5. Biodiversity

Vânia Proença, Cibele Queiroz, Miguel Araújo e Henrique M. Pereira

Part II: An Assessment of the Portuguese Ecosystems

6. Forest

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8. Montado

Carlos Carmona Belo, Marta Silva Pereira, Ana Cristina Moreira, Inocêncio Seita Coelho, Nuno Onofre e Ana Ambrósio Paulo

9. Mountain

Carlos Aguiar, Orlando Rodrigues, João Azevedo e Tiago Domingos

10. Inland waters

Maria Teresa Ferreira e António Guerreiro de Brito

11. Groundwaters

Luís Ribeiro

12. Coastal systems

Francisco Andrade, Henrique Cabral e Maria de Fátima Borges

13. Ocean

Maria de Fátima Borges, Henrique Cabral e Francisco Andrade

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15. Mondego river basin

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17. Sistelo: a participatory study in a mountain parish

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20. An assessment of ecosystem services in Portugal

Henrique M. Pereira, Tiago Domingos, Cristina Marta-Pedroso, Vânia Proença, Patrícia Rodrigues, Margarida Ferreira, Ricardo Teixeira, Rui Mota e Alexandra Noyal

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