2.3 LAND

The upper layer of the earth's crust, more commonly known as the land, is made up of mineral particles, organic matter, water, air and living organisms. The majority of the biosphere lives on it. Its formation is such an extremely slow process that it could be considered a non-renewable resource. Human activity is undertaken on it, it plays a central role as a genetic habitat and heritage, and it stores, filters and transforms a multitude of substances; it is therefore the planet's largest carbon "store".

The damage which its (complex and variable) structure can suffer affects natural environments and ecosystems directly. It suffers numerous degradation processes and threats: erosion, loss of organic material, local and widespread pollution, coverage, sealing, reduction in biological diversity, salinisation, flooding, etc. Some of these processes can be accelerated by, or are a direct consequence of, human actions. In arid or sub-arid conditions, the combination of some of these threats can lead to desertification.

Land degradation is a serious problem in Europe that is provoked or accentuated by human activities: inappropriate agricultural and forestry practices, industrial activity, tourism, urban and industrial expansion, infrastructure construction. These activities can reduce the land's fertility, its carbon content,

biological diversity, water-retention ability, gas and nutrient cycles and can slow down the degradation of pollutants.

Land use by agriculture, for infrastructures and, in particular, urban sprawl has serious and often irreversible consequences for the environment. The creation of artificial surfaces leads to a decline in habitats, fragmentation of landscapes and a reduction in the space vital to many species. In Spain, these artificial surfaces have become particularly widespread around large cities and along the coast, as discussed in previous editions.

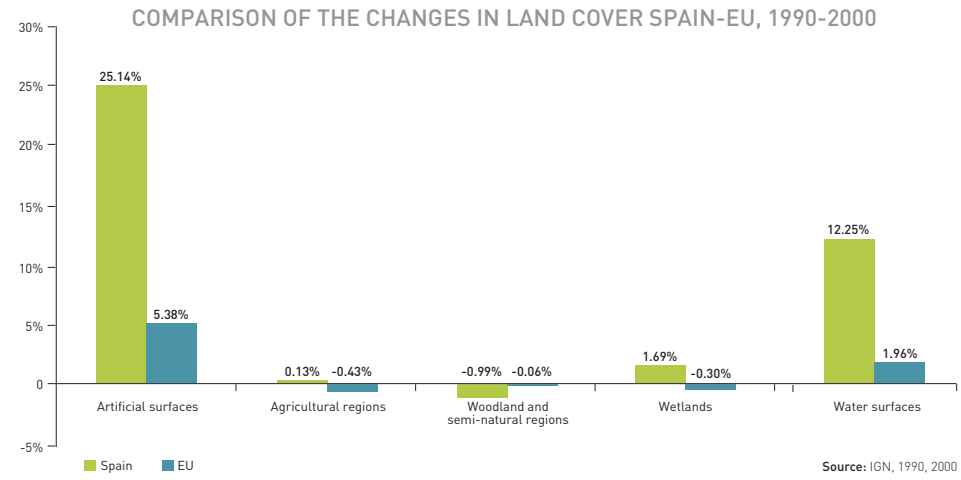
The European Corine Land Cover 2006 project was in its final stages as this edition was being prepared, therefore as its findings are still provisional, we limit ourselves to a comparison of the changes in land cover which occurred in Spain and Europe between 1990 and 2000, using data from the two previous Corine Land Cover surveys.

INDICATOR	GOAL	TREND
Soil cover	Achieve sustainable land use	Between 1990 and 2000, the artificial surfaces in Spain grew five times more than in Europe
Area affected by erosion	Hydrological and forest restoration	The majority of the land in the Autonomous Regions studied suffers from "moderate" erosion
Area at risk of desertification	Hydrological and forest restoration	Of the Autonomous Regions studied so far, Catalonia has the highest percentage of land affected by erosion

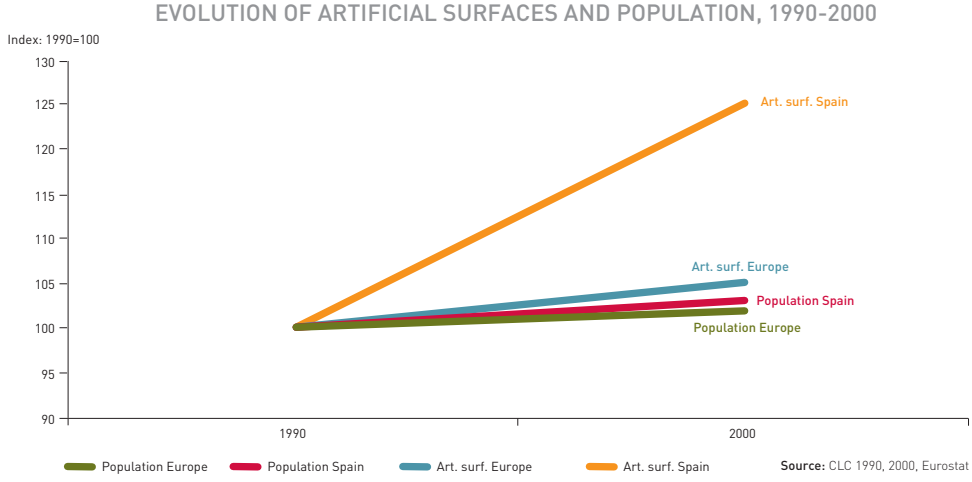
The National Soil Erosion Inventory continues to monitor the situation in Spain's various Autonomous Regions. On this occasion data for the Autonomous Region of Andalusia are added to those provided in the previous edition. The National Programme to Combat Desertification (August 2008) working document provides an overview of the proportion of land in danger of desertification for all Spain's Autonomous Regions.

Changes in land cover

The increase in artificial surfaces in Spain was five times greater than that in Europe



In the time period between the 1990 and 2000 Corine Land Cover (CLC) surveys, artificial surfaces in Europe increased by 5.38% (871,241 ha) from the value of 16,185,955 ha found in 1990. During the same period, artificial surfaces in Spain increased by 168,460 ha (25.14%) from the 669,993 ha found in 1990. Thus, slightly more than one out of every five hectares of new artificial surfaces created in Europe in that period was created in Spain.



The population of Europe increased from 462.3 to 472.2 million inhabitants between the first two CLC surveys, an increase of 2.13%. Artificial surfaces increased by 5.38% in the same period, slightly more than twice the population growth. The situation in Spain is significantly different: the population increased from 38.8 million in 1990 to 40.1 million in 200 (an increase of 3.15%), whereas artificial surfaces increased by 25.1%, almost eight times the population growth.

NOTES

- The CLC projects do not cover the entirety of some linear elements with a width of less than 100 m, such as roads and railways, despite their undeniable environmental impact.

The artificial surfaces considered as such in CLC 2000 were those in the following categories:

- urban regions
  - continuous urban networks
  - discontinuous urban networks
- commercial, industrial and transport-related zones
  - industrial or commercial zones
  - roads, railways and associated land
  - port zones
- mining and construction zones
  - mining zones
  - rubbish tips
  - zones under construction
- artificial green zones
  - urban green zones
  - sporting and recreational installations

- The following countries participated in Corine Land Cover 2000: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Romania, San Marino, Slovenia, Slovakia, Spain, United Kingdom.

SOURCES

- National Geographic Institute, Ministry of Development. Corine Land Cover 1990 and 2000

MORE INFORMATION

- **http://www.ign.es**
- **http://europa.eu**

Areas affected by erosion

Erosion reduces the soil's ability to absorb and accumulate atmospheric carbon

Autonomous Regions	"Moderate" erosive processes (%)	"Medium" erosive processes (%)	"High" erosive processes (%)
Cantabria	59.91	22.39	17.70
Asturias	61.92	21.67	16.42
Navarra	65.64	18.79	15.57
Murcia	66.41	18.13	15.46
La Rioja	65.84	20.43	13.72
Galicia	74.34	13.06	12.61
Balearic Islands	76.62	13.69	9.70
Madrid	81.28	10.89	7.83
Catalonia	54.41	24.86	20.74
Extremadura	83.75	9.81	6.44
Canay Islands	69.25	21.86	8.89
Andalusia	57.61	19.76	22.63

Source: MARM

Soil erosion, in all its manifestations, can be considered one of the main processes contributing to the degradation of ecosystems in Spain, and has important environmental, social and economic implications. Erosion is also one of the main causes of desertification on both a regional and national scale. The indicator

expresses the proportion of land surface with respect to the total surface area in each Autonomous Region affected by different degrees of erosion.

This edition provides updated information for the twelve Autonomous Regions in which the National Soil Erosion Inventory, which is being drawn up by the Spanish Ministry of the Environment and Rural and Marine Affairs, has been published. This inventory is drawn up continually on a cyclical basis, every 10 years, with an accuracy equivalent to a scale of 1:50,000. Its execution period covers the years between 2002 and 2012 (when the second National Soil Erosion Inventory will be started). The information concerning land affected by sheet and rill erosion in these 12 Autonomous Regions is taken from studies performed between 2002 and 2008.

Soil erosion is defined as the removal of material from the land, on the surface or at shallow depths, through the action of water or wind. In any case a distinction must be made between soil erosion on a geological scale, a natural phenomenon which takes part in landscape modelling and which, on a human scale, is usually compensated by the rate of natural soil formation, and anthropic, or accelerated, erosion, which occurs due to the inappropriate use of natural resources by humans and has detrimental environmental, economic and social consequences and should therefore always be taken into consideration when planning the exploitation and management of these resources.

The following five factors are involved in water-based erosion: precipitation, soil, relief, plant cover and its management by man. The effects of soil erosion in one region have an impact on others. Eroded soils filter fewer pollutants and are less able to absorb the water needed to top up underground aquifers. Erosion also reduces the soil's ability to absorb and accumulate atmospheric carbon.

The presence of eroded soil in suspension in waterways can significantly affect aquatic flora and fauna. Its accumulation can block river beds, with a subsequent increase in the risk of flooding, or reduce the storage capacity of reservoirs, silting them up and reducing their hydraulic potential and their ability to generate hydroelectric power.

The proposed EU Directive on soil protection (which would modify Directive 2004/35/EC) proposes that States should identify those risk areas where conclusive proof or sufficient evidence is available to suggest that they are, or soon will be, at increased risk of soil degradation, such as erosion. After this identification process, the States should prepare a programme of risk-reduction measures, with an execution timetable and an estimate of the financing needed to undertake them.

NOTES

- The erosion considered here is that known as "sheet" and "rill". The percentages of land provided refer to the total geographic area of the Autonomous Region. The erodable area is that susceptible to erosion processes and is calculated by subtracting artificial surfaces, surface-water bodies and wetlands from the geographical area.

- The National Soils Inventory groups together the calculated soil loss by sheet and rill erosion into the following erosion levels:

1: 0-5 t/ha/yr	5: 50-100 t/ha/yr
2: 5-10 t/ha/yr	6: > 100-200 t/ha/yr
3: 10-25 t/ha/yr	7: > 200 t/ha/yr
4: 25-50 t/ha/yr	

- In this indicator, the soil-loss interval termed "moderate" is from 0 to 10 t/ha/yr, "medium" is from 10 to 25 t/ha/yr and "high" is more than 25 t/ha/yr.

- The difference with respect to the data contained in previous editions is the grouping of the area affected by erosion into three categories (high, medium and moderate erosive processes) rather than only two in the previous editions.

- The inventory is structured into five modules corresponding to different types of erosion:
  - Sheet and rill erosion (quantitative estimate of soil loss obtained by applying the RUSLE (Revised Universal Soil Loss Equation) model).
  - Gully and ravine erosion (identification and demarcation of affected areas).
  - Deep erosion (bulk movements) (identification of potential risk areas and their qualitative classification)
  - Stream erosion (qualitative classification of hydrological units according to their susceptibility to suffer flooding in their drainage network).
  - Wind erosion (identification and classification of potential risk areas).

SOURCES

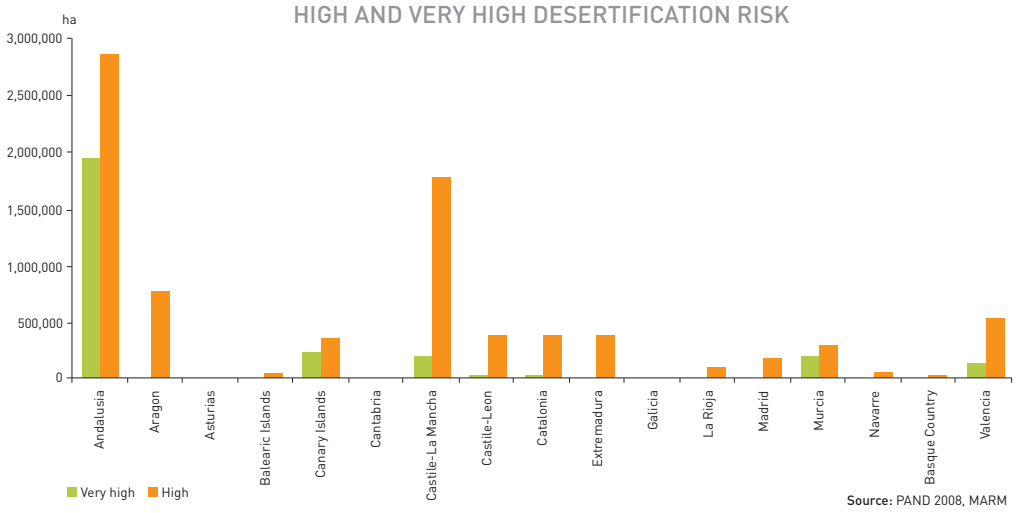
- National Soil Erosion Inventory 2002–2012. Secretariat General for Rural Affairs, Directorate General of the Environment and Forestry Policy. MARM.

MORE INFORMATION

- **http://www.marm.es**

Areas at risk of desertification

The National Programme to Combat Desertification has established both short- and long-term monitoring indicators



In arid or sub-arid climates, the combination of some of the threats to soil (erosion, loss of organic matter, local or widespread pollution, sealing, compaction, salinisation, etc.) can lead to desertification. The United Nations Convention to Combat Desertification (UNCCD) defines risk of desertification as the degradation of arid, semi-arid and dry sub-wetland regions as a result of factors such as climate change and human activity. Desertification has its origins in complex interactions between physical, biological, political, social, cultural and economic factors. Although land degradation has been noted all over the world, it is only considered to be "desertification" when it occurs in dry regions.

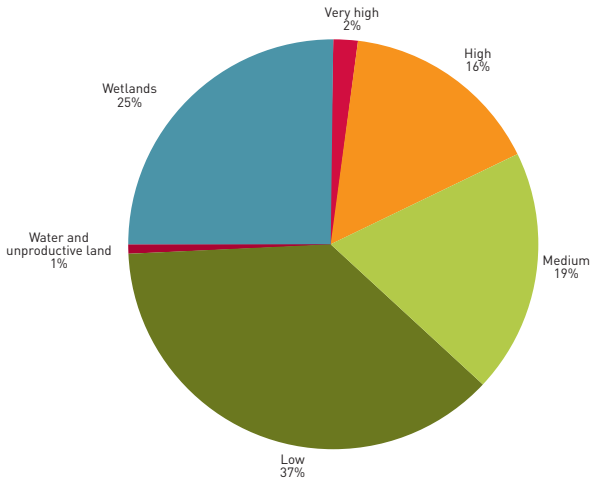
Desertification can also have a significant impact beyond the borders of those countries directly affected. Spain, like all EU member states, is a signatory to the United Nations Convention to Combat Desertification, and like Spain, most Mediterranean countries have begun to approve regional and national action plans. The Ministry of the Environment and Rural and Marine Affairs has incorporated the demarcation of areas at risk of desertification into the working document of the National Programme to Combat Desertification (PAND), August 2008. By identifying these areas, it will be possible to define the physical and socio-economic units in which policies need to be developed to combat desertification. The diagnosis of the situation in Spain considers qualitative aspects and provides a first approximation of

the distribution of desertification in this country. The following indicators have been used:

- Aridity index.
- Erosion: soil loss.
- Fires: percentage of accumulated land area affected by fire over 10 years.
- Over-exploitation of aquifers: the existence of over-exploitation problems.

The National Programme to Combat Desertification proposes two fundamental questions: to determine which areas are at risk of desertification, and what measures should be applied in these areas. The first of these goals shows that areas at serious risk (high or very high) of desertification cover 17.95% of Spain's surface.

DESERTIFICATION RISK, NATIONAL TOTAL



Source: MARM

The set of measures considered are taken from the following action groups:

- Agricultural activity, land use, regulation of water resources, soil conservation and forestry.
- Policy coordination (Spanish Sustainable Development Plan, Rural Development Programmes; Forestry Plan; National Hydrological and Forest Recovery Plan; Spanish Biological Diversity Conservation and Sustainable Use Plan; Irrigation Plan; National Climate Change Adaptation Plan).)

PAND has selected a series of environmental, social, economic and institutional indicators to identify and monitor desertification trends in Spain. Some of these allow

short-term trends to be detected (aridity and fires), whereas others, such as those related to erosion, over-exploitation of aquifers and soil coverage, require data to be collected over much longer time periods.

SOURCES

- Spanish National Action Programme to Combat Desertification. Directorate General for the Environment and Forestry Policy. MARM (Order ARM/2444/2008 of 12 August, BOE 19.08.08).

MORE INFORMATION

- http://www.marm.es