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Definition and context

The aim of this study is to estimate quantitative changes of land cover and/or land use in European coastal zones over a period of about 15 years. This project is carried out by the Joint Research Centre (JRC) of Ispra (Italy). Under the coordination of the Instituto Geográfico Nacional (IGN), the area of Catalonia has been assigned to the Institut Cartogràfic de Catalunya (ICC).

Methodology

The inventory of land cover changes is based on visual image comparison between digital satellite imagery, supported by consultation of the CORINE Land Cover (CLC) data base created during 1987 over coastal zones. A monitoring of changes between 1975 (Landsat MSS) and 1987 (TM) doing a retrospective updating of a strip of 10 km along the coastline has been made. The legend which is used in this territory is organised in levels. It is based on the Spanish legend of 64 classes (forth and fifth level), of which 44 correspond to the European legend (third level). Ancillary data like aerial photography has been consulted: The ICC provides the Catalanian flight on a scale of 1:20,000 and 1:18,000 covering the whole buffer area. The zone which was studied includes 12 sheets on a scale of 1:100,000 of the *Mapa Topogràfic Nacional* (National Topographic Map). The minimum area interpreted was an area of 25 ha, and in the case of artificial surfaces, areas of less than 25 ha were interpreted and retrospectively updated.

After this interpretation phase, the information has been integrated in a GIS, obtaining a difference map between both inventories. This map summarizes the land cover changes at CLC first level nomenclature (five categories).

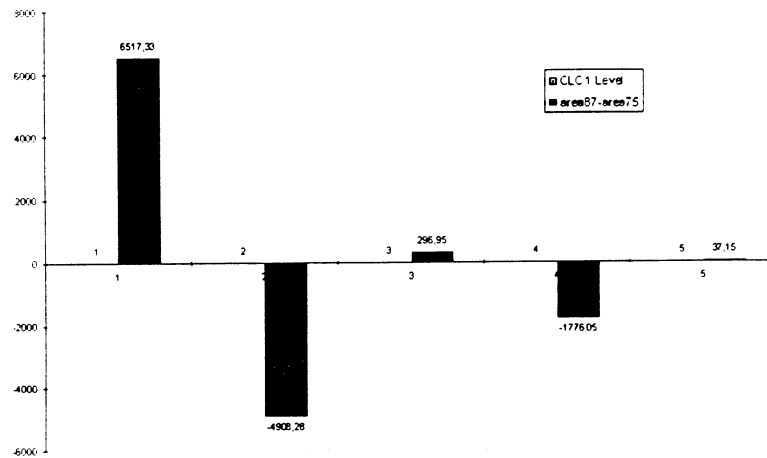
Global analysis of results

The evolution of the land cover in Catalanian coastal areas between 1975 and 1987 at first level of the CLC nomenclature, is as follows:

1. *Artificial surfaces.* Extension of discontinuous urban fabric (+ 5,726 ha) and industrial sites (+ 1,160 ha) mainly in agricultural and natural areas. Also extension of continuous urban fabric, harbours, camping sites and leisure parks, mineral extraction and the prolongation of the highway.
2. *Agricultural land.* Some areas of arable land decrease supplanted by bushy vegetation (there were non-productive areas) and extension of artificial surfaces. In the south of Catalonia agricultural land (rice fields) have increased replacing coastal wetland.

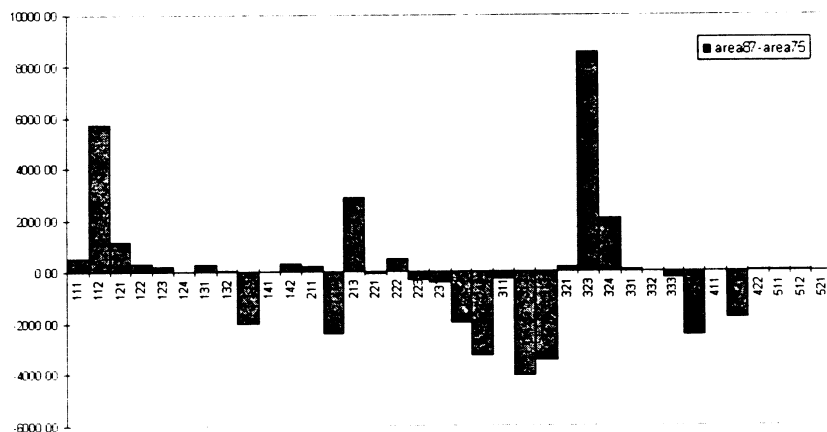
3. *Forest and semi-natural classes.* Forest have shrunk in zones where residential areas, mineral extraction, new crops and deforestation have increased. But in several areas shrub increased after forest fire regeneration or abandoned crops.
4. *Wetlands.* Coastal wetland decrease (- 1,801 ha). In the Costa Brava (Girona) changed into camping sites, and in the Delta de l'Ebre (Tarragona) mainly changed into rice fields.
5. *Water bodies.* Harbour extensions in the cities of Barcelona and Tarragona, and new marines along the coast. Modification of stream courses by human activities.

LAND CHANGES BETWEEN 1975 AND 1987 (ha)
(Catalonian coastline +10 km buffer)



The next histogram shows the evolution of the land cover in Catalonian coastal areas between 1975 and 1987 at third level of the CLC nomenclature, considering the difference between the two dates in hectares:

LAND CHANGES BETWEEN 1975 AND 1987 (ha)
(Catalonian coastline +10 km buffer)



Legend CLC 3rd level

- | | | |
|--|--|---|
| 1.1.1 Continuous urban fabric | 2.1.2 Permanently irrigated land | 3.2.1 Natural grasslands |
| 1.1.2 Discontinuous urban fabric | 2.1.3 Rice fields | 3.2.3 Bushy sclerophyllous vegetation |
| 1.2.1 Industrial or commercial units | 2.2.1 Vineyards | 3.2.4 Transitional woodland-scrub |
| 1.2.2 Road and rail networks and associated land | 2.2.2 Fruit trees and berry | 3.3.1 Beaches, dunes and sands |
| 1.2.3 Port areas | 2.2.3 Olive groves | 3.3.2 Bare rocks |
| 1.2.4 Airports | 2.3.1 Pastures | 3.3.3 Sparsely vegetated areas |
| 1.3.1 Mineral extraction sites | 2.4.2 Complex cultivation patterns | 3.3.4 Burnt areas |
| 1.3.2 Dump sites | 2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation | 3.3.5 Glaciers and perpetual snowfields |
| 1.3.3 Construction sites | 3.1.1 Broad-leaved forest | 4.1.1 Inland marshes |
| 1.4.1 Green urban areas | 3.1.2 Coniferous forest | 4.2.1 Salt marshes |
| 1.4.2 Sport and leisure facilities | 3.1.3 Mixed forest | 4.2.2 Salines |
| 2.1.1 Non-irrigated arable land | | 5.1.1 Stream courses |
| | | 5.1.2 Water bodies |

Main land cover changes between 1975 and 1987

- Residential areas extension in the north and central coast, and new constructions in the south coast
- Industrial sites and harbour extension, mainly around cities of Barcelona and Tarragona
- Rice field extension reducing coastal wetlands (south of Catalonia)
- Fruit trees increasing their surface taken over arable land and mosaic items
- Abandoned crops in difficult areas increasing scrub
- Burnt areas decreasing during this period
- Increasing bushy vegetation after forest fire regeneration
- Decreasing forest trees after deforestation (mainly human activities)

Observed trends

Based on the obtained results, a tendency of evolution of land cover can be estimated for the next years. These changes were due mainly to human activities, as they will continue to be in the future. Artificial surfaces will increase, but not so much as the 70's (during this period of time, investment in tourist complexes was very important along the coast). Some people from big cities like Barcelona move to live outside in residential areas, and this tendency will continue during the next years. Also second residences will increase. Area of arable land will change depending on the EC policy for subsidy, and non productive areas will be abandoned. Forest and semi-natural areas will decrease because of deforestation (forest fire and human activity). Coastal wetlands will remain more or less stable, because currently they are protected areas (natural parks).