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INDICATORS FOR INTEGRATED COASTAL ZONE MANAGEMENT (ICZM) : *Methodological Factsheets in support of comparable measurements and an integrated assessment in coastal zones*

The **ICZM Protocol for the Mediterranean Sea** (the 'ICZM Protocol'), signed in Madrid on 21 January 2008 and ratified on 24 March 2011, represents a milestone for the implementation of ICZM in the Region and can serve as a blueprint for the implementation of ICZM in other Regional Seas. The **PEGASO project** builds on existing capacities and develops common approaches to support integrated policies for the Mediterranean and Black Sea Basins in ways that are consistent with the ICZM Protocol.

The PEGASO project has developed **a core set of indicators** that are instrumental in measuring the implementation of ICZM policies and programmes. The core set of ICZM indicators addresses the specific requirement of Article 27 of the protocol to '*define coastal management indicators*' and '*establish and maintain up-to-date assessments of the use and management of coastal zones*'. In doing so, the PEGASO project has widely built on previous and existing indicator sets developed by different institutions and projects, and which are duly acknowledged (see '[Methodological paper for the selection and application of PEGASO ICZM indicators](#)' for further reading and background material)

The present Methodological Factsheet is part of a set of 15 factsheets that are made available to end-users. This set of factsheets is conceived to support a harmonized approach to calculate ICZM indicators at different spatial scales in the Mediterranean and Black Sea regions.

Name of the Indicator

Area of built-up space* in the coastal zone

**both the emerged and submerged area of the coastal zone; refers to permanent structures, as well as structures and platforms that are installed for temporary uses and purposes, e.g. oil and gas rigs, anchoring structures, windmills)*

Objective of the Indicator

The increase in built-up areas potentially has high impact on the environment and the living and non-living resources due to soil-sealing, to disturbance resulting from transport, noise, resource use, waste dumping and pollution, and others. Marine and terrestrial transport networks that connect areas of intensified activities in the marine and coastal zone, in particular to built infrastructures (oil and gas platforms, windmills, ports, recreational beaches, coastal towns and urban centres) add to the fragmentation and potential degradation of the natural landscape, both terrestrial and underwater. The intensity and patterns of urban sprawl and the built-up area are the result of three main factors - economic development, demand for housing, and extension of transport networks.

Although subsidiarity rules assign land and urban planning responsibilities to national and regional levels, most European policies have a direct or indirect effect on urban development. This indicator aims to monitor progress towards achieving the first goal for coastal sustainability set out in the EU Recommendation concerning the implementation of ICZM - to control further development of undeveloped coast as appropriate. The indicator has one measurement - the percentage of built-up space on land and at sea.

We want to know the extent to which the coastal zone has been built-up over the past several years because this will indicate the degree of pressure on the coast and the likelihood of further changes in the future. We also want to know whether development on the coast has been greater and more intense than in the wider region, and at which trend development in marine waters is taking place. It can also help to understand patterns of development and unravel cause-effect relationships.

Policy context

ICZM Policy Objective	Policy objective: To have a balanced use of coastal zone, and avoid urban sprawl
ICZM Protocol Article	Article 8: <i>Protection and sustainable use of the coastal zone</i>
UNEP-MAP Ecological Objective	Objective 8: <i>The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved</i>
INSPIRE ANNEX I-III Data Theme (34)	Land cover (Annex II – 2) Land use (Annex III – 4)

CALCULATION OF THE INDICATOR

Spatial consideration

Coverage	Resolution – Reporting units
<ul style="list-style-type: none"> Coastal zone of the Mediterranean and Black Seas at coastal NUTS3 level Coastal zone of the Mediterranean and Black Seas EEZ 	<ul style="list-style-type: none"> Coastal zone of the Mediterranean and Black Seas: coastal NUTS5/LAU2 level (can be aggregated at NUTS3) Coastal zone of the Mediterranean and Black Seas: 0-1 km and 0-10 km buffers from the coastline within coastal NUTS5/LAU2 Coastal zone of the Mediterranean and Black Seas: territorial waters and EEZ

Temporal consideration

Period	Resolution (time interval or unit)
Baseline and reference measurement with 5 or 10 years difference e.g. 1990, 2000 and 2010	Measurements should be consistent in reflecting the situation for comparable reference points i.e. 1 st of January or 31 st of December

Note: the idea is to dispose of two reference situations e.g. baseline 1990 or 2000 and reference 2010, and to calculate the changes that occurred from baseline to reference 1 to be able to interpret trends. However, we still want to have a view of the land use in the baseline and in the reference situation

Parameter(s)

- | | |
|-------|--|
| (i) | Area (in km ²) of built-up land ¹ in coastal NUTS 5 as a proportion of the area of built-up land in the wider reference region. |
| (ii) | Area of built-up space in the EEZ, territorial waters, or in other relevant marine spatial units. |
| (iii) | Percent of built-up land by distance from the coastline in 0-1km and 0-10km buffers <i>units, by NUTS3</i> |
| (iv) | Percent of built-up land by distance from the coastline in a 100m buffer zone, <i>by NUTS3</i> |

Calculation method

Steps		Products
1	For the wider reference region, overlay NUTS 5 boundaries with CLC data for 1990 and 2000 and where available GlobCorine 2009 (ESA Globcorine 2005) or other standardized land use datasets and clip polygons (or grids) labeled as land use 1.1, 1.2 and 1.3 for each coastal NUTS 5. Add up the area of the polygons or grids (using GIS statistics function)	Area of built-up land within coastal NUTS 5 for CLC 1990, CLC 2000, Globcover 2009, others
2	Repeat for each of the non-coastal NUTS 5, and for the entire reference area (average)	Area of built-up land within each non-coastal NUTS 5 for CLC 1990 and 2000, and for the entire reference area

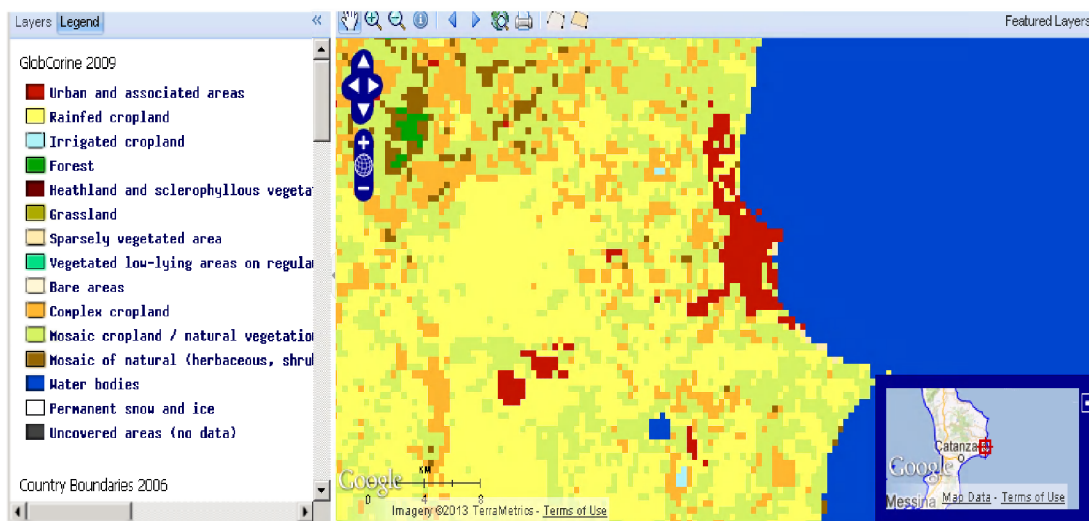
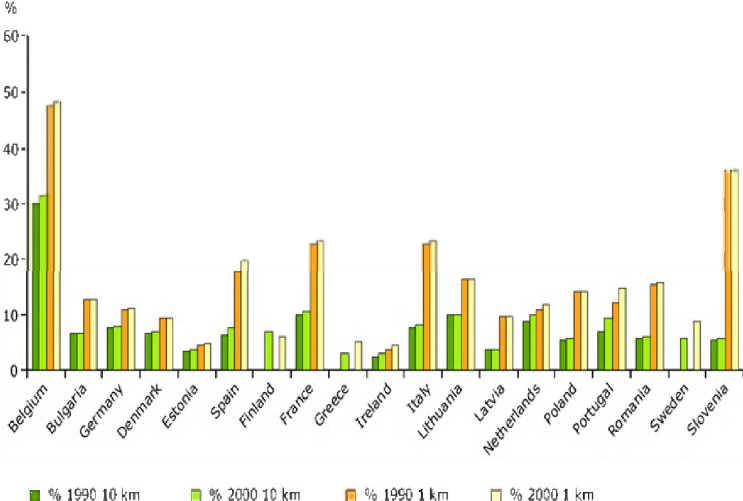


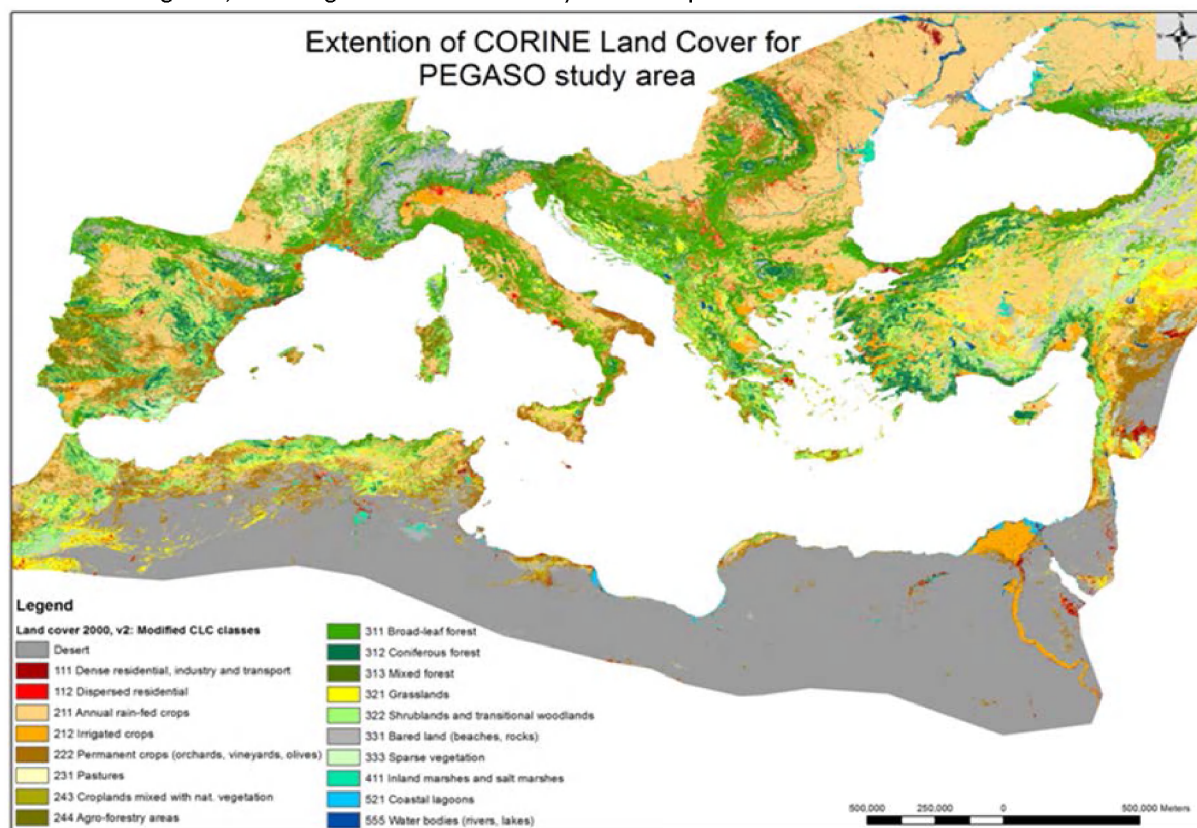
Figure: representation of land use data (GlobCorine 2009) in the coastal zone (Source PEGASO SDI Map Viewer)

All of the following steps to be taken into account for the baseline (1990 or 2000) and for the consecutive reference situations (2000 or 2010)

¹ Land-use classess according to the classification by CORINE or Eurostat-OCDE, 1998: <http://unstats.un.org/unsd/environment/a2004land.pdf>

3	For each coastal NUTS 5, non-coastal NUTS 5, and for the wider reference area: divide the product of step 2 by its total area (all land) and	Percent of built-up land within each coastal NUTS 5, non-coastal NUTS 5, and wider area
4	Add together the area of built-up land for every coastal NUTS 5	Total area of built-up land within all coastal NUTS 5
5	Overlay buffers of 0-1 km and 0-10 km distance from the coastline with CLC data and clip polygons labelled 1.1, 1.2 and 1.3 for each buffer. Add up the area of the polygons labelled 1.1, 1.2 and 1.3 in each buffer (using GIS statistics function)	Total area of built-up land within the 0-1 km and 0-10 km buffers
6	Overlay buffers of 0-1 km and 0-10 km with CLC data and obtain the total area of land for each buffer	Total area of land within each buffer
7	Divide the total area of built-up land/space in the coastal buffers by the total area of land (all land uses) and multiply by 100	<p>Percentage of built-up land/space by 0-1 km and 0-10 km buffers (example below), for the baseline and reference. The difference can also be visualized.</p> 
Current monitoring		Data sources
<p>Data are available from the Corine Land Cover datasets for 1990 and 2000.</p> <p>Landcover products are created from GlobCorine or other e.g. MODIS multispectral data, following discrete CORINE land cover categories</p> <p>For the marine waters, this data has not been systematically collected according to international standards, and therefore national/local databases need to be accessed and explored.</p>		<p>Data are available from the Corine Land Cover datasets for 1990 and 2000. However, CLC does not cover all countries. There was no coverage in 1990 for Finland, Sweden, UK, Cyprus, Malta and Turkey. By 2000, coverage had extended to all of those countries with the exception of UK and Turkey. Nevertheless, the lack of cover in 1990 means that comparisons with the past cannot be made using CLC and in such cases national datasets must be substituted. For national land use surveys that deliver datasets in shape format, steps 1-12 can be followed. When only numerical datasets are available, the products of step 1 and step 10 can be calculated using the same methodology. However, map 2 and graph 2 cannot be produced. Although Corine Land Cover data can be used as a standardized reference data source, this data may be of insufficient resolution and/or accuracy to be used for certain purposes at the local level/scale. Therefore, the use and sharing of local datasets with high resolution, is strongly stimulated. Nevertheless, to make sure these data can be compared with the CORINA or other databases at regional level, it is important to employ the CORINE land cover classifications to analyse and report the data.</p>

Extension of CORINE Land Cover for the Mediterranean and Black Seas (Source: CEM-Univ. of Nottingham), with an indication of CORINE Land Cover categories, including those used to classify as 'built-up'.



Source: CEM, University of Nottingham, using MODIS (NASA) and CORINE land cover (EEA) data

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Assessment context

Use of the indicator in previous assessments/initiatives	Mediterranean Strategy for Sustainable Development (MSSD) coastal indicators The changing faces of Europe's coastal areas- European Environment Agency EEA (2006) SAIL Schéma d'Aménagement Intégrée du Litoral (2006) DEDUCE Développement durable des Côtes Européennes (2007)
DPSIR framework	Pressure
Link to anthropogenic pressure	The increase in built-up areas potentially has high impact on the environment due to soil-sealing, to disturbance resulting from transport, noise, resource use, waste dumping, pollution, etc.. The intensity and patterns of urban sprawl and the built-up area are the result of economic development, demand for housing, and extension of transport networks.
Sustainability target or threshold	The Article 8 of the ICZM Protocol for the Mediterranean orders the parties to establish the no-construction zone that may not be less than 100 m in width, as from the highest winter waterline, and if the countries have stricter regulations they should keep applying them. The countries may make exceptions to the ban of construction within the 100 m zone only for the projects of public interest and in areas having particular geographical or other local constraints, especially related to population density or social needs, where individual housing, urbanisation or development are provided for by national legal instruments.
Link with other assessment tools	
Example of integrated assessment	UNEP-MAP plan Bleu : State of the environment and development in the Mediterranean 2009 The changing faces of Europe's coastal areas- EEA (2006)

Scope for future improvements

Extend methodology and monitoring to regional basins in order to make regional, comparable assessments.

Include analysis of the built-up in the 100 m zone at regional scale, in order to assess follow-up of Article 8 on the establishment of the non-construction zone.

Develop methodologies, datasets and classifications for 'built-up' in the marine waters (e.g. windmill parks, oil and gas rigs, energy convertors, mooring facilities,...)

In order to build a common, regional view for a particular indicator, it is crucial to harmonize the data in terms of e.g. concepts, definitions, reporting units, colour codes, value class boundaries and scoring methods. For this purpose, the PEGASO consortium has developed 'Guidelines for Data Harmonization' which are available from the 'Products' section on the PEGASO project website www.pegasoproject.eu. Although agreements may exist related to the presentation of certain indicators that are legally embedded, this may be less evident for indicators which are not (yet) used as an instrument within a policy context or within a region where the policy is not applicable. The PEGASO consortium encourages contributing partners, stakeholders and end-users to consult the 'Guidelines for Data Harmonization' document, and to actively engage in this process.

Indicator references (i.e. UNEP, EEA, ...)