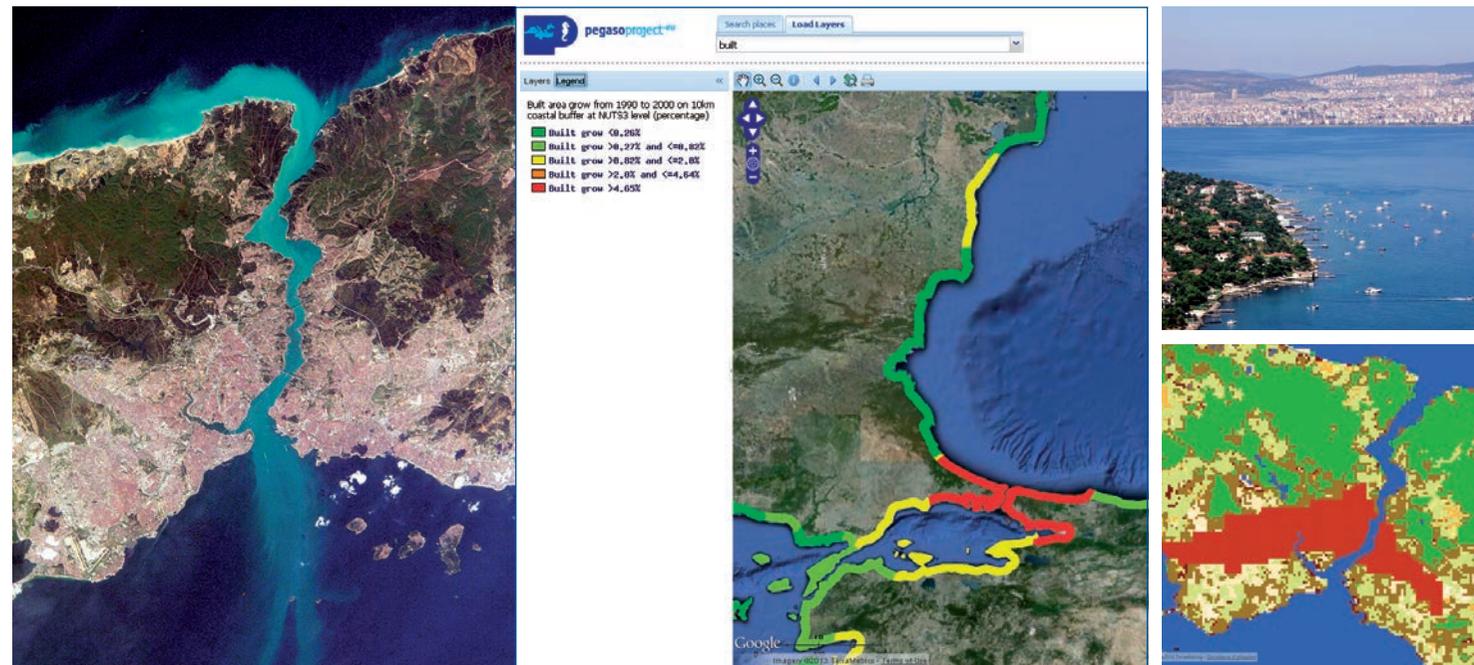




People for Ecosystem based Governance  
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Ocean and coast: [pegasoproject.eu](http://pegasoproject.eu)

## A Shared Data Infrastructure (SDI) for integrated coastal management in the Mediterranean and Black Sea Basins

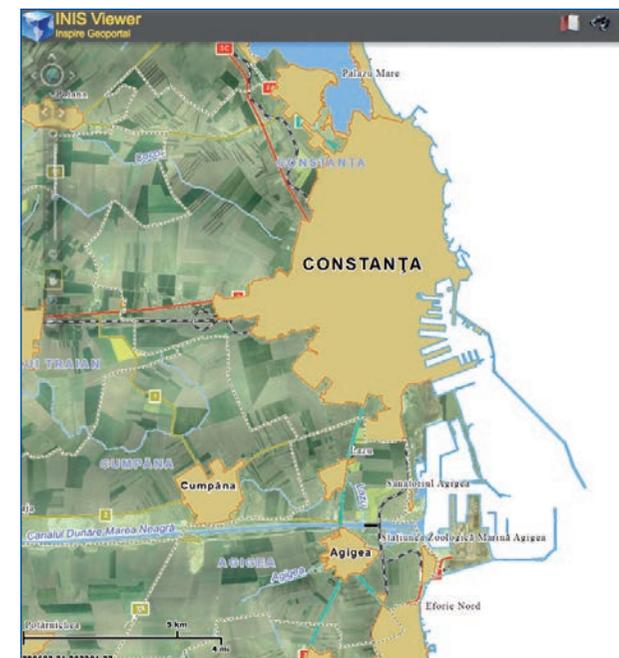
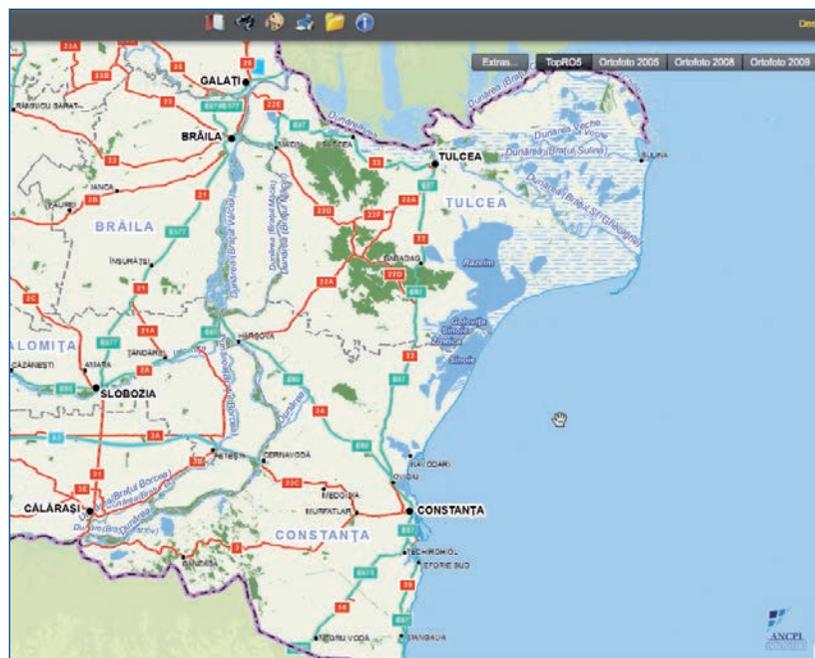


## The ICZM Protocol and the INSPIRE Directive

Every day we access an enormous and continuous flow of information, with much of it happening on or referring to a position or a specific place on the surface of our planet. This information is geo-referenced. In the last 30 years, the amount of geo-referenced data available has grown dramatically in line with the swift improvement of new communication channels and technologies such as the rapid development of spatial data capture technologies i.e. Global Positioning Systems (GPS), remote sensing images, sensors, etc. However, finding and accessing certain environmental and socio-economic information is not always straightforward.

In the Mediterranean and the Black Sea, the coastal zone is strategically important from environmental, economic and societal points-of-view. However, the fast and imbalanced development of its coastlines over the last decades highlights the clear need for an integrated, interdisciplinary and multisectoral approach to maintain a sustainable utilisation of coastal resources.

A major challenge for applying the recently adopted ICZM Protocol for the Mediterranean<sup>1</sup> to help decision making, is the integration of different types of data together with the institutional fragmentation of responsibilities concerning coastal areas at regional, country and local levels. Data on various government and public sector activities are sometimes hard to access and combine, making it difficult to get a comprehensive picture of the coastal environment at local level or across different sectors and geographical areas without previously gathering and standardizing information. This fundamental challenge has been recognized by government organisations and across the Mediterranean and Black Sea region as in other regional and private organisations.



The Romanian national spatial infrastructure facilitates the discovery and exchange of geospatial information with web-based interactive maps from the national topographic system.

Romanian INSPIRE Geoportals :  
<http://geoportal.ancpi.ro/geoportal/viewer/index.html>

<sup>1</sup> PAP/RAC. 2007. ICZM Protocol in the Mediterranean (signed in Madrid on 21 January 2008).

In the case of EU countries, present regulations are increasingly requiring data integration under the INSPIRE Directive to help create an Infrastructure for Data Information (DI) or Spatial Data Infrastructure (SDI) in Europe (e.g. Air Quality, Floods Directive, Water Framework Directive, Marine Strategy Directive, and European Statistics Programme). Increased international cooperation in this field could help develop the full potential of geographic information systems and new technologies, making them more valuable and widely available to a broader range of users and policymakers (UN-ECOSOC, 2010)<sup>2</sup>.

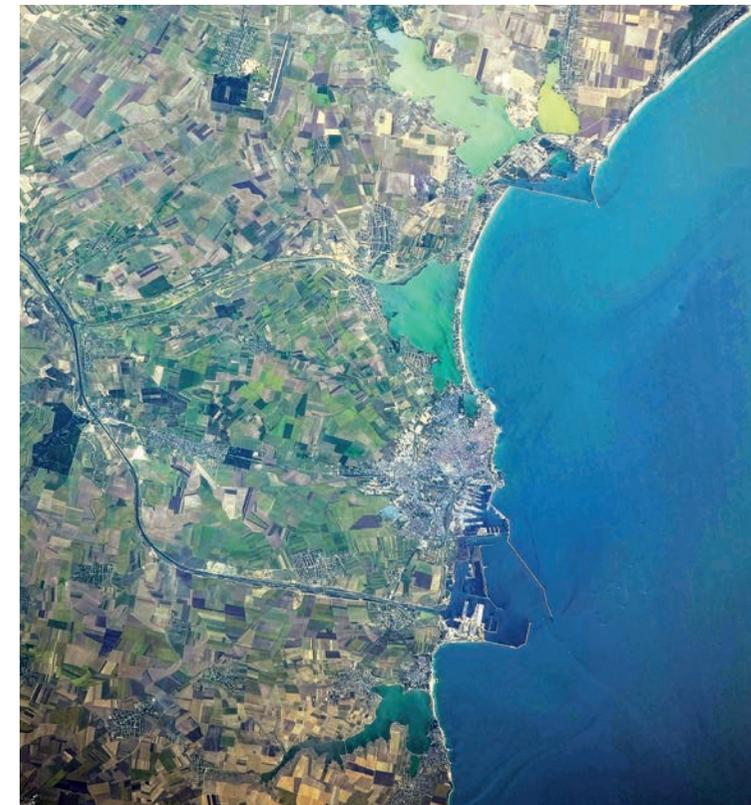
The SDI allows the application of new spatial technologies and spatial information to store data and their attributes, and their related documentation (metadata), offering a means to discover, visualize, and evaluate related coastal information, and finally provide access to the data themselves.

Many countries have developed or are now in the process of creating open data catalogues, geoportal and spatial data viewers. This approach is also beginning to be implemented in a limited number of municipalities and regions, offering very valuable information for coastal management.

<sup>2</sup> United Nations Economic and Social Council (UN ECOSOC) (2010), *Report on global geospatial information management*. Report of the Secretary-General prepared for the forty-second session of the United Nations Statistical Commission, 22-25. February 2011, New York, USA.

### The benefits of a SDI for coastal management

- It allows the downloading of relevant data for more detailed local analysis by a simple Geographic Information System (GIS) manipulation. The geospatial tool can assist in identifying ideal or potential locations for new projects in the coastal area.
- It offers a mean to discover, visualize, and evaluate the existing coastal information for different purposes, and finally provide access to the raw data.
- The SDI nodes (i.e. information providers) can be integrated with other local SDIs through standard services and thus significantly enlarge the capacity to access available geographical information.
- It allows better coordination across organizations, joining together land and sea management bodies and reducing the costs of delivery.
- It allows managers and decision makers to create and evaluate different policy scenarios for coastal zone management by examining the effects of different coastal activities in relation to policy targets.
- In certain circumstances, it can help visualize the consequences of different management approaches on coastal processes such as erosion, floods or other associated risks. Maps may be generated in support of disaster prevention efforts and response to emergencies.



Costanta Region, Romania.

© Image Science and Analysis Laboratory, NASA-Johnson Space Center. "The Gateway to Astronaut Photography of Earth." <<http://eol.jsc.nasa.gov/scripts/sseop/QuickView.pl?directory=ESC&ID=ISS020-E-27177>>.

## The PEGASO Project

PEGASO (« People for ecosystem based governance in assessing sustainable development of ocean and coast ») is a collaborative project between 25 institutions and organizations around the Mediterranean and Black Sea that seek to assist Mediterranean countries to put into practice the Protocol for Integrated Coastal Zone Management (ICZM) in the Mediterranean and explore its applicability in the Black Sea.

The PEGASO SDI is designed to support the PEGASO Shared Governance Platform for the delivery of Integrated Coastal Zone Management, and the integrated assessments of coastal zones and marine areas in the Mediterranean and the Black Sea. It supports the ICZM Platform and the suite of sustainability assessment tools required for making multi-scale integrated assessments in the coastal zone.

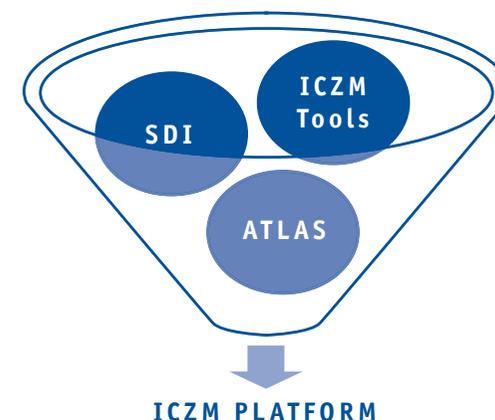
Thus PEGASO is constructing such an infrastructure by drawing on existing SDIs from project participants and others, and extending their capacities via easy Internet access to data and coastal zone management indicators. The setting up of PEGASO SDI aggregating national portals and regional organizations portal with information on the coasts of the Mediterranean and Black Sea becomes a powerful tool allowing governments, companies and citizens to easily find, understand and re-use coastal data for information, evaluation and decision making.

### The architecture of the SDI- ICZM network

The SDI is an integrated collection of software components designed to deliver spatial data and metadata utilizing standardized network services. It works at different organization levels ranging from local to provincial, national, regional and international scale.

The SDI is a practical tool, accessible via the Internet, that acts as a central repository for geographical information and allows for a better understanding of coastal features and options. It increases effectiveness for planning and managing a coastal area towards Integrated Coastal Zone Management by allowing the examination of different interests and demands for a coastal space and its overlaying results.

The Geoportal is the key element that provides access to information and data exchange from institutions. Each individual geonode, as the visual interface through the SDI network, can assemble a large dataset of coastal and marine environmental aspects with socio-economic information from different sectors (towns, shipping, tourism, urbanization, aquaculture, industry, etc) for display and analysis into a common map. Various layers of information can be then cascaded synchronously in the map, facilitating decision makers to coordinate and share updates on information on top of the map viewer and visually evaluate the effects of activities in relation to policy targets and indicators.



Concept of ICZM and SDI in PEGASO (Malvarez et al., 2011)<sup>3</sup>.

<sup>3</sup> Malvarez, G. C.; Pintado, E. G.; Navas, F. & Lescrauwaet, A. K., 2011. Spatial Data Infrastructures as a critical tool for ICZM in the Mediterranean basin. *Proceedings of the 10<sup>th</sup> International Conference on the Mediterranean Coastal Environment: MEDCOAST*. Erdal Ozhan (ed.), Rhodes (Greece). ISBN: 978-605-88990-6-3, Vol. 1, pp. 179-189.

### The PEGASO SDI and its components

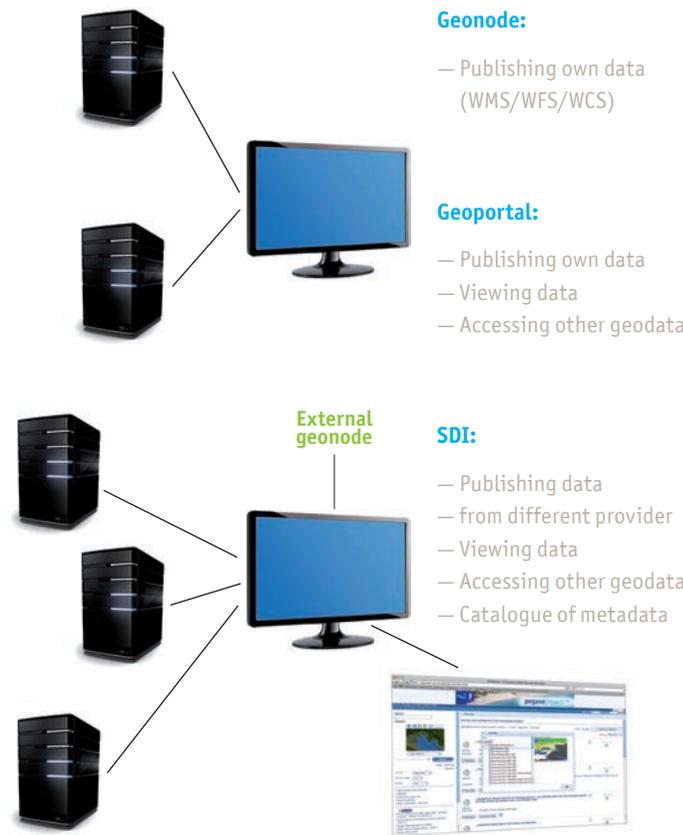
PEGASO SDI (<http://www.pegasoproject.eu/geoportal>) is a functional network of geonodes of the project partner institutions. It has been built by supporting the capacity to co-develop existing geonodes and expand into additional local/regional or national geonodes and with the aim to support the delivery of ICZM policies in the region.

- Geonodes offer accessibility to individual organizations' metadata (WMS/WFS/WCS Services) containing their geoinformation. Metadata are created and stored in other local Catalogues, in their own Catalogues or in the PEGASO SDI Catalogue;
- Geoportals are websites offering a Web Client the possibility to visualize and download geodata, allowing access to other external geodata. Metadata are created and stored in their own local Catalogue or in the PEGASO Catalogue;



- Individual SDIs belonging to particular organizations can similarly offer metadata through an extension to other servers.

With a simple GIS manipulation, end users can download relevant data for more detailed local analysis through a common map viewer.



The PEGASO SDI Geoportal

### GLOSSARY

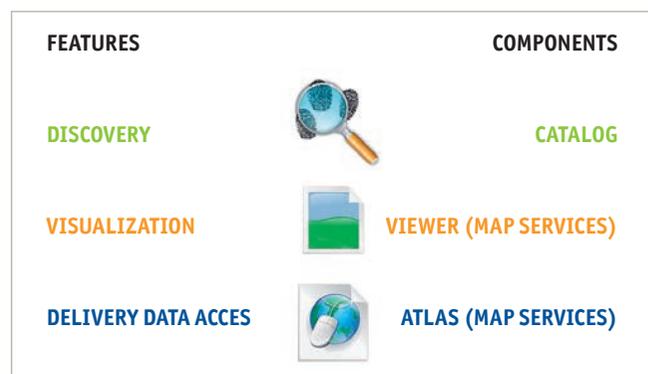
- **Geoportal.** Web application offered by an organization which allows a standard access to its own geo-information by means of a WMS Client (viewer), and also to other geo-information available from external Web Map Servers that the SDI allows to connect to. It can include a Catalogue of metadata related to its own geo-data.
- **Geonode.** Provider of geo-information within the network of Web Map Servers which form a particular SDI.
- **Metadata.** Metadata is structured information that describes how and when and by whom a particular set of data or a service was collected or prepared, and how the data is formatted or the service is available
- **Web map services.** Interface that allows a client to retrieve maps of geo-referenced data. In WMS context, a map means a graphical representation (jpeg, gif or png files) of a geospatial data meaning that a WMS service does not give access to the data itself. It is used for mapping purposes and can be combined with other WMS services.

## PEGASO SDI structure

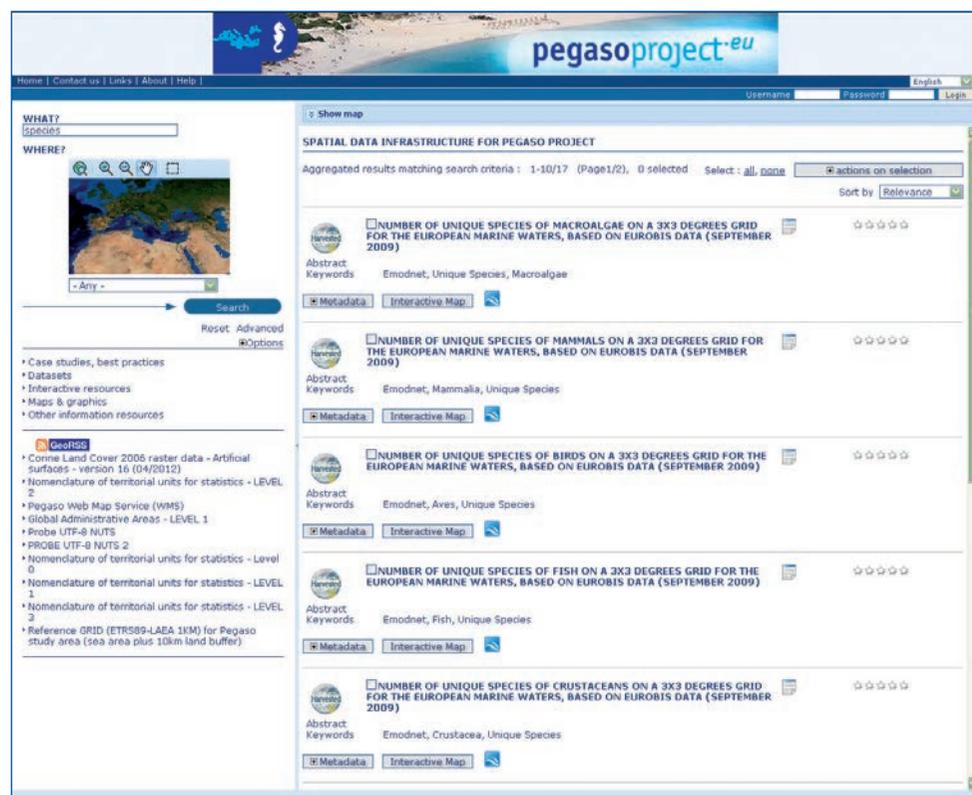
The PEGASO SDI breaks up into three functions that guarantees and facilitates the access to data and information: the Catalogue, the Map Viewer and the Atlas.

## THE CATALOGUE

The Catalogue is a mechanism for storing and accessing descriptive metadata and allows users to query and retrieve data items of the available geographical information. Through the Catalogue, any user (scientists, coastal zone management practitioners, natural resource managers) could access the repository of data on PEGASO SDI Catalogue as well as information from other services and data providers.



Main features and components of the SDI



PEGASO Catalogue system showing basic elements of the catalogue service and the available metadata.

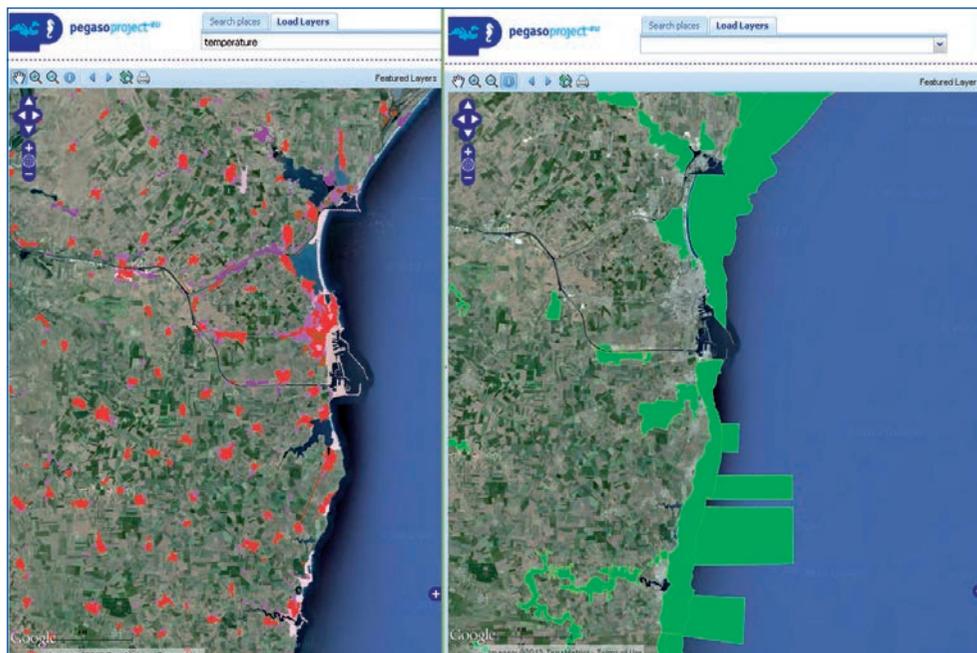
<http://pegasosdi.uab.es/catalog/srv/en/main.home>

## THE MAP VIEWER

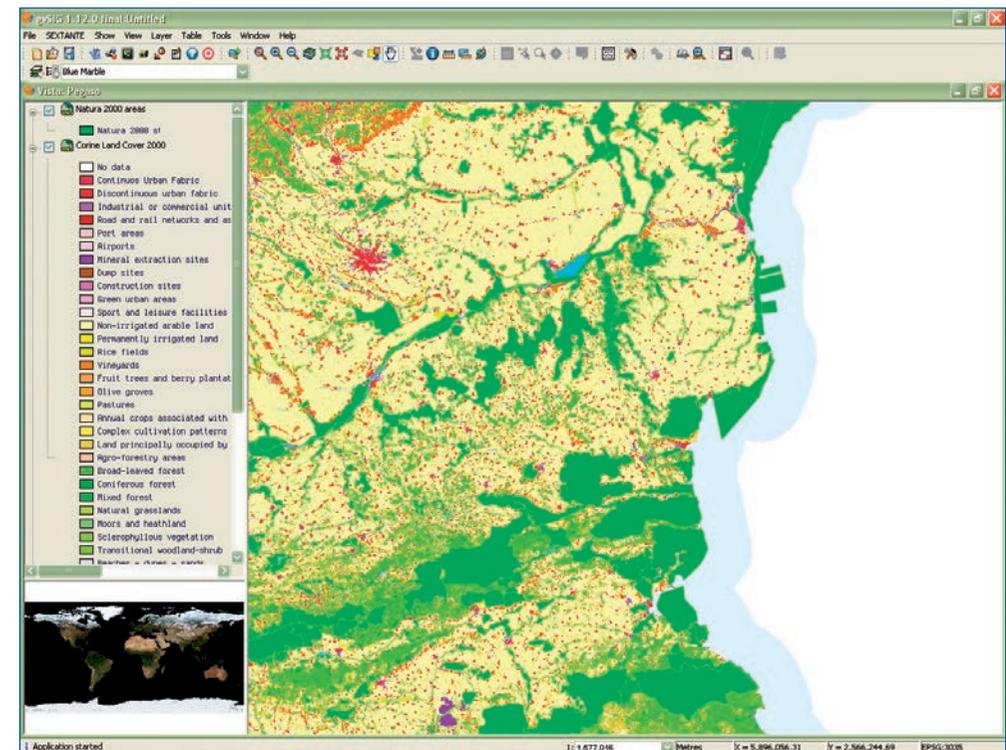
The PEGASO Map viewer is a practical tool, accessible via Internet that allows the visualisation and search of interoperable coastal data stored on the main catalogue and on partners geonodes connected to the central SDI. Thus, the viewer can show a whole range of spatial information, from basic data such as the distribution of Natura 2000 sites, Corine Land Cover data, elevation models or boundary layers of towns and cities, to other more specific tools and attributes around the area of interest of the user.

The PEGASO Map viewer thus provides access to the spatial information, the legend and the attributes of the information visualised through the information searching tool.

Pegaso SDI Map Viewer use for the coastline of Rumania to evaluate the potential impacts of coastal development (structures and transport network) to Natura 2000 sites (green areas) in Costanta Region, Black Sea.



Pegaso SDI allows accessing and uploading layers of data using external GIS software tools. Here, it displays Corine land Cover information with an inventory of land cover categorized in 44 classes.



## THE ATLAS

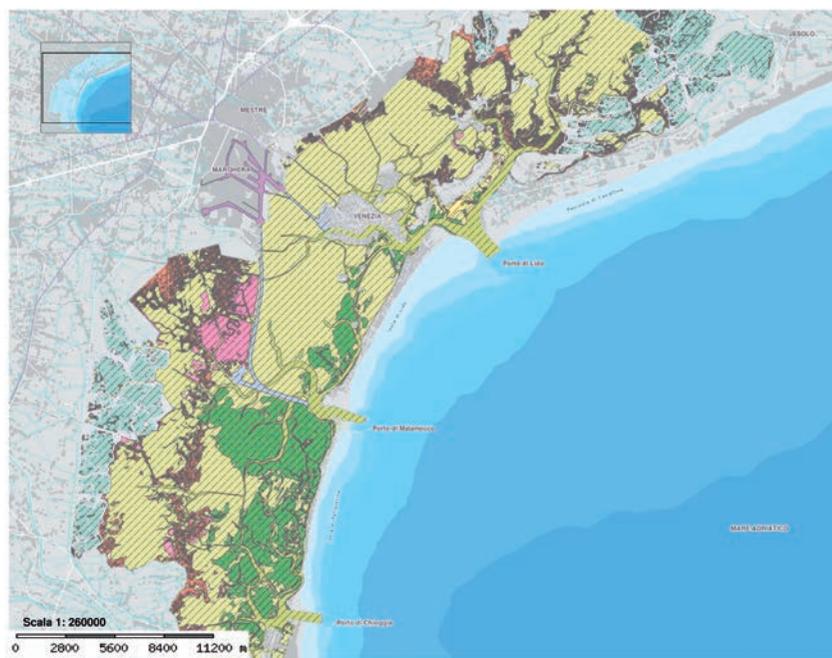
The Atlas presents a synthesis of the current spatial information and knowledge from the Mediterranean and the Black Sea coastal environments. It acts as a digital repository with an integrated summary of the available geodata and geoservice information represented by different thematic maps with a descriptive narrative. Basic information (i.e. coastlines, coastal cities, ports, ...) and sustainability indicators, giving an insight into the state of the coast and the sustainability of its development, can be displayed and downloaded to facilitate spatial planning in the coastal zone.



A good example of a local scale atlas is provided by the Atlas of the Venice Lagoon (Italy), divided into different thematic sections to cover from basic cartography to territorial transformation, administrative control and integrated analyses. The Biosphere thematic maps displays a wide range of data and information related to the environment of the Lagoon and its habitat types

<http://www.silvenezia.it/>

## Atlante della laguna il sistema informativo della laguna di Venezia



### Habitat di laguna costiera ECOTOPI

- |  |  |
|--|--|
| Laguna costiera  | Barene e canneti delle valli   |
| Barene naturali lagunari   | "Bacan"  |
| Canali lagunari  | Sedimento subtidale dei fondali lagunari   |
| Sedimento intertidale ("velime") senza vegetazione   | Sedimento intertidale ("velime") dominato da angiosperme marine  |
| Sedimento subtidale dominato da angiosperme marine   | Sedimento subtidale delle valli  |
| "Barene artificiali" (mosaico di habitat intertidali su accumuli di sedimenti di dragaggio in via di rinaturalizzazione) | Cassa di colmata (mosaico di habitat intertidali e terrestri su accumuli di sedimenti di dragaggio colonizzati da vegetazione spontanea ...) |
| Aree portuali  | Canali artificiali profondi di grande traffico navale  |
| <b>Carta base</b>  |  |
| Barene artificiali   | Casse di colmata   |
| Aree urbane  | Fiumi  |
| Assi stradali  | Assi ferroviari  |



© NASA/GSFC/MITI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team  
<http://eimages.gsfc.nasa.gov>



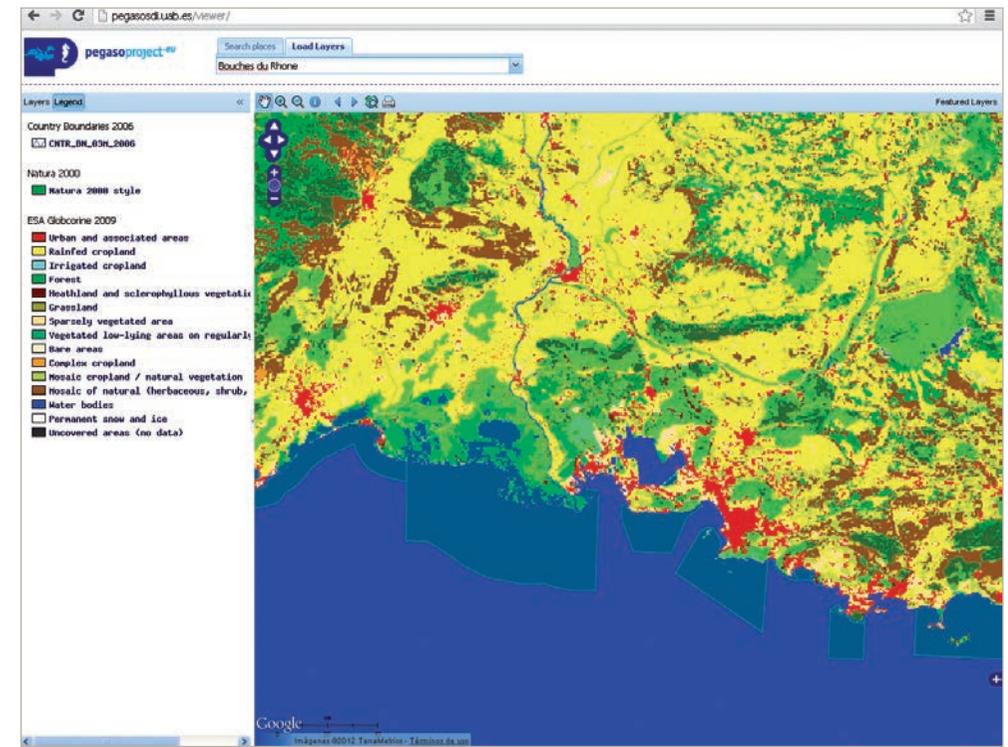
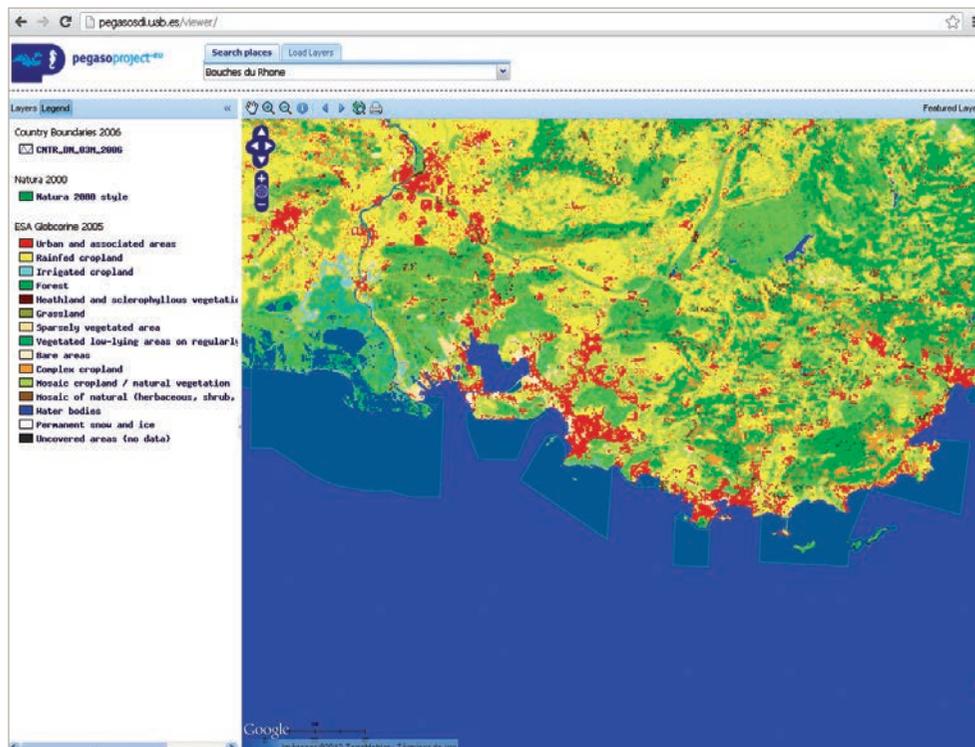
## Pilot Case of Bouches-du-Rhône (France)

Much of the coastal region of Bouches-du-Rhône (France) has become more fragile and suffers from a continuous conflicting use of interest as urbanisation around Marseille and other developments associated with coastal tourism spread along the coast itself.

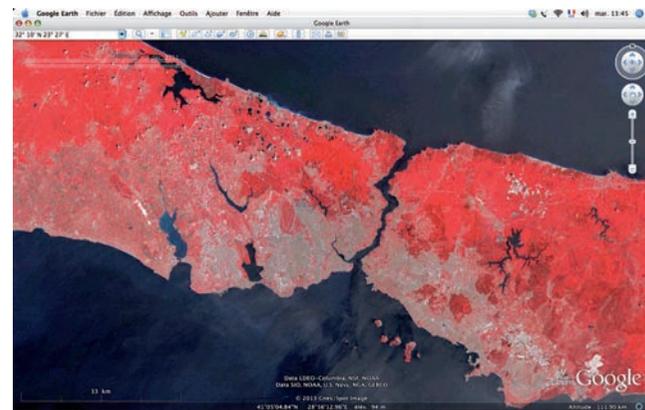
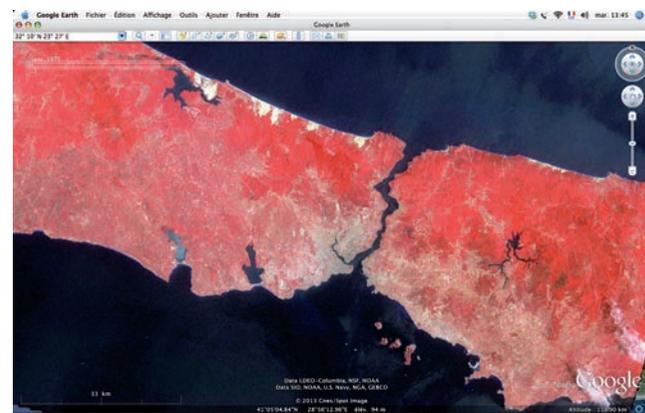
To prepare a rigorous assessment of coastal urbanization and land use and to examine strategic options for the evaluation of the coastal management, trends and changes need to be analysed. Through the PEGASO SDI viewer, information from the GlobCorine (Land Cover from ESA) in the year

2005 and 2009 can display the land use changes and the growth of urbanization along the coast. The incorporation of the spatial distribution of the NATURA 2000 Network can further assist with the potential links and impacts on the protected coastal areas. Thus, the viewer can aid “real” decision making, link land-cover and land use change information for a specific coastal area and present coastal vulnerability for the evaluation of present and future projects.

SDI Map viewer use for assessing coastal development to help guide local conservation efforts in Bouches-du-Rhône (France). Land use data and vegetation cover viewed alongside planning zones of protected areas.



A Shared Data Infrastructure (SDI) for integrated coastal management in the Mediterranean and Black Sea Basins



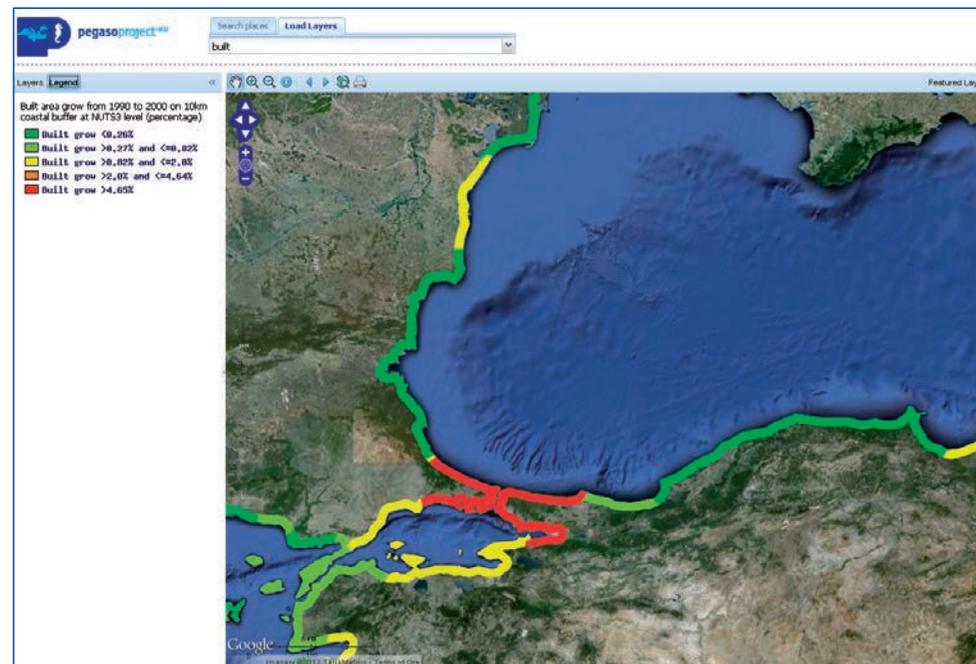
Istanbul, 1975 (up) and 2011 (down).

© Google Earth. NASA Earth Observatory images by Marit Jentoft-Nilsen, using Landsat data from the United States Geological Survey. <http://earthobservatory.nasa.gov/IOTD/view.php?id=77042>

Concluding remarks

## Concluding remarks

Integrated Coastal Zone Management requires accurate and replicable scientific data which can be used as a basis for informed decision making. Managing coastal and marine ecosystems and resources includes among many other aspects, infrastructure and urbanization planning, marine protected areas planning, management of coastal water quality and the management of catchments and waterways that flow into coastal areas. A set of suitable indicators with a reduced selection of parameters can provide useful information to policy makers to measure and encourage implementation of ICZM policies and programmes. By offering an overall picture of the different users in the coastal area and the state of the coastal environment, the SDI with its suite of integrated assessment tools, will support the assessment of coastal policies at different scales and measure progress in achieving sustainable development of the Mediterranean and Black Sea coasts.



SDI Map Viewer: Assessing coastal development growth around Istanbul coastal region to develop a vulnerability evaluation. Based on the trend analysis of growth rate on buildings and industrial complexes in the vicinity of Istanbul between 1990 and 2000, a vulnerability index is produced. The green color indicates low urban growth impact, the green medium impact and the red indicates the highest urban growth impact.

## For more information

### EDUCATIONAL ROUTINE PROGRAMMES THAT ARE OFFERED TO ACHIEVE SDI AND GEOPORTAL REQUIREMENTS

- Training Course on the Application of remote sensing & GIS Coastal and Ocean Management developed by the IOI and IOC-UNESCO IODE Project Office (Oostende, Belgium)
- University Training Course in University Pablo de Olavide (Sevilla, Spain). Sistemas de Información Geográfica y Cartografía.
- ESRI Technical Certification Programme.
- Training on Open Source GIS, University of Geneva in collaboration with UNEP/GRID-(Geneva, Switzerland) <http://www.unige.ch/formcont/opengis.html>
- Workshops about the strategy to implement INSPIRE specifications. <http://www.eurogeographics.org/>

### ADDITIONAL READING AND WEBSITES

- SDI PEGASO project: [www.pegasoproject.eu/](http://www.pegasoproject.eu/)
- SDI Envirogrid project:  
Black Sea Observation System portal  
<http://portal.envirogrids.net/>
- SDI Medina project: Marine Ecosystem dynamics and indicators for North Africa  
[www.medinaproject.eu/puplic/home.php](http://www.medinaproject.eu/puplic/home.php)
- SDI UNESCO IOC – Marine/Coastal Spatial Data Infrastructure development  
[www.iode.org](http://www.iode.org)
- KnowSeas Project: Knowledge-based Sustainable Management for Europe's Seas  
[www.knowseas.com](http://www.knowseas.com)
- Global Spatial Data Infrastructure Association  
[www.gsdi.org](http://www.gsdi.org)
- Eurogi- European Umbrella Organisation for Geographic information  
[www.eurogi.org](http://www.eurogi.org)
- Group on Earth Observations (GEO) building the Global Earth Observation System of Systems (GEOSS),  
[www.earthobservations.org/ag\\_partorg.shtml](http://www.earthobservations.org/ag_partorg.shtml)
- EuroGEOSS – GEOSS Project,  
[www.eurogeoss.eu/default.aspx](http://www.eurogeoss.eu/default.aspx)
- INSPIRE Geoportal: [www.inspire-geoportal.eu/](http://www.inspire-geoportal.eu/)
- INSPIRE. *Good practice in data and service sharing*,  
[http://inspire.jrc.ec.europa.eu/documents/Data\\_and\\_Service\\_Sharing/GoodPractice\\_%20DataService%20Sharing\\_v1.1.pdf](http://inspire.jrc.ec.europa.eu/documents/Data_and_Service_Sharing/GoodPractice_%20DataService%20Sharing_v1.1.pdf)
- INSPIRE DT Data and Service Sharing (2010a), *Guidance on the 'Regulation on access to spatial data sets and services of the Member States by Community institutions and bodies under harmonized conditions*,  
[http://inspire.jrc.ec.europa.eu/documents/Data\\_and\\_Service\\_Sharing/DSSDraftGuidancedocument\\_v4.1.pdf](http://inspire.jrc.ec.europa.eu/documents/Data_and_Service_Sharing/DSSDraftGuidancedocument_v4.1.pdf)
- *Towards a pan EU portal*  
[http://ec.europa.eu/information\\_society/policy/psi/docs/pdfs/towards\\_an\\_eu\\_psi\\_portals\\_v4\\_final.pdf](http://ec.europa.eu/information_society/policy/psi/docs/pdfs/towards_an_eu_psi_portals_v4_final.pdf)

### RELEVANT MEDITERRANEAN AND BLACK SEA LEGISLATION

- INSPIRE Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community, *Official Journal of the European Union* L 108, 1-14.
- INSPIRE Metadata Regulation. COMMISSION REGULATION (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata.
- Corrigendum to INSPIRE Metadata Regulation published in the *Official Journal of the European Union*, L 328, page 83.



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## Pegaso Partners:

