GIS* & ICZM

(Geographic Information Systems)*

factsheet

Bite-sized introductions to Sustainable Development themes

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ERM

WHAT ?

A **geographic information system (GIS)** allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. GIS is used to capture, store, analyze and manage data and associated attributes about features of the Earth. The system usually takes the form of a computer-based database where each feature is spatially located according to single co-ordinates (a position in X, Y or in Latitude/Longitude) with attached information that describes each feature. Information relating to similar "types" of features can be grouped together to make up different layers of a GIS, for example separate layers for population statistics, biodiversity data, environmental data and physical geography. A GIS greatly increases the potential to make complex spatial analyses across multiple layers of information (e.g. which areas of wetland are most threatened by encroaching human population and/or pollution) and present the outputs of the analysis in different ways (cartographic, statistics, in 3D) thereby answering complex requests that were not accessible by processes from traditional cartography.

Today GIS often refers to any information system capable of integrating, storing, editing, analyzing, sharing, and displaying geographically referenced information. It is a tool that allows users to create interactive queries (user-created searches), analyze the spatial information, edit data, maps, and present the results of all these operations. GIS is often used today without actually being named as such. One example is Google Earth, which implements geo-referenced data bases, viewed as a virtual sphere, and offers users a suite of tools for their requests (e.g. find to me a restaurant, measure distances between two points).

WHY ?

Geographic Information Systems can integrate and relate any data with a spatial component, regardless of the source of the data. GIS is used to analyze, follow changes and understand biological, chemical, physical, social, economic and political features of the Earth that have an influence on its function and appearance. In a coastal setting, the territory is an area of interface and interactions that often becomes a centre of competition between users and/or policies that ICZM attempts to resolve. Within this restricted space, where fragile ecosystems rub shoulders with particularly strong anthropogenic (man-made) pressures, the attempt to reconcile economic development with safeguarding natural systems is a source of conflicting interests and heated debate. GIS has much in common with ICZM: both are interdisciplinary and facilitate the interpretation and integration of data. GIS is then a tool of choice to **understand**, **monitor**, **anticipate**/**plan** and illustrate/communicate management choices in the medium and long term.

Understanding the situation at any one time: cartographic representation of data clarifies components of the territory and their relationship to each other (e.g. which dwellings are located less than 200 m from the coast and not connected to the sewage system? Where are the main coastal wetlands, registered as "Sites of a Biological and Ecological Interest" at the national level?). People and organizations implementing ICZM use this understanding of the coastal space to determine the constraints and potentials of development activities affecting the area, their nature, their interactions, as well as the laws which control them.

Monitoring: GIS makes it possible to quantify some of the dynamics and evolution of processes over time and incorporate this into descriptions of the territory (e.g. what changes can be expected in wetlands over the next 10 years from which sectors? Which sectors will benefit from these changes (residential areas, industrial, agricultural, etc.)?

Future scenarios and planning: GIS makes it possible to simulate future scenarios and to take into account the risks associated with changes in the coastal space according to observed natural or anthropogenic dynamics (e.g. which urban zones will be affected by an increase of *x* cm in sea level in 50 years according to observed measurements from Mediterranean shores? where will the coast remain accessible to the public if urban development continues at its current rate?)

Disseminating and communicating: cartographic (charts, static or animated, numerical applications, models in 3D) and associated data (descriptive, qualitative or quantitative, such as indicators) can be presented to audiences in a variety of ways. Choosing the appropriate mode of presentation for each different audience, communication can be tailored so that the information and alternative scenarios are easily accessible to them. GIS facilitates information sharing through its ability to:

- Automate processes and manage diversity of information.

- Integrate and present multi-disciplinary information, by supporting visions from different sources but which lead to a shared vision of the same space.
- Contribute to decision-making by making information and its analysis readily available and by producing simulations and projections of change.

WHEN ?

GIS is used when the multiple processes affecting the coastal space cannot be managed by a simple system of traditional charts. GIS also meets a need for regular updating of data. Like other components of IT (information technology), GIS is simply a tool which helps the processes of investigation and planning and complements, rather than undermines, the need for dialogue between the various actors of the coastal space on their needs, aspirations and expectations.

GIS is thus a tool for integration which should be employed early on in a management process so as to include all the actors and organisations with knowledge relating to the coastal area. Their own understanding and information is incorporated within the database so that the complexity of issues is fully accounted for. GIS can then be used as an aid to decision making by illustrating future scenarios under different management strategies. GIS does not in itself determine solutions to management problems.

WHO ?

National organisations should be involved in the collection, dissemination and standardisation of data (quality control) for the coast through base maps, photographs (aerial or satellite) or other data bases on principal networks (road network, hydrographical features concerning the coast, etc.). These largely empirical data need to be "interwoven" with local visions and understanding of the coast, with a other actors (research centres, NGOs, communities, nature conservancy associations etc.) producing data relating to their own vision. Effort must be made in particular to ensure the active participation of locally elected representatives since they are the key decision-makers for developments at the local level. Among its other benefits, GIS will provide them with tools for communication, largely accessible to any citizen, giving greater transparency to their action and supporting the debate necessary for any process of ICZM.

HOW ?

The process of implementing a GIS requires successive phases of needs definition, identification of actors, inventory of necessary data and its structuring, followed by a choice of the data-processing platforms (hardware and software). User-centred views on the data, reflecting the "interwoven" nature of the application, are then defined for the final stage of communication. In the countries of the Mediterranean, basic national reference frames are seldom accessible in numerical form, and so the time required to produce high quality geo-referenced data should not be underestimated. Quality data (that is exhaustive, up-to-date, valid and geo-referenced) is essential to help the decision-making process.

WHERE ?

A number of projects focused on the coast have used GIS to support their implementation. For instance, The Medam project(http://www.medam.org) made an inventory of coastal development on the French Mediterranean coast and its impact. Other projects, including many of the SMAP III ICZM projects, have used GIS for archaeological studies, monitoring of urban development, monitoring pollution, mapping flora and fauna distributions and habitat mapping.

SD LINKS

SMAP Factsheets: ICZM Factsheets (series), The *Integration* of ICZM

SUGGESTED READING

COASTLEARN: GIS course: http://www.netcoast.nl/coastlearn/website/fr/gis/index.htm
Coastal Resources Center - GIS and Remote Sensing pages http://www.csc.noaa.gov/?bin=7
CoastGIS 2003, Genova: http://www.gisig.it/coastgis/
IFEN Coastal Observatory: http://www.littoral.ifen.fr/
French Ministry of Ecology site: http://www.geolittoral.equipement.gouv.fr/
http://www.ordnancesurvey.co.uk/oswebsite/gisfiles/
http://www.geo.ed.ac.uk/home/gishome.html