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DATABASE FOR THE PURPOSE OF INTEGRATED COASTAL ZONE MANAGEMENT

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Abstract: The database was created in response to the need of obtaining complex information necessary for efficient management of the Polish coastal zone. Database preparation processes are co–ordinated within the EU PHARE project focusing on harmonising such databases in Estonia, Lithuania, Latvia and Poland. The majority of the information concerns the geographical objects, therefore the database was generated with application of Geographic Information Systems.

Keywords: integrated coastal zone management, GIS, database design, GIS Internet access

1. Introduction

One of the basic demands for effective management of the coastal zone is to deliver information necessary for such management in the operational mode. The majority of the data necessary for so–called process of Integrated Coastal Zone Management (ICZM) are those, which are recognised as spatial data. Geographical structure of the data used in the ICZM project is the main reason for using geographical information systems (GIS) as a base for this database project, both on the level of delivery of data and while analysing them as well.

The initiative to create the National GIS Centre for Integrated Coastal Zone Management is realised at the Maritime Institute in Gdansk in order to provide the potential customers — ICZM managers — with the geographical data and analysis. It is partially supported with EU PHARE project entitled "Integrated Coastal Zone Management in the Baltic States and Poland — Satellite Imagery, GIS Applications and Pilot Studies". The project focuses on standardising and assuring compatibility

between data and systems created in the countries involved in the project. As a part of the project the pilot project of Wladyslawowo municipality is currently being realised at the Maritime Institute in Gdansk. In addition all of the countries still work at preparing common definitions of the database elements.

2. Objectives of the National Centre of Integrated Coastal Zone Management

The main aims of establishing the National GIS Centre for ICZM are:

— to provide the ICZM team members with all necessary geographical information, spatial and time analysis, including short–term, mid–term and long–term forecasts;
— to maintain the storage of spatial information system;
— to provide means for archiving and restoring spatial data.

There are several reasons for the creation of such central databases. As far as smaller countries (Estonia, Lithuania and Latvia) are concerned it is obvious, because databases created for purposes of the coastal zone management cover quite big area of those countries. It is not so obvious in Poland, but there can be found several reasons for doing it, among others:

— there is insufficient knowledge of GIS tools among coastal zone managers;
— regional and local authorities are not yet prepared for building up and maintaining very complicated GIS systems;
— coastal zone management should be considered from a wider perspective than the local and regional ones.

The centralised implementation of ICZM GIS is useful especially for countries in transition. One of the advantages is that quite expensive GIS tools for data production and storage are maintained centrally, which means that resources are not spread over different weak centres, but we may provide users with high quality data from a well established and well equipped centre.

The basic weakness of the centralised database is that centres of data utilisation and places of information preparation and creation are diffused. Fortunately, both relational databases and GIS systems allow to exchange data remotely through Internet, even by a common WWW browser.

3. Customers of the National GIS Centre for Integrated Coastal Zone Management

There are different levels of ICZM GIS customers. The division can be made on the basis of spatial parameter — the area of the coastal zone, which is being managed. There are 3 groups of users — regional and local authorities and government agencies (see Table 1). It is important to notice that at the moment most of the institutions listed in Table 1 have not yet developed GIS tools for ICZM. There are only a few ongoing projects and pilot studies. One of them is realised at the Maritime Institute as a pilot project for Wladyslawowo municipality.

Table 1. *Customers of ICZM GIS and their tasks in Poland*

Customer	Responsibilities and tasks
Local authorities	1. Development of land use plans for the municipalities
	2. Flood risk prevention
	3. Preparation of contingency plans
Regional authorities	4. Environmental policy
	5. Optimisation of contingency plans for the coastal zone (e.g. for harmful substance spill)
	6. Construction permits within the area of the Technical Belt and the Protection Belt
Maritime Offices	7. Planning and design of coastal protection systems
	8. Decision making on all forms of use of the sea and sea bottom
	9. Safe exploitation of approach channels and ports
	10. Issuing of permits for dredging and dumping of spoil and waste in sea waters
	11. Optimisation of life saving and oil and chemical spill removal actions on the sea

4. Layers and products in ICZM GIS

Basing on the different definitions of the ICZM tasks which exist in the countries participating in the PHARE project the preliminary list of layers which should be included into the database was created (see Table 2). Additionally it was agreed that work at particular descriptions of layers was divided into four domains:

— coastal dynamics (Poland);
— nature conservation and cultural heritage (Latvia);
— impacts of tourism and recreation (Lithuania);
— integration with existing (municipal and county) planning (Estonia).

It is anticipated that in October 99 the data from Wladyslawowo municipality covering layers form Table 3 will be served through Internet. Data in the database will not only be slowly changing but also changing every day (e.g. short–term hydrodyna–mic forecasts).

Table 2. *Preliminary list of features to be included in the ICZM GIS*

Main category	Sample subcategories
Topographic reference markers	Survey marks, border signs, navigation marks, geodetic towers, compartment signs, topographical point markers
Administrative borders and boundaries	Legal borders, administrative borders, territorial planning borders, protected areas, technical service borders (e.g. telecommunication service area, distribution networks)
Geology	Profiles, boreholes, geotechnical maps, thickness of dynamics layer, geological maps, sediment distribution maps
Digital Terrain Modelling	Bathymetry at least to 15 meter water depth, topography at least to dune crest and for possibly flooded areas

Geomorphological structures and objects	Nearshore bars, nearshore trough, shoals, beach sectors with descriptions, coast sector's type with descriptions, erosion and accumulation areas
Hydrological features	Nearshore currents, wind and wave climate and forecast data, water level fluctuations, ice conditions, rivers, lakes, wells, ground water flow directions
Nature objects and habitats	Vegetation forms, forest types
Coastal defence, shore protection and hydrotechnical structures	Dykes, dams, groynes, breakwaters, seawalls, artificial beaches, jetties
Land and water use forms	Farms, fishing zones, mariculture enterprises, cities, settlement structures, industry, restricted areas, water use
Traffic infrastructure	Roads, railroads, airways, shipping, ports and harbours, ferry terminals, lighthouses, marinas
Supply networks	Electricity, oil and gas, freshwater and wastewater, heating system network, communication facilities
Infrastructure (others)	Health service, waste treatment, fire protection and fighting, educational complexes
Tourist infrastructure	Recreation sites, hotels, pensions, restaurants, swimming pools

Table 3. *List of layers and products in ICZM GIS for Wladyslawowo municipality*

Category	Components
	Layers
Meteorological data	Wind speed and direction, temperature, pressure
Hydrological and hydrodynamic data	Current speed and direction, salinity, temperature, wave height and direction, water level
Geomorphological data	Topography, bathymetry, side-scan sonar imagery, air photos
Geological and sediment data	Sediment types, grain size distribution, thickness of dynamic layer
Human impact	Coastal protection structures, nourishment areas, breakwaters, ports
	Products
Climate data	Wind, waves, currents and water level
Maps	Geomorphological variability, possible flooding areas, coastline development, photo-maps for the coastal zone
Calculations	Sediment budget calculations

5. Notes about realisation of the database for ICZM purposes

Implementation of the pilot project will last till the end of October 1999. The following tools are used during database creation:

1. ArcInfo — GIS system for the vector data preparation and pre–processing everyday updating with new forecasts);
2. ArcView — GIS programme for the vector data preparing and for serving through Internet as maps;
3. TNTMIPS — GIS programme for the raster data preparing (processing of aerial photos);
4. JBuilder — for building up the users application of network database;
5. Oracle Enterprise Server — to manage the relational database with extensions allowing the storage of spatial and time changing data (Spatial Data Cartridge and Time Series Data Cartridge);
6. GEODIN View — system for graphic representation of geological data.

Over 1000 aerial photos were included into the database. The systematic processing still lasts at the Maritime Institute. There will be a topographic base for the whole Polish coast, a base for creating a DTM and a base for vectoring some of the information layers. There is an example of a processed photo in Figure 1.

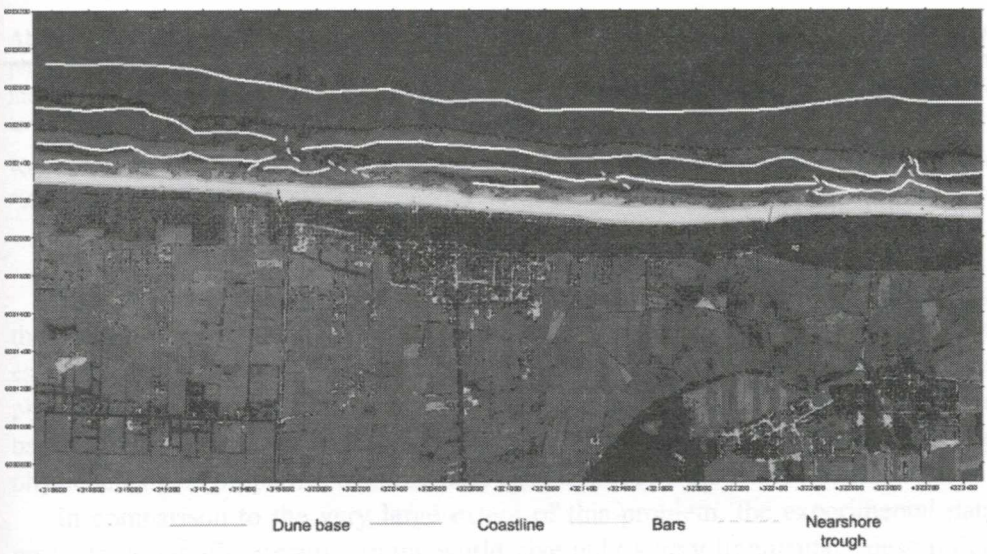

Figure 1. *An example of demarcation of nearshore bars and nearshore trough from aerial photos near Karwia area*