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GEOGRAPHICALLY REFERENCED DATA BASE OF POLISH COAST SUPPORTED BY GMS-DECIDE

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Abstract: The coastal zone is an interactive and dynamic complex of sub-systems, where human activities and natural processes in one sub-system may adversely affect other sub-systems. Therefore, one of the most important issues in the area of Coastal Zone Management (CZM) is to avoid conflicts and to prevent overlapping of development interests of the various resource sectors such as tourism development, land use planning etc. The GMS-Decide is the software designed to create, organise and analyse data as it relates to the geographical information. It can be used for scientific investigations, resource management, and development planning. For CZM purposes, GMS might allow emergency planners and decision-makers to easily calculate emergency response in the event of a natural disaster. In the strictest sense, a GMS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e. data identified according to their locations, which is extremely useful to deal with coastal areas.

1. GMS™-Decide

GMS-Decide (Geo Managment System, Da Vici, Belgium) is a full-featured PC-desktop software package allowing one to store, select, integrate and analyse all kinds of geographically referenced data and files such as: tables (e.g. Excel, Lotus), texts (e.g. ASCII, Word, WordPerfect), images (e.g. PCX, BMP, TIFF), software, sound, etc.), which may be located and viewed in front of various base maps. The base map, which is geographically referenced (in Map Referencer — attached to the software package), is a BMP file with links to the above-mentioned information.

GMS-Decide is essentially a tool for decision-makers, who want to evaluate and plan their actions relating to sites. The range of actions requiring geographical analysis

may be as variable as: protecting, controlling, measuring, selecting, investing, allocating resources, evacuating, drilling, building, promoting, etc. in such sectors as coastal engineering, coastal management, land-use planning, environmental protection, etc.

2. Data base

The data base for the Polish coast created in GMS-Decide may include all the data types referring the Polish coast of the Baltic Sea, as well as of the Baltic Sea itself. The data can be useful in a process of planning, at preliminary stage, of an implementation strategy for flood protection schemes, etc.

Table 1 includes detailed description of the database. It is worth mentioning that the entire data set is dynamic, i.e. still under process of modification and upgrading. The size and resources of the database depend only on the user's needs or hardware configuration (mainly hard disk capacity).

Title	*Data format*	*Description*
A. Coastal chainage, location of onshore structures and borders of morphological stretches of the Polish coast. Situation in 1992 – 1994 (*)	table	3,23 – 78,85 Piaski – Sopot
	table	79,0 – 99,145 Sopot – Mechelinki
	table	99,5 – 119,18 Rewa – Gniezdzewo
	table	~119,58 – H59,0 Swarzewo – Kuznica
	table	H59,0 – 156,1 Kuznica – Bialogora
	table	~158,65 – ~225,2 Szklana Huta – Debina
	table	~225,2 – ~266,8 Debina – Kopan Lake
	table	~264,2 – ~307,5 Kopan Lake – Sarbinowo
	table	~307,5 – 331,43~ Sarbinowo – Podczele
	table	329,67 – 345,44 Kolobrzeg – Dzwirzyno
	table	346,68 – 378,47 Dzwirzyno – Pobierowo
	table	~381,04 – ~411,4 Lukecin – Miedzyzdroje
	table	~411,4 – ~427,31 Miedzyzdroje – Swinoujscie

B. Dune and cliff – stretches of Polish coast (*)	table	0,0 – 428,2 Piaski – Swinoujscie
C. Cliff and flat stretches of Polish coast without groins. Protected and anthropoge-nically changed stretches (1992 r (*))	table	79,0 – 411,4 Gdynia-Kolibki - - Wolin Island
D. Protected and anthropogenically changed stretches of the Polish coast without groins (situation in 1992 – 1994 (*)).	table	~65,0 – ~424,57 Gdansk – Swinoujscie
E. Polish coast of Vistula Lagoon (*)	table	~4,5 – ~15,6 between state border and Pasleka River mouth from Krynica M. to state border
F. Polish coast of Odra Lagoon (*)	table	Polish coast of Odra Lagoon
G. Frequencies [%] of wave height and direction in selected regions of Polish coast in 1951 – 1978 (regions: A – H) and 1961 – 1977 (regions: I - J), computed by the Krylov method (*)	table	Wave height data set fo different regions (depth of 20, 10 and 5 m)
H. Maximum (over 1 m above Mean High Water) storm surges, for Polish coast in 1954-1975 (Majewski, Dziadziuszko, Wiśniewska 1983, p. 56 – 57) (*).	table	Descriptive tables: (max. water levels, duration, direction o air flow) for Swinoujscie, Kolobrzeg, Ustka, Władysławowo and Gdansk
Wind (**)	map (PCX)	A – January, B – April, C – July, D – October, E - annual, F – most frequent wind directions
Thermal wind roses (**)	map (PCX)	A – January, B – April, C – July, D – October, E – annual, F – Annual variation of daily mean of an air pressure, Hel
Storm waves (**)	map (PCX)	Direction: A – W, B – N, C – E, D – S, E – NW, F – NE
Air temperature (**)	map (PCX)	A – January, B – April, C – July, D – October, E – annual average F – indicator of the relative continentality of the climate
Hydrology (**)	map (PCX)	A – surface currents in summer B – mean annual surface water salinity, C – mean surface water temp. in summer, D – mean surface water temp. in winter, E – mean conventional density of surface water in summer, F – mean conventional surface water density in winter

Bathymetry of South Baltic (**)	map (PCX)	Base map
Hazards to the marine environment (**)	map (PCX)	A – sea ice, B – zones of flood hazards, C – biological effects of sea pollution, D – mean levels of particulates in the near-water air layer, E – mean concentration of radioactive strontium 90Sr, F – mean concentration of radioactive caesium 137Cs
Development and protection of the coast (**)	map (PCX)	A – recreational attractiveness of the environment, B – tourist development, C – environmental hazards and protection

Table 1. *The Polish Coast database prepared in the GMS-DECIDE system for ICZM and other purposes.*

(*) — *unpublished manuscript by A. Mielczarski, IBW PAN*

(**) — *maps scanned from: „Atlas Środowiska Geograficznego Polski" (Atlas of Resources, Values and Degradation of Poland's Geographical Environment), Agencja Reklamowo-Wydawnicza A. Grzegorczyk, Warszawa 1994*

3. Integrated Coastal Zone Management Based On GMS-Decide

The coastal zone is an interactive and dynamic complex of sub-systems, where human activities in one sub-system may adversely affect other sub-systems. Most coastal zone policies are implicitly based on the expected interaction between natural and social processes, many of which have been the subject of detailed scientific research. The coastal zone is a region intensively exposed to damage due to natural and anthropogenic hazards. For this reason coastal management takes into consideration technical, social, economic, ecological and many other factors, and should lead to implementation of strategies described by various scenarios of developments in both natural and man-induced processes (e.g. climate change scenario or 30-year socio-economic development plan).

During the World Coast Conference in The Hague in 1993 the following definition of ICZM was proposed:

Integrated coastal zone management (ICZM) involves the comprehensive assessment, setting of objects, planning and management of coastal systems and resources, taking into account traditional, cultural and historical perspectives and conflicting interests and uses; it is a continuous and evolutionary process for achieving sustainable development.

The Coastal Zone Management is a complex art and, if properly supported by means of computer software and technology (e.g. GMS-Decide or CAD/GIS family), it can offer a powerful basis for stable and continuous long-term development of the

coastal zone. The more elements interacting between one another along a coastal segment are included, the better results of CZM can be expected. System integration should not be limited to analyses of short- medium- and long-term processes, but it should also embrace smooth co-operation of decision-making organisations, institutions and authorities, should provide for spatial, temporal, organisational, etc., interactions at all possible levels.

Taking advantage of Polish as well as world-wide experiences one can distinguish a number of crucial requirements that should be fulfilled to achieve successful implementation of the ICZM:

1. Initialisation of planning by local and regional (if necessary depending on the scale) authorities, after recognition of the need of CZM.
2. Division of tasks among existing and newly established institutions and smooth co-operation, exchange of experiences and information among them.
3. Determination of skills and productivity of human and technical resources needed in initial phase of planning (to describe existing situation), program implementation and monitoring the implementation results.
4. Decision enforcement consisting in e.g. effective supervision or application of relevant incentives during implementation of a coastal zone management program.

4. Concluding Remarks

One of the most important aims of coastal zone management is the need to prioritise the development directions so as to avoid conflicts and to prevent overlapping of development interests of the various resource sectors, such as tourism development, land use planning, ecological aspects, etc. By integrating the development thrusts and conservation needs in the coastal zone, the Integrated Coastal Zone Management should optimise the use of the various coastal resources to ensure their sustainability. It is important to consider the environmental characteristics of each area from the point of view of development potential. Coastal zones can be delineated for specific impacts such as tourism development, aquaculture, ports & harbours, coastal industries, offshore oil and mineral exploration/exploitation, marine parks and protected areas etc.

It is obvious that in all these aspects the important steps are spatial planning, monitoring and anticipation of planing decisions, although they all are difficult procedures, not only the visual substantial size of due to magnitude of study areas. To achieve high quality results of the analysis, which involves plenty of factors influencing all processes in the coastal zone, one should use computer technology together with modern and sophisticated tools as GIS (Geographic Information System) and data base engines. GMS-Decide matches both: precision of GIS with functionality and speed of traditional databases, offering intuitive geo-referenced data management.

Appendix

Basic terms in GMS-DECIDE:

Cards — each document or file can be referenced through a card index in acatalogue. The information on the card — often called meta information — is in fact a description of these documents, although actual data could be stored as well. Cards can be selected in different ways, using thematic keyword indexes, geographical references, dates, numerical selection criteria, etc.

Catalogues — GMS may contain several catalogues. Catalogues contain cards, organised thematically to contain references to data on a related topic. The scope of one catalogue can be as broad or restricted as the user likes. It is possible to define, for each catalogue, what information is stored in the fields on every card. Each card in a catalogue has the same fields, but it is possible to have different fields in different catalogues. Six character fields, two numerical fields, two date fields, a thesaurus filed and free-keywords filed are provided.

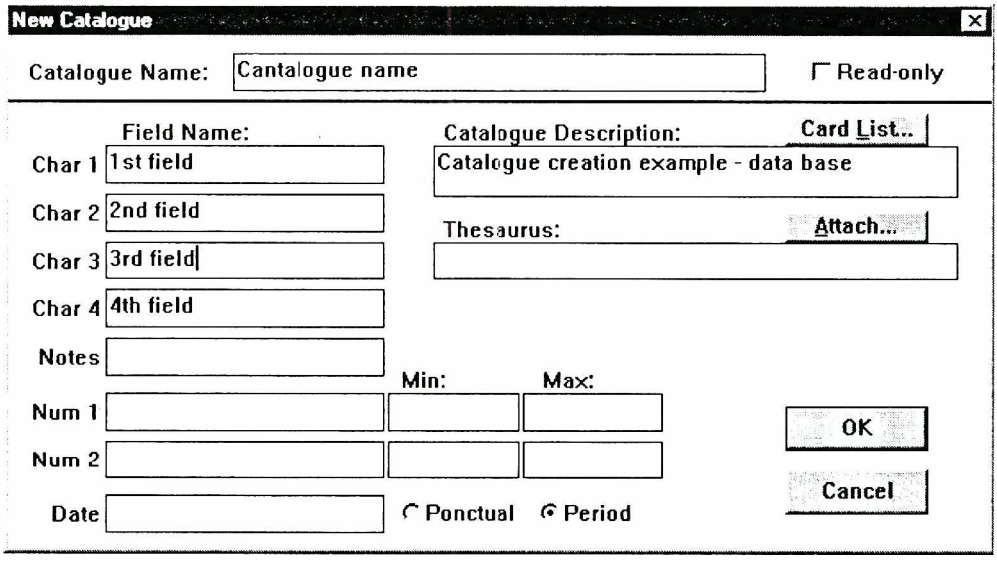

Figure 1. *New catalogue creation window*

Maps — all cards can be referenced by their position on the Earth — and GMS uses latitude and longitude as its basic geographical co-ordinates. As a consequence, it is possible to overlay markers (see below) representing the cards over maps. GMS includes a selection of basic maps, but the user is not limited to these. Using Map Referencer module the user can easily introduce new maps into GMS.

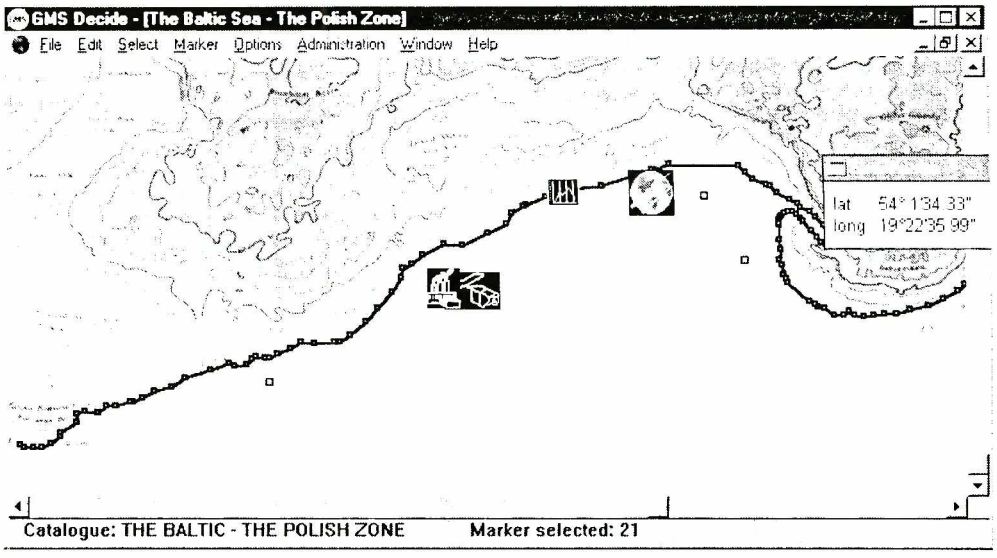

Figure 2. *Base map with markers and geographical co-ordinates window.*

Markers — each card may be georeferenced to a position on the map with a marker. You can create new markers or use those that come with GMS. In this way, markers can be used to represent a particular type of information, for example a symbol of a camera for a scanned photograph of feature of interest, an application icon for a word processing or spreadsheet (e.g. ). The marker can also be a line, as well as an area, and can be shaded with different colours, line thicknesses, etc. Any marker may be displayed in format of any map, regardless of the original map projection or scale.

Documents — electronic documents or files are „attached" to the cards in a catalogue, so that you are able to select cards which meet the search criteria the user defines, and then „retrieve", or call up the documents. With GMS-Decide, the information keeps its own format — there is no need to translate the data. Furthermore, it is readily available in standard software packages under MS Windows for visualisation, processing, printing, copying, etc.