

# **The creation of a national atlas of Greece using GIS technology**

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## **ABSTRACT**

The aim of this paper is to present the first results of a project titled: *The creation of a national atlas of Greece*. It includes all the phases concerning the design of the atlas and also the implementation of the first part of the atlas which represents the physical environment.

Initially, the topics of the atlas are defined, according to the average user's needs and the contemporary trends of cartographic technology. An analysis of existing similar cartographic products of Greece is given, as well as a review of national atlases of other countries. The titles of the included maps and their information content is based on the results of the above analysis. The symbology is defined according to the user's needs and the principles of visual perception.

The implementation of the first part of the national atlas is presented and emphasis is given to three cartographic steps: data collection, processing and graphical representation.

The whole project is accomplished using GIS technology under the platform of pc Arc/Info.

## **1. Introduction**

It is well known to the authors that the production of a national atlas needs a tremendous amount of effort to be done and a large group of people to be involved. The lack of such a similar cartographic product in our country led the authors to introduce a dialogue on the creation of a national atlas of Greece. This paper can start the preliminary discussion on this subject.

As a first step before applying the standard cartographic procedure for creating the national atlas, an effort was done to define some fundamental issues and give answers to basic questions (Petchenik, 1987) like the following:

- ▶ What is really a digital national atlas and to whom does it address?
- ▶ Who decides what information goes in it?
- ▶ How do the maps of a national atlas as a form of information relate to other form in which the same type of information is presented to and obtained by the users?
- ▶ Is it possible to establish any meaningful, specific standards in comparison to which atlases can be evaluated?
- ▶ Are there any principles which apply to atlas development in domains as: perceptual, cognitive, affective, geographic/spatial, societal, utilitarian, aesthetic, political and commercial?
- ▶ Is the term *digital* determinate for the definition of the above issues?

It is hard to say that for each one of the above questions was a single answer given and every issue was clearly defined in the process of creating the atlas although, the concepts that are introduced through the above questionnaire were under consideration in every step of the project.

## **2. Basic considerations about digital national atlas**

### **2.1 As a definition**

Creating a national atlas is identical to graphically representing the geographical space (physical and manmade) of a country and *all* the characteristics and phenomena occurring on it.

Creating a digital national atlas means building a data base with the characteristics and phenomena of the geographical space, their place of occurrence -(X,Y) coordinates- and their Z components (whatever those can be), processed in such a way that data can be displayed in form of maps. Contemporary technology integrates the existence of a data base with forms of graphical representation through GIS.

## 2.2 Users

Many are the users of a national atlas and there is a great peculiarity in the way they read the maps. A national atlas can be read as a magazine, can be searched as an encyclopaedia and can be studied as a source of spatial information. It is rather impossible to identify the average user's needs, but the choice of information to be included must be done under the consideration of satisfying all the above users. This is a very difficult cartographic problem and can be solved only by:

- Designing, easily readable but not simplified maps.
- Using non sophisticated methods of symbolization, but according to the rules of the visual perception.
- Giving the more detailed information in supplementary forms (graphs).
- Designing friendly user interface.

Following the above directions the maps of a national atlas could be easily read by high school students, by a person of an average educational level, by scientists (planners, geographers, engineers, social scientists etc.).

## 2.3 Editorial board

Obviously a national atlas will consist of many sections, describing the physical and manmade geographical space. After defining the topics of the sections, specialists for each one of them should comprise the editorial board.

The responsibilities of each member of the editorial board is as follows:

- ◆ To define a comprehensive list of information referring to the section of his speciality.
- ◆ To evaluate the indexes and magnitudes of quantitative or qualitative phenomena and their variables.
- ◆ To perform the administration and management needed for the data collection and aquisition. It is the cartographer's responsibility afterwards to choose the appropriate methods through which these magnitudes/indexes can be represented graphically and with the geographical space as a reference, in a map form.

The members of the editorial board will give prestige and reliability to the whole

project.

## 2.4 Information content

The information content of the national atlas was developed after thorough and systematically performed review and analysis of adequate literature including the *Economic and Social Atlas of Greece* (National Statistical Service of Greece, 1964), the *Industrial Atlas of Greece* (National Statistical Service of Greece, 1966), the *Britannica World Atlas* (Encyclopaedia Britannica, 1967), the *National Atlas of Japan* (Geographical Survey Institute, 1977), the *Atlas of Israel* (Survey of Israel, 1970), the *National Atlas of Wales* (Griffiths, 1989) and (Myridis, 1990). The parameters describing the Greek geographical space with its natural and social/economic characteristics were under consideration. The final choice of the following sections which are the topics of the national atlas' information (table 1) reflects the authors opinion.

TABLE 1

CODE	TOPICS
1	PHYSICAL ENVIRONMENT
2	LAND USE
3	POPULATION
4	ECONOMY (AGRICULTURE, INDUSTRY & SERVICES)
5	UTILITY NETWORKS AND TRANSPORTATION
6	SETTLEMENTS

A proposal for the analytical definition of each one of the above topics is given at the appendix. This proposal must be reviewed by the editorial board in order to achieve its final form. Concerning the physical environment since it was planned to be created the detailed description is given in part 3.

## 2.5 Atlas evaluation

Quite a few atlases of different countries were studied and analysed in the evolution of this project. It is very dangerous to evaluate them and say which one is better than the other and which one is the best to be followed as an example in the creation of the new one. The main reason is that as being national, the reviewed atlases are representing a space with peculiarities and are designed according not only to the cartographic standards but also to the ethnic ones (political, social and economic parameters) and finally they are not treated by digital techniques. In addition, it is known that there are no specific standards already established in the cartographic community, which can make the evaluation of an atlas possible. Anyway this literature review was an experience useful for the design of the national atlas of Greece.

In the contrary, a deep review was done for the most efficient existing Greek national atlas titled *Economic and Social Atlas of Greece* (National Statistical Service of Greece, 1964). The basic remarks can be summarised in the following:

- The information content is analytical and fully describing all the indexes and magnitudes of the spatial phenomena occurring in the country.
- The applied symbology is poor compared to the contemporary standards of perceptual and cognitive domains.
- The final product is black and white, a rather weak point for such a cartographic product.

The shape and the size of the Economic and Social Atlas of Greece as a book is quite efficient easily to handle and be stored and represents the country in a convenient scale (1:2.5 M).

## 3. Implementation of first section (physical environment)

The first section of the atlas represents the physical environment of Greece. According to the area covered by the Greek territory and the ability of the human eye to read a map from a distance of 30-40 cm, the spatial data base resolution was estimated to be 500 m, or the equivalent scale 1:2 M.

Of primary importance for the description of every geographical space are the elements of the physical environment. In those elements all the variables of the physical

environment are included. The term variables above refers to the components of the physical structure of the geographical space. These variables are:

- Surface morphology and relief
- Soils
- Hydrology
- Climate
- Vegetation

**TABLE 2**

<b>CODE</b>	<b>TOPICS</b>
1.1	RELIEF
1.2	GEOLOGICAL STRUCTURE
1.3	MONTHLY (JANUARY) MEAN TEMPERATURE
1.4	MONTHLY (JULY) MEAN TEMPERATURE
1.5	ANNUAL MEAN TEMPERATURES
1.6	MONTHLY RAINFALL
1.7	WIND DIRECTION (%)
1.8	WIND FORCE (%)
1.9	EARTHQUAKES
1.10	TRENCHES
1.11	WATERLANDS
1.12	WATERLANDS AFTER RAMSAR CONVENTION
1.13	WATERLANDS EXCEPTED FROM RAMSAR CONVENTION
1.14	NATIONAL PARKS
1.15	AESTHETIC FORESTS
1.16	CAVES
1.17	VOLCANOES

According to the above variables the analytical content of the physical environment section was defined in seventeen topics as given in table 2. Each topic corresponds to a digital map.

The data was collected from the National Statistical Service of Greece, the Institute of Geological and Mineral Exploitation, the National Meteorological Service, the Goulandri Museum of Natural History, the Greek Caves Association and the Astronomical Observatory

of Athens. The topographic base map was derived from digitization of 1:1 M scale map of Greece edited by Hellenic Military Geographic Service.

The main effort in the data processing phase was the application of transformation techniques in order to homogenize the data.

The selection of the symbols was based on using the visual variables (shape, size, hue, value and orientation). An effort was made in choosing rather simple cartographic systems of representation, so that the maps could be easily read by the average map user. More sophisticated methods (i.e. cartogramms) would be of course much more representative, efficient and elegant, but they were excluded because they are difficult to be read by a wide range of users.

All maps are colored.

The project was designed and implemented under the platform of pc Arc/Info (v. 3.4D). The data base was build using dBase III Plus package.

#### 4. References

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## 5. Appendix

### 1. Physical environment

- 1.1 Relief
- 1.2 Geological structure
- 1.3 Monthly (January) mean temperature
- 1.4 Monthly (July) mean temperature
- 1.5 Annual mean temperatures
- 1.6 Monthly rainfall
- 1.7 Wind direction (%)
- 1.8 Wind force (%)
- 1.9 Earthquakes
- 1.10 Trenches
- 1.11 Wetlands
- 1.12 Wetlands after Ramsar convention
- 1.13 Wetlands excepted from Ramsar convention
- 1.14 National parks
- 1.15 Aesthetic forests
- 1.16 Caves
- 1.17 Volcanoes

### 2. Land use

#### 2.1 Agriculture

- 2.1.1 Types of agricultural use
- 2.1.2 Coverage of agricultural use

#### 2.2 Grasslands

- 2.2.1 Ownership
- 2.2.2 Coverage

#### 2.3 Forests

- 2.3.1 Location
- 2.3.2 Coverage
- 2.3.3 Ownership
- 2.3.4 Types
- 2.3.5 Forest products
- 2.3.6 Type of exploitation
- 2.3.7 Fires (type-frequency-area)
- 2.3.8 Reforestation (year-area)

#### 2.4 Hydrology

- 2.4.1 Types (swamps, lakes, rivers and salt mines)
- 2.4.2 Coverage
- 2.4.3 Type of exploitation

#### 2.5 Settlements

### 3. Population

- 3.1 Population distribution
- 3.2 Population density



- 3.2.1 Physical population density
- 3.2.2 Density of agricultural population
- 3.2.3 Density of urban population

### 3.3 Components of population change

- 3.3.1 Population change
- 3.3.2 Births, deaths, marriages

### 3.4 Population structure

- 3.4.1 Population distribution (by age and sex)
- 3.4.2 Urban, semi-urban and rural population
- 3.4.3 Living in level, semi-mountainous and mountainous population
- 3.4.4 Active, non active and unemployment population
- 3.4.5 Agricultural, industrial and service employment
- 3.4.6 Educational level

### 3.5 Social characteristics

- 3.5.1 Householdings
- 3.5.2 Sizes of householdings
- 3.5.3 Family status

### 3.6 Migration

- 3.6.1 Internal migration
- 3.6.2 External migration

### 3.7 Immigration

- 3.7.1 Immigration by country abroad

## 4. Economy

### 4.1 Primary industry

- 4.1.1 Agriculture (exploitations, parcels, products/production and mechanical equipments)
- 4.1.2 Livestock (type, number and production)
- 4.1.3 Fishery (resorts, fishing boats, production and fish farming)
- 4.1.4 Mining (type, number, location, coverage, production/products)

### 4.2 Manufacturing industries

- 4.2.1 Building construction (number, floors, volume and value)
- 4.2.2 Handicraft/industry (size, annual employment, installed power, production, capital, exports)

### 4.3 Service industries

- 4.3.1 Tourism (hotels, campings, pensions)
- 4.3.2 Commerce (wholesale, retail trade establishments)
- 4.3.3 Services (education, social insurance, health, recreation/sports, culture)

### 4.4 Bank credit

## 5. Utility networks and transportation

### 5.1 Utility networks

- 5.1.1 Energy (electrical, gas, solar and wind)
- 5.1.2 Telecommunications
- 5.1.3 Irrigation
- 5.1.4 Drainage
- 5.1.5 Litter collection
- 5.1.6 Post offices

### 5.2 Transportation

- 5.2.1 Land (road network, railways, public transportation, taxis, trucks and cars)
- 5.2.2 Sea
- 5.2.3 Air

## 6. Settlements

### 6.1 Settlements structure

- 6.1.1 Number of settlements
- 6.1.2 Categories (location, population and production)

### 6.2 Urban characteristics

- 6.2.1 Urban plan
- 6.2.2 Densities

### 6.3 Morphological characteristics of urban areas

### 6.4 Historical characteristics

### 6.5 Utilization of settlements

### 6.6 Building construction activities