REGIONAL SPATIAL DATA INFRASTRUCTURE DESIGN FOR TRABZON CITY

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Abstract

Developing information technologies provide important opportunities for environment management. Building a regional database for Trabzon City as a prototype of Turkey executes decision making and future planning process. A web based service named as online GIS can be built to develop the use of spatial data. In this study, after database design, geographic data was collected and processed with the using of Geographical Information Systems (GIS) and Remote Sensing (RS). As a result of analyzing and querying database, elevation model, land use, potential landslide, settlement suitability maps and so on were created. A web based map servise was built. The service provides wider involvement in decision making process and also results in widespread participants for environment management.

Introduction

Environment management for decision making and future planning is current topic in global and regional works all over the world. At this point, the using of developing information technologies such as Geographical Information System (GIS), Remote Sensing (RS), and the Internet is considerably important. Constructing Spatial Data

Infrastructure in wide extend areas provides many opportunities for controlling natural resources and environmental changes.

A web based service named as online GIS is described as a network-centric GIS tool using the Internet to access and transmit data and the analysis tools to enhance the visualization and integration of spatial data. This service makes relevant data more accessible to the politicians, the public, and municipal administration. Capturing information for a region is essential for supporting operational and corporate decision making with web technologies.

In this study, building a regional database was examined as a prototype for Turkey. Trabzon City has been selected as a pilot area. This study is an initiative to establish a nation-wide Geographic Information System. The first step for this is to design a system and collect data. A planning process is executed about what kind and quality of data should be involved in such a system. A Spatial Data Infrastructure capable of determining risk areas in natural areas and producing base maps for tourism and risk activities have been built. A web based system providing wider involvement for decision support has been built to transmit and present the data.

Methodology

In Turkey, there are three base local administration systems which are province, county, and village. Province system which constitutes the basic administrative parts of Turkey is accepted as a base in view of central management, eliminating regional development differences, and providing a national wide balanced improvement. This administration forming integrity in its constitution is a small model of national

administration of Turkey. Building Spatial Data Infrastructure at a regional scale will provide an important tool for future planning.

Study Area

The city of Trabzon is situated between 39^{o} 7' 30'' - 40^{o} 30' east-longitudes and 40^{o} 30' - 41^{o} 7' north-latitudes in the middle of East-Blacksea Region of Turkey. (Figure.1). In the city, increasing elevation beginning from the sea level exceeds 3000m in some areas. Generally, mountains, hills and high plateaus take part in inner land of the region. The city is the most important trade centre in the region with the features of having historical and cultural wealth, being the centre of other population units as well as its unique geographical position.

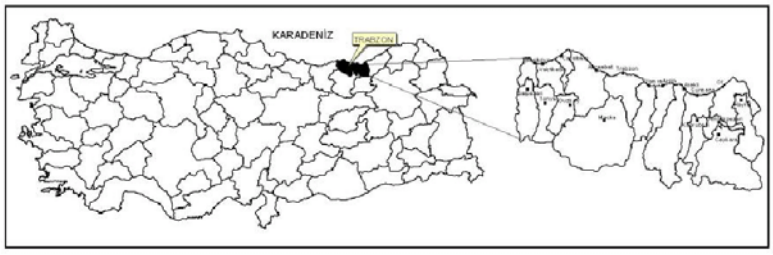

Figure 1: The location of Trabzon in Turkey

Designing Regional Geographical Data-Base

The first step for this process is determination of user requirements. Database design is executed, depending on these requirements. A regional wide Spatial Data Infrastructure may reflect all country structure because it includes a variety of data. Geographic data layers include Hydrology, Forest, Geology, Climate, Arrival, Settlement, Soil, Land use data and so on together with base layers including geodetic reference, topography, and map index.

Data Processing Through Geographical Information Systems and Remote Sensing

In producing region wide geographical data, it was took advantage of high data gathering capacity of the Remote Sensing techniques and, in processing gathered data, it was gained from high power querying and analysing facilities of GIS. The point that should firstly be paid attention is to classify this data in accordance with required standards, accuracy and scale in acquisition process of the data sets. In Turkey, a standard between public foundations in respect of authority and responsibility in producing spatial data up to now has not formed. A lot of data types are being used by various institutions with different quality, scale, accuracy and standards at the same time. Therefore, the proper information for this study that comes from different sources was integrated with each other.

After the available data existing in the constitution of institutions were acquired, missing data, in accordance with the aim of the study, were acquired through remotely sensed images. By taking advantage of the

features of Landsat ETM+ images used most in region wide works and acquiring data related to natural resources, missing or lacking data were gathered. Data on the image were gathered in two ways as visual interpretation and image processing techniques. Visual interpretation works were carried out by providing the integration of image with vector data by means of features of ARC/INFO software. In this process, especially, some data that is possible to follow and interpret manually such as routes, streams and shore lines were obtained.

Land cover types were obtained by classifying Landsat ETM+ images in ErMapper software. Supervised classification technique was used for this process. Area proportion for each class was calculated. At a result of this, Land use classes were collected in 11 classes after supervised classification and image enhancement works were executed.

Analysing and Querying Database

Proportions and percentages for land use were obtained for a province as a result of classification processes. A very percentage of the province is covered with plant. The class having the largest proportion is hard wood including beech, hornbeam, and chestnut, etc. with 38 percent. The other classes are range, agriculture, hazelnut, hard-soft wood, rocky, green tea, settlement, cloud respectively.

A 3D model of this area in TIN data model was formed and converted to GRID data model. Digital Elevation Model (DEM) obtained with resolution of the image by re-sampling was overlapped with image. A real model of the province was constituted. It is determined that the province has a rough and sloping topographical structure. As a result of

these processes, slope map, aspect map, potential landslide, settlement suitability maps were created.

Administrative and demographical structures were represented with the using of graphic and non-graphic data in database. Analysis and queries created for different purposes provide many opportunities for investment and services. Queries about roads, streams, and tourism information are especially mentioned here. Tourism map and road map were prepared through geographic database for representing the wealthy of the province.

Building a web based system

A combination of technological improvements regarding GIS and web leads to the modern management support environments. Different architectures can be used to design an online GIS application. ArcIMS architecture to establish a web based system was used in this study. The basic structure for this system is multitier architecture consisting of presentation, business logic, and data tiers. The system uses Microsoft Internet Information Server (IIS) as a web server. The application requires the client machine to be attached to the Internet (or an intranet) and to support only a standard Web browser. The web page contains an interactive map container which displays the map layers, a toolbar column that is used for setting parameters and controlling layers, and a legend column that is an explanatory table of the symbols appearing on the map. The users can use the maps interactively by performing conventional GIS functions such as zoom, pan, identity, etc. Some boxes and buttons are used for the user interaction. Besides default

templates, required templates were created with the using of ActiveX Connector, depending on user needs. ActiveX Connector is a COM DLL that can be used in a COM application such as Microsoft Active Server Pages. This implementation allows for processing on server side. [Aydınoğlu, A.C.]

Spatial Data Infrastructure was constructed for Trabzon city of Black Sea region as a province. Determined data was collected and presented over the Internet. Many users can reach this information in a common platform as a web browser. Data can be maintained and be updated in a centralized location or distributed locations. Figure.2 represents an example of data display on the web.

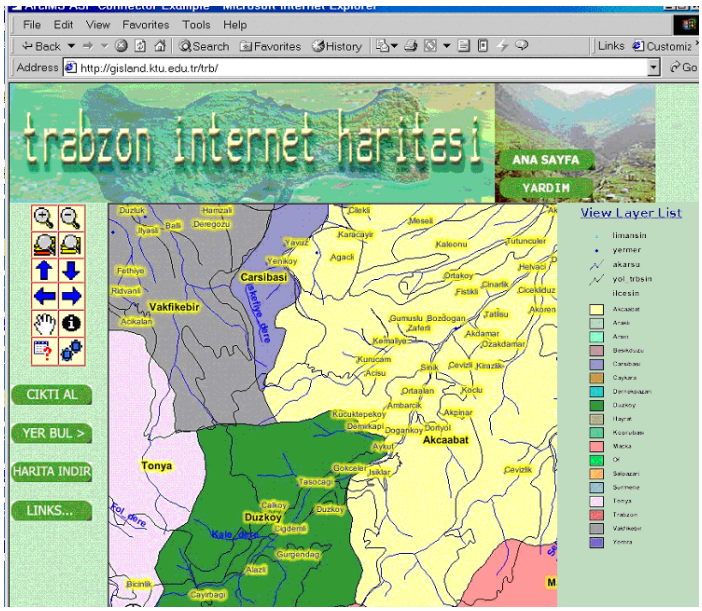

Figure 2. A data display on web browser

Conclusion

There are not large scale GIS studies in rural areas or provinces. Urban and rural areas spread much larger fields and include much more spatial details. Spatial Data Infrastructure must be built as a prototype for a local administration to provide the best management and decision making tools for planners. With the helping of this system, decision making and future planning can be possible. Online GIS provides easy access to the Internet for the users with low requirements. Users can reach conventional GIS, query, analysis functions. This method can also incorporate up-to-date and real-time information and make overlapping inter-disciplinary information possible. The service provides wider involvement in decision making process and also results in widespread participants. Online GIS enables future improvements and opportunities for the spatial data infrastructure.

References

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