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Determination of the relations between shore border line and land ownership by using GIS: An example from Eastern Coast of Black Sea

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Coastal areas, because of its unique natural resources, in every period of history of civilization have created a focal point, in terms of placement and use of a social order has become important. Both in the world and in Turkey, coastal areas, where the settlement and social and economic activities have become intense, are facing some problems. In Turkey, varieties of the climate, topography and the characteristics of habitation in the coastal areas are showed. There are subsisting several problems in the applications related to coastal planning. First of all, there have been striking differences in the socio-cultural life on different coastal regions. Secondly, the distance between coast line and shore buffer zone is fixed and the same for different regions of the country. Thirdly, residential and architectural typology appropriated for the physical conditions of the country's coastal regions is not in place yet. Finally, there are ambiguities in the coastal areas. In this study, a pilot area is located in east coast of Trabzon have been chosen for experimental work. Addition to this, the relationships between landownership and shore border line are examined by using geographical information systems (GIS). Cadastre maps and town maps have been digitised and transferred in to arc/info environment in order to make topology. Then attribute database pertaining to the parcels have been established to make analysis and queries regarding the relationship between shore border line and landownership. As the result of this study, it has been found that, the coast have not been used for public benefit, which are due to violates of constitutional law. The violations on coastal areas are due to both citizens and public organizations.

Key words: Land ownership, shore border line, geographical information systems.

INTRODUCTION

Coastal areas are important natural habitats, which must be conserved (Williams, 1990). Integrated Coastal Zone Management (ICZM) aims to solve worldwide-perceived problems of the coastal zone. Especially, population growth and urbanization trends pose a long-term threat to a sustainable development in the region. Both, demographic and economic growth, are the strongest in the coastal provinces (Lau, 2005). In recent years, the coastal zone, probably more than any other part of society has been exposed to pressure and processes of change. Among these changes are urbanization and new infrastructure, exploitation for recreation and tourism, acute nature and environmental problems, retreat of coastal occupations, reorganization of freight traffic between land and sea and changed functional demands and working conditions for harbours (Anker et al., 2004). The coastline

can be defined as the line of contact between land and a body of water (Pajak and Leatherman, 2002; Alesheikh et al., 2004). Knowledge of coastline is the basis for overcoming coastal problems, measuring and characterizing land and water resources such as the area of the land and the perimeter of coastline (Kuleli, 2009). Coastline changes may be caused by natural processes and/or human activities. The natural processes include phenomena such as waves, currents, and storms. The human activities involve changes in the environment, sometimes expressed as modification at landscape levels. The magnitude of these activities and their effects are related to urban growth and therefore, urban development must be seen as part of the ecological systems (Bailly and Nowell, 1996; Bedford, 1999; Ji et al., 2001; Jackson et al., 2001; Ruiz-Luna and Berlanga-Robles, 2003). Coastal areas

are easily accessible, making them centers of human activity, where people live, derive their recreation and their means of livelihood. Industrialization and urbanization are recent phenomena, consequences of human activity looking for economic development, which is leading to serious degradation of the ecosystems, especially, pollution and habitat encroachment along the coast of Trabzon. Population increases, together with rural and urban activities, directly affect the availability and quality of natural resources, but also induce secondary effects that must be evaluated from a regional view (Sekhar, 2005; Ayad, 2005). Nowadays, there have been some problems which are the unreliable and unplanned construction, lack of transportation, water pollution, wasting the garbage to the Black sea, traffic, air pollution, lack of common use land and recreation areas in all around Trabzon. Trabzon is one of the cities in which rapidly and unplanned organization is being applied in Turkey. In the city rapidly developing and growing, sea has been filled up for solving some transportation problems and building highways in the large filling areas. There are ambiguities in the coastal regulations in Turkey.

The existence of the life in the three-figure of nature, environment and living things, the determining and removing of the polluting sources are available with the geographical information systems (GIS) (Alkış, 1997). Recently, it has become to be a unique tool in coastal and seaside areas management and planning. GIS products are increasingly available on inexpensive personal computers. These products offer significant GIS functionality at a much lower cost than traditional work-station based software. It provides a mechanism for storing, analyzing, using and displaying georeferenced information. Spatial decision support relies heavily on maps, which form the backbone upon which plans and policies are defined. Environmental planning, further-more, involves studies of risk/impact assessment and contingency planning, which combine what and where to when and how (Seffino et al., 1999). The growth of GIS applications is also made possible by the growing availability of spatial data for popular GIS software, thereby reducing the costs of data collection (Keenan, 1998). Developing information technologies like GIS considerably support managerial decision making process to manage spatial information. The management of coastal areas is an important issue to prevent the harmful effects of environmental changes. The natural and socio-economic processes in coastal zones are complex and inter-related to each other. Hence, decisions on the processes in coastal zones require a thorough knowledge of the systems and activities. Integrated coastal zone management (ICZM) can be used to create a framework for policy-making and decision-making in coastal zones. ICZM can be defined as 'a continuous and dynamic process by which decisions are taken for the sustainable use, development and protection of coastal and marine areas and resources.' (Cisin-Sain and Knecht, 1998). The term 'Integration' can

be related to many aspects: integration among levels of government, integration among government and non-government agencies and institutions, spatial integration of land-based activities and marine issues and integration of science and management. These different types of integration require large sets of data of a diverse nature. A substantial amount of this data has a spatial component. Geographical information systems (GIS) are especially designed to handle and analyse spatial data. GIS are a 'powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world' (Burrough, 1986). The term GIS also refers to organisational, financial and other issues related to spatial information. Geo-information technology is a wider concept of (computerised) tools for handling spatial data and also includes for example multimedia tools. Geo-information technologies integrate information with a location component (x;y-coordinate). The integrative capabilities of geo-information technologies make them very useful to support ICZM (Douven et al., 2003).

In this study, a pilot area located in the East Coast of the Black Sea Region of Turkey has been chosen in this study. An area of 10 km length on Trabzon east shore line has been selected to this aim. It has been aimed to give samples to queries and analyses which can be made on coastal areas by using GIS. In this study, spatial data including cadastre maps and town maps attribute data including property were combined to make analyses and queries on ArcInfo/View program environment. On practice, these investigations are done on the Arc/View environment with joining, intersection and locational analyses. Relations between land ownership and shore border line were determined with the use of GIS technologies.

DEFINITIONS ABOUT COASTAL AREAS AND RELATED LEGISLATION IN TURKEY

According to the Coastal Law numbered 3621/3830;

Coastline

It is a natural line on the sea, lakes and rivers that changes due to some meteorological events which is formed by the fusion of the points on which the water touches the earth on the positions other than flood.

Shore border line

It is a natural border of sandy, gravel, rocky, marsh, rushy and other similar areas formed by the water motions against the earth after the coast line of sea, lakes and rivers. This border cannot be changed eventhough sea is filled to obtain land.

Coast

This is an area between coast and shore border line.

Shore buffer zone

It is an area of at least 100 m with horizontally from the shore border line of sea, lakes and rivers to earth.

The detection of a sash as shore buffer zone especially in the developing countries, aims to prevent from coastal erosions, to provide public reach to the coast and to be open to coastal view (Sorensen, 1995). According to the article 43 of the Constitution Law of Turkish Republic, the coasts are at the disposal of the government. In utilizing from the sea, lake and river coastlines one must take care of first of all the Public Benefit. According to the 2001 date Turkish Civil Law, the places with no property and the goods in the benefit of the public are in no ones landownership and can never be a subject of a private landownership. According to the Coastal Law numbered 3621/3830, the detection of the shore border line is obligatory to be able to make plans and plan's implementation on the coast and shore buffer zone. But unfortunately, the usage out of public benefit is being seen because of the agitated in planning and the detection of shore border line not in the way or at the time it must be done (Sonmez, 2002).

ISSUES ON THE COASTAL REGIONS IN TURKEY

Turkey has a long coastal zone surrounded by the Mediterranean, Aegean and the Black Sea and has cultural and historical merits, especially natural attractive-ness. Therefore, various investors prefer these areas. This situation causes many environmental problems on coastal areas. On coastal areas in Turkey;

- (1) Unbalanced construction causes unplanned urban areas, scattered buildings, environmental buildings and destroying water sources.
- (2) Coastal areas have insufficient social and technical infrastructure.
- (3) Uncontrolled urbanization and insufficient service appear.
- (4) Unbalanced developments on coastal areas result in land occupation.
- (5) The filling to obtain land parts violates the public benefit (Onal and Nuray, 1997).

STUDY AREA AND DATA SOURCES

Trabzon, a city of the most important centre of Eastern Black Sea Region, has a history of approximately 5,000 years. The city is selected as a study area within its typical coastal area and used as a case study to analyze coastal changes and their influences on

the environment. Trabzon lies along the eastern coast of Turkey, at an average altitude of 300 m covering about 200.000 ha. The study area is a part of rapidly developing eastern coastal zone of Turkey, a strip of land that averages about 10 km in depth from the Black Sea shoreline. It is located between longitudes 29°23' E and 29°33' E and between latitudes 30°49' N and 30°58' N. The study area extends about 10 km eastward along the shoreline with a width that ranges from 0.1 to 1 km inland. The width of the study area was selected based on an area bounded by the shoreline from the north and the contour line of about 10 – 20 m above sea level from the south, which represents the highest point on the first rocky ridge. The eastern coastal zone of Turkey, where the study area is located, may be divided into main physiographic part: an eastern part between Yalincak district and Trabzon city center (about 10 km east of Trabzon) (Figure 1).

MATERIALS AND METHODS

The graphical analyses which can take a long time with classical methods or CAD programs and the statistical informations produced after these methods can be available by the softwares which are important tools in GIS. The study area is selected on Trabzon eastern shore line, approximately 10 km length and 100 - 1000 m width. Graphic and nongraphic data required in this study are classified and digitised as coverages with Autocad programme according to their properties. Map sheets provided on the digital environment have been transformed and graphical corrections and area quality controls have been done. They have been made the topology of graphic datas by the Arc/Info programme as separate coverages. These map sheets' attribute information input on the Arc/View programme. Various samples to spatial query that can be available on the coastal areas with GIS are given.

RESULTS AND DISCUSSION

Violations of lands on the border line are calculated and confirmed in GIS environment easily. The violations can be detected by the determining the intersections between different coverages on the Arc/View programme with the help of intersect command (Figure 2). For example, if we think of making a study like this with the CAD programmes, to do the query above, separate areas must be transformed and calculated. This kind of study brings some negative results for working power and time. Among 127 parcels on the study area, 67 parcels were close to the shore border line. In 67 parcels of these 127 parcels, the shore border line was passing through out the landownership boundary. An area of 143651.93 m² (14.37 ha) of these lands were making violation of shore border line (Table 1) (Sesli, 2005).

Thus, a landownership is seen on the coast where there is no landownership and this shows that coastal areas are being used out of public benefit eventhough this is their main aim. Below the query about the violated lands is made with intersect or select by theme commands and the analysing and display of attributes and graphical data are made (Figure 3).

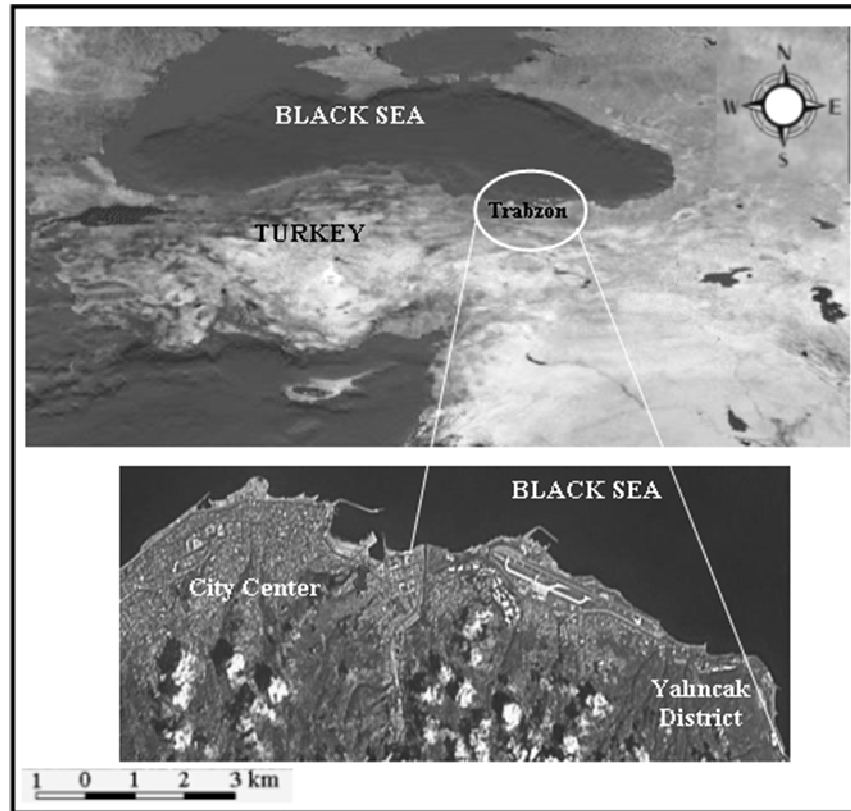


Figure 1. Location of study area.

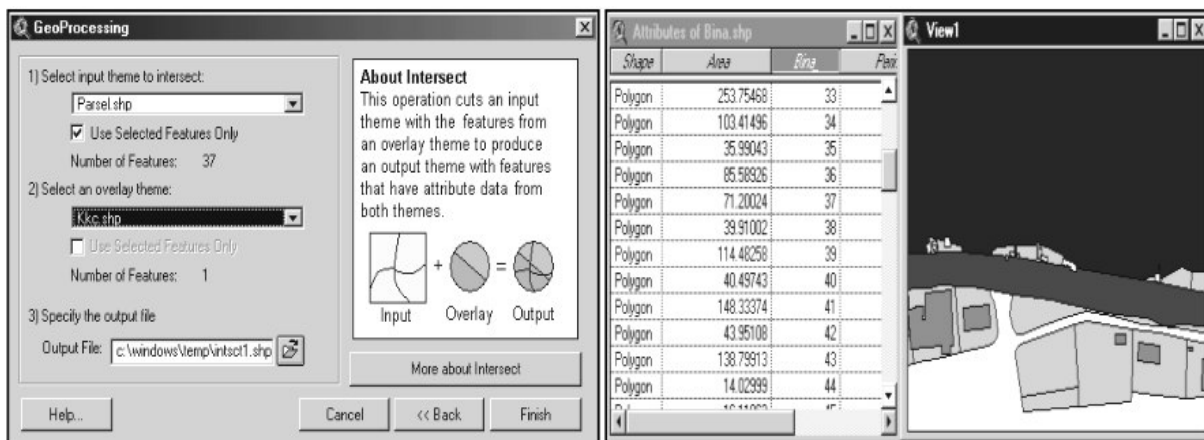


Figure 2. The using of intersect command and screening violation of shore border line.

Conclusion

In coastal areas, all kinds of analyses and query associated with these areas are available by using GIS technologies. By this way, meaningful plans can be made for the future. Some precautions must be taken and executed.

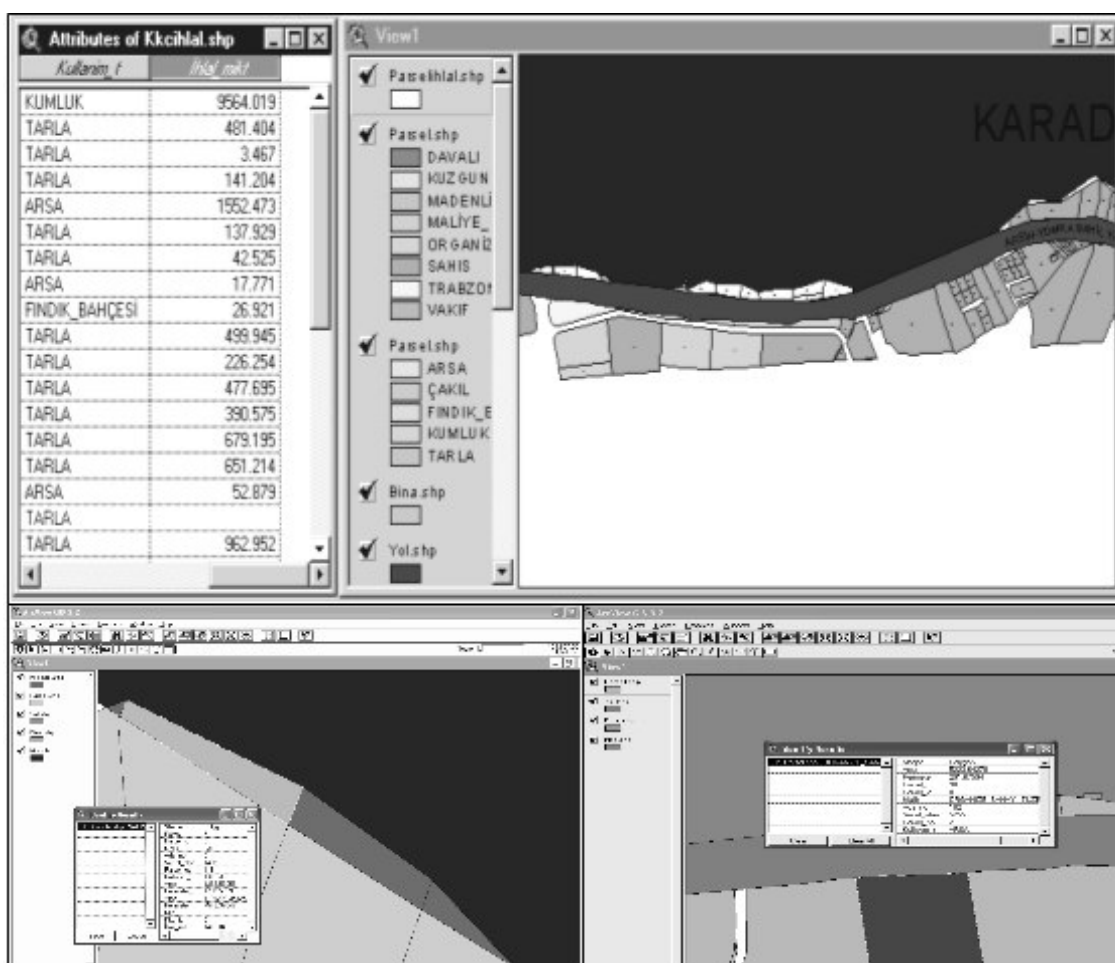
(1) Shore border line urgently must be detected; landownership boundary and their legal states must

immediately be defined clearly. The cadastre facilities about coastal region must be scrutinized.

(2) The information required for the management of coastal areas must be provided to be available to use the coastal areas for the public benefit. On the intensive coastal settlements, the studies to obtain data for the management of coasts are being performed with GIS. (3) The protection of natural balance on the coastal area and shore lines, the analyses of the land ownerships and the

Table 1. Violation areas of shore border line.

Land owner	Number of parcels	Violation area (m ²)
Public organization	25	63722.56
Citizens	11	17521.33
Public domain	31	62408.04
Total	67	143651.93

**Figure 3.** Interrogation of shore border line's violation.

decisions of planning associated with these studies can be realized with coastal management information systems.

(4) GIS and other information technologies for analyzing and querying functions related to coastal areas must be used.

(5) Coast is the place with no property and the goods in the benefit of the public are in no ones landownership and can never be a subject of a private landownership. Shore border line must be detected on all coastal region of Turkey. Land ownership boundary and their legal states must immediately be defined clearly. If there is an ownership on coast, this gives up public benefit.

(6) The information required for the management of coastal areas must be provided, to be available to use the coastal areas for the public benefit. On the intensive coastal settlements, the studies to obtain data for the management of coasts is being performed with GIS.

(7) Using the techniques of GIS technologies for analyzing and querying functions related to coastal areas must be used seems promising for detecting changes in the coastal zone.

(8) The protection of natural balance on the coastal area and shore lines, the analyses of the land ownerships and the decisions of planning associated with these studies can be realized with GIS technologies.

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