GIS BASED SECTORAL CONFLICT ANALYSIS IN A COASTAL DISTRICT OF TURKEY

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ABSTRACT:

Integrated coastal zone management (ICZM) has recently become an important topic in Turkey as the country is surrounded by seas from the three sides. An application of ICZM is done in this study for the selected district of Akcakoca along the Black Sea Coast of Turkey. A methodology developed within Tacis/EuropeAid projects (1998-2003) with the aim of supporting management decisions is tested in the overall project that is engaged to Istanbul Technical University (ITU) by the United Nations. Specifically in this paper emphasis is given to displaying the sectoral conflicts in the form of digital maps to the decision makers with the aim of presenting the actual land use activities. It is the duty of regional authorities to further develop spatial plans by utilizing the sectoral conflict maps. For this purpose, a baseline survey on the geological, climatic, hydrological conditions together with other environmental characteristics of the district are reviewed and further determined by the group of experts. At this stage, Remote Sensing (RS) and GIS technologies are used to produce necessary thematic maps. Besides, field trips are realized to the area to better evaluate the maps produced. Stakeholders meetings at each of the site visits are also organized by the Akcakoca Municipality to share the findings of the study.

1. INTRODUCTION

The findings that will be mentioned and discussed within the scope of this paper will be part of the outcomes of the Pilot Project on 'Testing of Methodology on Spatial Planning for Integrated Coastal Zone Management (ICZM)' engaged to Istanbul Technical University (ITU) as Consultants to perform the services required by the United Nations Office for Project Services (UNOPS). The project lasted 9 months in year 2007. One of the specific objectives of the project was to identify the sectoral conflicts between the competing types of nature management, the needs of inhabitants, and the demands of the contemporary and future generations in a selected coastal district along the Black Sea Coast of Turkey (Ozturk et al., 2007a).

The main objectives of the ICZM pilot project were (Ozturk et al., 2007b);

- To improve the protection of the marine environment and vulnerable coastal zone,
- To help in creating the common regional understanding of ICZM approach and its benefit to the area,
- To enhance and strengthen the capabilities of the regional authorities for the coastal planning and management,
- To contribute to the effective implementation of the Black Sea Strategic Action Plan in the pilot area

The specific objective of the ICZM pilot project is to develop a spatial plan for the identified territory of the Black Sea coastal zone using the "Methodology of Spatial Planning for Coastal Zones" developed within Tacis/EuropeAid projects (1998-2003) with the aim of supporting management decisions at a district unit related to land-use and natural resources by means of;

- Evaluation of resources availability adjusted for the present and future needs,
- Identification and resolution of conflicts between competing types of nature management, -between the needs of individuals and societies, and between the demands of the contemporary and future generations,
- Identification of the optimum development alternatives and selection of the most acceptable/suitable,
- Planning orientation for the realization of the desired and coordinated changes, and
- Continuous experience analysis and its adjustment to the prevailing situation (Ozturk et al., 2007b).

The general principles of coastal zone management are sustainable development, prevention, precaution, forecast, rehabilitation, polluter pays and user pays, use of the best available technology and the best environmental practices, information for the public and public participation, international cooperation. Besides, the principles specific to coastal zones are equitable distribution and sustainable management of common resources, hinterland development, protection of sensitive areas and threatened ecosystems and of habitats and species, priority for coastal-zone-dependent activities, unrestricted access to the shore, where appropriate. Within the framework of the Project, sectoral conflict analysis is followed by testing the methodology on spatial planning by means of generating importance and vulnerability maps various GIS layers. In this paper, only the sectoral conflicts determined via GIS will be introduced and discussed. The identification and analyses of the conflicts will form the basis of the paper where GIS based information system is utilized as the main tool to illustrate the findings.

2. THE STUDY AREA

The pilot area selected for the implementation of the Project is the Akcakoca district located along the Black Sea Coast of Turkey as shown in Figure 1. After the 1999 earthquake as Düzce is declared as the 81th province of Turkey in year 2000, Akçakoca has become one of the eight districts of Düzce Province. It has a coastline of approximately 30 km length. The central town is located on rocky soil formation except some structures established along the river beds and the coastline. The central town is at an elevation of 80-90 m. The soil surrounding the centre is composed of sand, stone and partly limy and clayey soil. The bottom of the creek valleys are highly formed of alluvium, the slope of the hills is of silica formation and the top of the hills is composed of sandy and gravely layers. The dominating climate of the town is moderate sea climate. Even tough the region is at a transient condition between Marmara and Black Sea Regions, the western Black Sea climate characteristics are dominating in the region.

Almost 12.8 % of the town's land is covered with Soil Capability Class of I, II and III, known as agricultural soil (Ozturk et al., 2007c). The rest 86.6 % belong to soil classes of IV, VI and VII. Soils of Classes I and II surround the valley beds. Land up to classes VII are used for hazelnut growing which is the dominant agricultural activity in the region. There is lush vegetation cover in the town because of the abundant rainy climate. The coastline of the district is mostly covered with hazelnut fields and pristine forests. The distribution of tree types in the forests is 43% beech, 6% oak, 1% poplar, 0.8% hornbeam, 0.4% plain-tree, 0.25% linden-tree and, 0.1% chestnut-tree (Ozturk et al., 2007c).

The population of the town has been increasing since 1985. After 1990, especially between years 1997–2000, rapid population increase is observed. The reason of this increase is migration from Düzce centre to Akçakoca and its seaside after the 1999 Earthquake (Ozturk et al., 2007c).

In 1985–1997, rate of population increase in Akçakoca centre was comparatively higher than the Düzce centre. Besides, Akçakoca among the other Düzce districts is the second district in terms of migration from villages to the town. Table 1 indicates the urban, rural and total population of Akçakoca in 1990 and 2000, according to the census figures together with annual rate of population increase between these years (Ozturk et al., 2007c).

Table 1. Urban, rural and total population of Akçakoca in 1990 and 2000 census of population and annual rate of population increase (SIS, 2002)

	1990 Population	2000 Population	Annual Rate of Population Increase (‰) between 1990-2000
Total	32.839	43.895	29,01
Urban	13.582	25.560	63,21
Rural	19.257	18.335	-4,90

The most important means of livelihood are hazelnut cultivation and fishery. 90 % of economical structure is based on hazelnut cultivation. As income from hazelnut cultivation was satisfactory enough for the families' years ago, tourism did not develop well as has been suggested. However, as families started to disintegrate, income gained from hazelnut groves became insufficient. Decreasing of income from hazelnut cultivation caused people to find other new economic sources. Nowadays, the other important economic sources are tourism activities and poultry husbandry (Ozturk et al., 2007d).

It is important to note at this section that the inhabitants wish to reduce unemployment rate in their town which seems to be possible by increasing the tourism investments without destroying and damaging the natural environment, and to establish hazelnut processing plants as soon as possible.

There are 8 industries established in Akçakoca. These are hazelnut and bait processing industries together with pipe and steel manufacturing plant. Especially, the pipes manufactured in the district are exported that supplies an important economic income to the district.

Figure 1. The location of the Study Area

3. DATA AND METHODOLOGY USED FOR SECTORAL CONFLICTS

The methodology followed in this project is summarized below.

- Development of a GIS data base,
- Displaying environmental, land-use, and socio economic data on maps using GIS thematic layers,
- Identifying conflicting uses and presentation of these uses via GIS layers,
- Development of prioritising uses, based on analysis of natural and economic resources and land-use features,
- Development of spatial plans (functional land-use zones), using primary information and evaluation of conflicting land uses, and display via GIS layers,
- Incorporating opinion of stakeholders in iterative series of refinements to land-use plans.

The GIS based information system is developed, tested and put into operation to support management decisions related to land-use planning, functional zoning and utilization of natural resources in a sustainable manner. The database provides support for the development of coastal zone management of the area. During the development of database; initially, collected spatial data and attributes were entered into the system. Data used in this study has been collected from various sources. Soil Map scaled 1:25000 is obtained in digital form. Standard

Topographic Maps used 1:25000 scaled, were obtained as hard copies and converted into digital form via digitizing. All different map data were transferred to UTM coordinate system and merged with the previous digital data. GIS is based on relational database. The developed GIS database contains several layers such as administrative boundaries, sub-watershed boundaries, topography, soil characteristics, land use/cover, transportation network, water resources and streams, 1:25000 scaled soil map (produced from the map of former General Directorate of Rural Affairs), dump site, wastewater treatment plants, etc. In a general sense, digital elevation model is the digital and three-dimensional expression of the surface of the land. By means of elevation information, it is possible to create new data, carry out evaluations about the study area that would not otherwise be possible through two-dimensional analysis and find out the topography of the area. Within the Project time, 3 site visits and surveys are realized by the consultants of the Project. At each visit, stakeholders meeting have been also arranged by the representatives of the Municipality (Ozturk et al., 2007a). In this study, digital elevation model was merged with LANDSAT TM image taken the year of 2006 and this 3D view of the study area is shown in Figure 2.

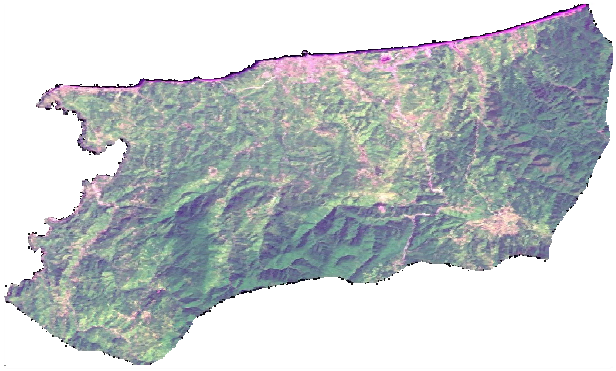

Figure 2. LANDSAT satellite image of Akçakoca (2006)

A detailed baseline survey on the geographical, socio-demographic, economic, and ecological status of the district is carried out together with an investigation of the polluting sources prior to conflict analyses. The main sectors active in the district are mainly agricultural activities (hazelnut cultivation is the dominating activity), forestry, tourism and fishery besides urban and rural residential sites.

The sectoral conflicts occur between agriculture-agriculture, agriculture-forestry, agriculture-tourism, agriculture-industry, and industry-industry. Besides, conflicts are observed in the land-use distribution and infrastructural status of the district. Figure 3 is an example of the conflict display reflecting the conflict between forestry-agriculture. Due to economic demand and better living standards, the inhabitants unfortunately tend to use part of the forestry for hazelnut cultivation. Similarly, hazelnut cultivation is not recommended at higher slopes as such an application increases the rate of erosion and hazelnut trees are not suitable plants to hinder erosion. Figure 4 on the other hand shows the conflict between high erodibility and hazelnut cultivation. It is an example indicating that in reality part of the highly eroded land is used for hazelnut cultivation. Another property of hazelnut is that it can be cultivated in higher soil classes (> Class V) as it does not need fertile land. However, the inhabitants practice hazelnut cultivation on soil Class of I (Figure 5) and on soil Class I, II and III (Figure 6) (Ozturk et al., 2007e).

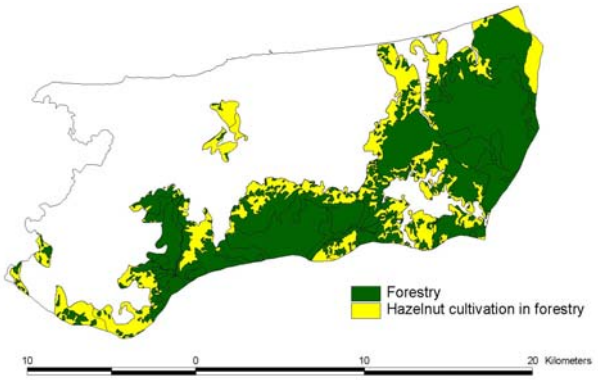

Figure 3. Hazelnut cultivation in forestry areas

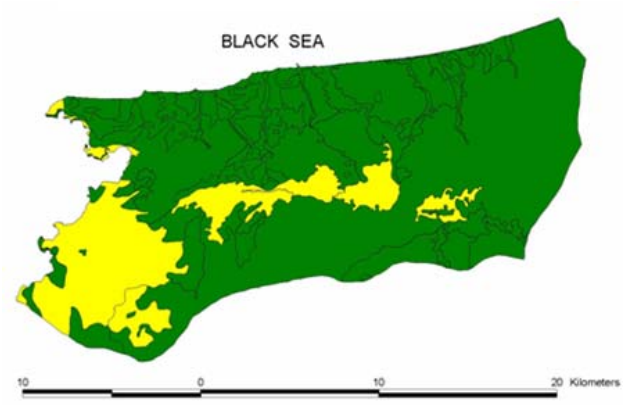

Figure 4. Hazelnut cultivation land with high erodibility

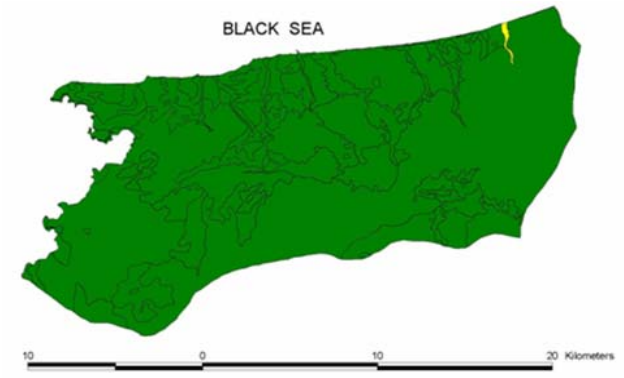

Figure 5. Hazelnut cultivation area on soil of land capability Class I

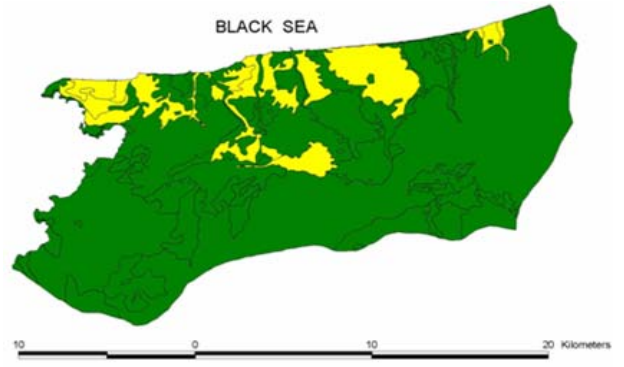

Figure 6. Hazelnut cultivation area on soil of land capability Classes I, II, III

4. CONCLUSIONS

Such studies integrating GIS technology to field surveys and data gathered from different sources lead to presentation and display of the sectoral conflicts. Similar work highly contributes to especially the decision-makers related in the management of coastal regions. The outputs of this study indicate conflicts that may be further used as a decision-support tool in spatial planning activities.

On the basis of the results of the different pilot projects and implementation of the methodology some criteria and indicators of the coastal zone management can be developed. It is not an easy task to develop some general criteria and indicators but a comparative evaluation of the pilot projects may help to develop the criteria and indicators of ICZM.

Besides experience gained in this project, the team of experts recommends addressing some issues for future studies. As this methodology has been deployed in different countries and in different cities of the Black Sea region, it will be interesting to harmonize the findings and experiences within the countries that have already tested the methodology. A comparative evaluation may help to define and clarify the applicability of the methodology.

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