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A case study in natural coastline of Enez–Kesan districts by using natural threshold analysis

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ABSTRACT

Study area takes place in coastal line of Enez–Kesan districts starting from Dalyan Lake region which was also legally declared as wetland conservation zone of Maritza basin. In this study, nearly 56 km of coastal development in Enez – Kesan, located northern part of Saros Bay, is evaluated according to the ecological threshold analysis. Despite the ecological and socio-cultural importance of the region, transformation of the ecological quality is getting more noticeable. Mapping of Morphological structure are performed from General Directorate of Soil and Water surveys including Slope, Erosion and Land Use Capability Classification data. Furthermore, anthropogenic effects (industrial and residential zones etc.) and natural areas (forestry, wetlands etc.) are determined using SPOT 5 imagery acquired in 2006. The methodology involves covering the study area with grids and potential land evaluation charts. These charts are assessed by "Usage Value Analysis for Supporting Method of Planning" and obtain total usage value of the lands. Adverse effects on natural potential lands depending on current land use at the study zone appraised for strategic environmental assessment. Study is aimed to analyze development dynamics and natural thresholds affected by physical geography in coastal line of Enez – Kesan districts including also wetlands, natural areas. Study indicates proposals according to the landscape assessments. Additionally, legal tools applied on the study area are provided to pose the effects of legal impediments and to establish the question of law.

1. Introduction

In recent decades human activities are limited due to the environmental impact intensity. The anthropogenic pressures mostly surround the natural flora and fauna and suffocate them swiftly. Environmental degradation is reducing acceleration of sustainable development and threatens future development process (Martino et al., 2007). Impacts on environment due to the intensity level (cause) to regulate the environmental balance in local/global regions. Some regulations protect the rich agricultural soil type, natural beauty, forest lands, habitats, species, water basins etc. In the late 1960's legal protection was followed quickly in the USA and European countries (Tarlock, 2009). The Netherland Indies (Indonesia) was the first country to designate protected areas: the Dutch colonial government passed protected area legislation between 1916 and 1933. Subsequently, the Suharto New Order Government (1967–1998) adopted a science-based protected area policy and expanded the designated area to nearly 10% of the terrestrial land area in the form of national parks, wildlife sanctuaries and nature reserves (Jepson and Whittaker, 2002; Jepson et al., 2002). In the 1990's Protected areas (national parks, nature reserves, etc.) are characteristics of the modern nation state; 169 of 171 countries had protected areas and supporting legislation (IUCN, 2004). In Turkey, lands having a rich biological diversity of historical, cultural and natural values have been designated by various organizations and institutions under different categories and statuses of conservation and preservation. At present, 16 different conservation statuses are classified in the resource values of Turkey. These statuses are announced in line with national and international legislations (Yalınkılıç and Yenilmez Arpa, 2005). Through its World Commission on Protected Areas (WCPA) (one of six commissions of IUCN) IUCN International Union for Conservation of Nature has developed six Protected Area Management Categories that describe protected areas according to their management objectives (IUCN, 2004). The categories (Strict Nature Reserve, Wilderness Area, National Park, Natural Monument or Feature, Habitat/

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Species Management Area, Protected Landscape/Seascape, Protected Area with sustainable use of natural resources) create international standards for protected areas and encourage conservation planning according to their management aims (Dudley, 2008).

One of the land use forms of the protected areas is wetlands. Wetlands have many functions such as preventing floods by holding water like a sponge, providing the area for migration or reproduction of many animals that live in other habitats, controlling erosion by wetland plants, cleaning the water by filtering out sedimentation, decomposing vegetative matter and converting chemical into usable form (Çamur-Elipek et al., 2010). Moreover discrete wetlands (lakes, ponds, and oxbow lakes) can provide a range of ecological services and also ensure the preservation of biodiversity (Semlitsch and Bodie, 1998; Leibowitz, 2003).

Human activities cause habitat fragmentation which has been widely considered as a major threat for biodiversity and ecosystem conservation (e.g. Spies et al., 1994; Lathrop and Bognar, 1998; Phua and Minowa, 2004). Ecologists, environmental scientists, geographers, and economists are still debating the role of anthropogenic factors versus natural disturbances in ecological dynamics (Botkin, 1990; Phillips, 1991) and the effects of modeling strategies on conclusions (Pahl-Wostl, 1995; Bascompte and Sole, 1998; Sui and Zeng, 2001). Regulatory agencies (AXYS Environmental Consulting, 2001; Srebotnjak et al., 2010; Environment Canada, 2011), non-governmental organizations (Environmental Law Institute, 2003) and ecologists (Boutin and Hebert, 2002; Lindenmayer and Luck, 2005; Duinker and Greig, 2006; Rompré et al., 2010) have proposed that ecological and natural thresholds can support the development of legislation and planning to limit the human activities.

Threshold analysis was the first developed evaluation technique in 1945 by Boleslaw Malisz. The threshold theory of Malisz has emerged from the purpose of developing an effective co-operation between physical planners, economists and the requirements to simplify the long term planning methods (Kozlowski and Hughes, 1972).

The natural threshold analysis has features including the evaluation of natural assets depending on the importance of the region, grading and is also a property of main data source and a route for taking decisions of protection-use after analyzing. Natural Threshold Synthesis is a technique which handles life support systems and natural risk areas within the scope of natural thresholds. This technique is used to moderate the emerging pressure on the natural structure and resources in irreparable levels and to eliminate it over time (IBB, 2006). It is possible to associate numerical data which has geographic and multi parameter features for taking decisions of protection and use it to reach the ideal area information, with queries and alternatives. Numerical data are entered into the data base according to the rules of the Geographic Information System (GIS) in Natural threshold analysis and new data can be produced from query models by experts.

Natural threshold analysis is a result stage that must be implemented after entering the analytical data. Parameters, which are affecting and directing the planning activities, are natural objects and risks as well as some existing land use patterns. Therefore the performed analysis is called as a natural threshold analysis (Unsal and Kurucu, 2012).

Threshold analysis can allow quantitative assessment for evaluating whether environmental changes will have critical consequences on ecosystem dynamics and can identify conservation targets (Groffman et al., 2006; Denoel and Ficetola, 2007). Potential conservation areas are generated using thresholds for delineating potential new protected areas.

Conservation optimization techniques (e.g. Ive et al., 1989; Boyce, 1995; Kangas et al., 2000) can be used to produce the best management plan to balance conservation and economic activities on the multiple use area (Phua and Minowa, 2004). An important aspect of conservation planning is the evaluation and selection of conservation areas using a set of criteria termed criteria-based evaluation (Bibby, 1998; Phua and Minowa, 2004). Criteria and indicators of natural threshold can be evaluated with easily accessible remotely sensed data sets using GIS. A GIS is capable of determining criteria-based evaluation for prioritization and analysis of (potential) conservation areas in spatial conservation. GIS-based multicriteria decision making approach can solve planning problems. The GIS-based multi-criteria decision-making approach allows incorporation of decision makers, experts or other stakeholders into the conservation planning. This may help in preventing and reducing conflicts between the sectors because the potential protected areas are based on mutual agreements and compromises (Maikhuri et al., 2000).

2. Study area and materials

The study area is located in southwest part of the Sub Thrace Region in Turkey which has coordinates between west longitudes of 26°02′12.95″ – 26°46′27.10″ and north latitude of 40°43′45.95″–40°39′23.06″. The study area, situated on coastal line of Aegean Sea, North West borders of Turkey has area of 586,45 km^2 (Fig. 1). Greece and Gelibolu–Canakkale are neighborhoods of the study region. The Marmara Water Basin borders in Sub Thrace Region determine the border of study area to provide the integrity of the study in the region. Settlement pattern of the region is based on rural structure and the residential areas are scattered in the region.

2.1. Geological and geo-morphological features

The Enez Basin opened along the southern margin of the former Thrace basin as an E-W-trending half graben during the middle Miocene. The age and geometry of this basin corresponds to the extensional basins of the Aegean graben system to the south. Stratigraphy and structures related to the North Anatolian fault indicate that the fault started to be active since Pliocene and modified older structures. The fault zone evolved in two stages in and around the Gulf of Saros (Tuysuz et al., 1998). However in the study region there is not any active fault line.

2.2. Soil structure

Largest areas in the study area are non-calcareous brown forest soil which is 96%. The rest of the lands are hydromorphic and alluvial soils. Productive lands are 69% of the study area (I. Class 8%, II. class 29% and III class 32%) in regard to the Land Use Capability Class legend.

2.3. Weather – atmospheric condition

Generally the Aegean coast of Thrace Region is under the influence of Mediterranean Climate. Generally summers are hot and dry, winters are rainy and mild. Climate features help to provide a variety of economic activities in the region. Average monthly temperatures in Enez are ranges from 4° C to 24.6° C.

As can be seen from Table 1 the highest temperature is seen in July the lowest temperature is in January. Warm and humid winds from South and South West affect the area. Average temperatures as well as especially high and low temperatures play a significant role in agriculture (Proutsos et al., 2010). Agricultural life does not affect the region adversely from high and low temperature. High