Determination of Plant Sensitivity In Protected Areas For Land Management: Kaş-Kekova Region

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Key words: Land Management, Spatial Planning, Protected Area, Biodiversity, Ecologial Corridoor, Spatial Analyzing, Management Plan

SUMMARY

In the protected areas, it is performed a lot of works which are conservation of plant genetic diversity, biodiversity and protection of living quarters of threatened plant and animal species, to determine the protection area and realized the land management plan. These natural data are classified according to various classification methods to determine areas of absolute protection, vulnerable zones, ecological corridors etc. However, the thematic maps are often created only by visualization of the data for use in land management decisions and physical planning.

In fact, it would be true that spatial analysis of all data of natural values would be performed with mathematical models. It is possible to use mathematical models based on the spatial data of flora and fauna data.

With this study, it is shown that the boundaries of absolute protected areas, vulnerable zones, ecological corridors and similar protected areas in protected areas are obtained by plant sensitivity maps according to spatial analysis and modelling of available plant species (main biotope, endemic indicator, endangered species etc.) and preparation of management plans with geographical information technologies and implementation of land management criteria according to spatial data.

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1-INTRODUCTION

The nature protection system brings with the process of spatial decision making and analysis. Increasing the right decision-making capacity provides protection-use balancing and land management. For this reason, firstly, the acquisition of spatial-ecological decisions about the protected area is examined. The first step in understanding ecological processes is to define spatial patterns. In this study, the spatial analysis of ecological data with mathematical approaches is introduced to identify and determine the spatial patterns of plant and animal ecology.

For this purpose, an examination of the biodiversity inventory put forward in previous research studies of Kaş-Kekova region, the spatial analysis of flora and fauna points data in the direction of the Bird Directive, the Habitat Directive and IUCN (World Nature Conservation Union) Euoropean Union Nature Information System) classification maps; According to the IUCN threat categories, studies on the establishment of thematic bases and taking protection measures have been carried out.

The major contributions of the present paper pertain to methodological development for analysing ecological networks, and the results are relevant for formulating suggestions for the protection and planning of ecological networks at the regional level. The objectives of this study were to propose a feasible and rapid method for identifying landscape ecological network elements; analyse the spatial configuration of ecological networks using an integrated density index of landscapes; and propose significant suggestions for the protection and planning of ecological networks in the Kaş-Kekova Region.

2-STUDY AREA: KAŞ-KEKOVA REGION

Kaş-Kekova Region is in Antalya province in Turkey. Study area is approximately 260 km2, the Kale-Ucagiz settlements along the coast of the Special Environmental Protection Area, as well as surrounding and covered villages are inland.

Belonging to 51 families, 187 types and 272 species were identified within SEPA. 26 of these species are endemic to our country. Two species have been identified as a new record for Turkey. In addition, there are 20 mammal species, 96 bird species, 16 reptiles and 4 amphibian species.

20 mammal and 96 bird species were detected in the region and in this species there is no endemic species to our country. Capra aegagrus mammal (wild goat), according to the IUCN categories of threat, is in "Vulnerable (VU) category.

Kaş-Kekova Region also contains 4 amphibian and 16 reptile species. Lyciasalamandra luschani (Black Salamander) in IUCN category VU (Vulnerable) is endemic to our country.

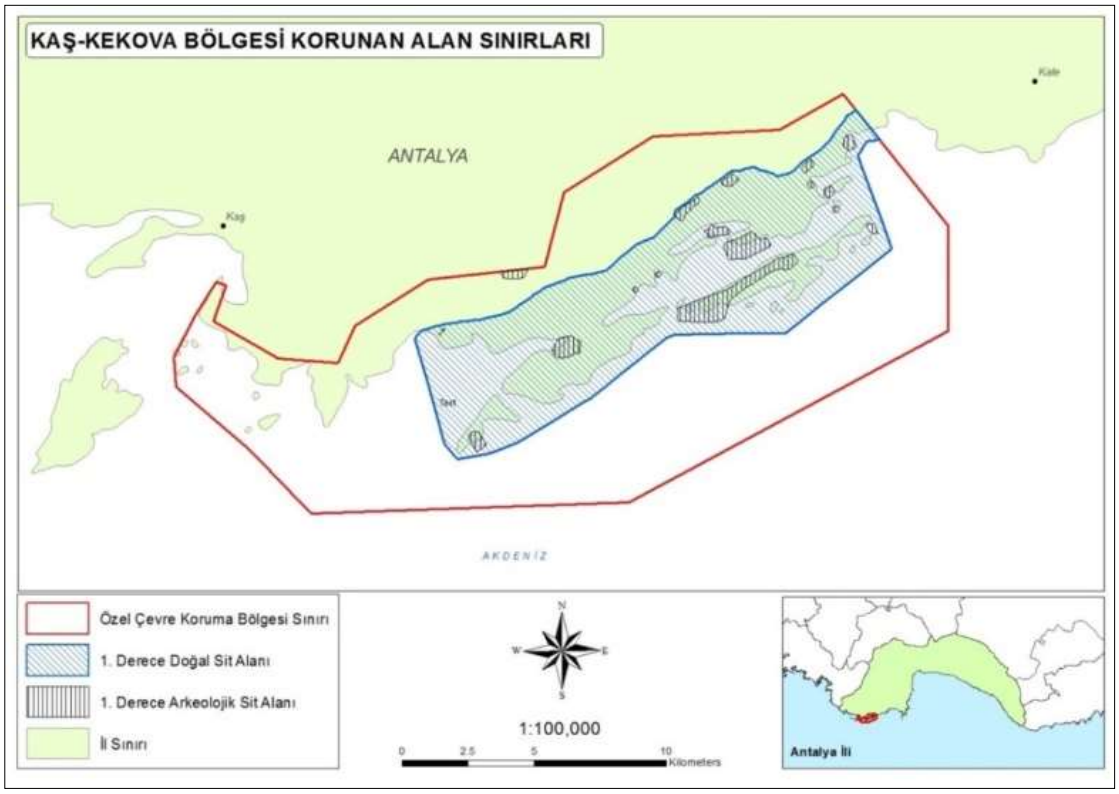


Fig.1. Protected Areas of Kaş-Kekova Region.

3-MATERIAL AND METHODS

The first and essential material of this study is the preparation of the management plan and physical plan to provide in a protected area;

- Investigation of biodiversity (flora and fauna) data obtained directly from field works
- Determination of the hot spots in the study area

is a spatial analysis of ecological data with mathematical approaches to identify and characterize the spatial patterns and patterns of plant and animal ecology.

The secondary material of the study was formed by analyzing the data related to the application field in order to determine the values existing within the scope of physical, social, environmental and land ownership. In the field of application, past research studies and numerical data have been provided, mapping of data has been provided with the results of remote sensing, and thematic bases for effective area conservation and planning have been obtained.

3.1. Data Collection

The study area is under the responsibility of the Ministry of Environment and Urbanization, which is in the stage of planning within the scope of the thesis and which is under the risk of deterioration or disappearance due to pressures such as industry, tourism and settlement with ecological precaution in our country and in the World. Kaş-Kekova Special Environmental Protection Area, which is one of the protected areas with social and physical problems in terms of ownership and land use. The quality of point data obtained by the research and biodiversity studies carried out within Kaş-Kekova Special Environmental Protection Region has been effective in selecting the field of application.

3.2. Spatial Data Analysing

Spatial data obtained from field studies were used in the evaluation of natural sites in the scope of the study area, within the scope of Kaş-Kekova Special Environmental Protection Region Biological Diversity Detection Project (2008-2010).

Examination of protected area boundaries of Kaş-Kekova region, investigation of past and current aerial photographs and / or satellite images, observation of protected area boundary changes with remote sensing techniques, visualization of changes are provided.

Data analysis was carried out within the scope of Kaş-Kekova Region considering the needs of all the numerical data provided for the protected area. The site and data analysis of the spatial data of important / endemic / endangered plant species were made up to date (if at the same time as the images) produced. The supplied data are extracted so as to be within the working area, and the points of the working area are confirmed.

The data sets in which the existing digital data are stored are evaluated and the necessary geographic data inventory for the database design to be edited in the research is taken. This data inventory; information about the geometry of the data, the coordinate system, the information about the relevant unit. A single database has been created for all data to be used in spatial data analysis and the creation of thematic maps.

Aetheorhizo bulbosae-Pinetum brutiae (forest vegetation), Quercus aucheri-Oleetum europaeae (maquis vegetation), Alysso-Genistetum acanthocladae (furigana vegetation) and Salicornietum ramosissimae (halofit vegetation) communities are exist in the area. Aetheorhizo bulbosae-Pinetum brutiae and Quercus aucheri-Oleetum europaeae communities are endemic for Turkey.

Spatial data analysis studies are carried out through different spatial phenomena and spatial relations. Spatial events are examined in two groups, discrete and continuous. Discrete events include the identification of phenomena by geographical objects, which are expressed as continuous data surfaces.

When analyzing data to understand spatial phenomena, the analyzes include data expressed by points, lines and area. The distribution of plant species, the epicenter of earthquakes, diseases, accidents are expressed as discrete points. The methods used in spatial statistics are generally divided into three categories according to the type of spatial data being analyzed (Bailey and Gatrel, 1995):

- Point Pattern Analysis
- Spatially Continous / Geostatistical Data Analysis
- Area Data Analysis

It was decided that the spatial analysis of the flora and fauna points in the study area covering Kaş-Kekova region will be realized by Point Pattern Analysis. In analyzing any point pattern; testing the hypothesis of distribution; a three-step approach consisting of visualization of points, analysis of distri- butions, analysis and testing system. In this direction, necessary studies have been carried out and the testing of spatial analysis and analysis has been completed.

Fig.2. Visualization of endemic flora data.

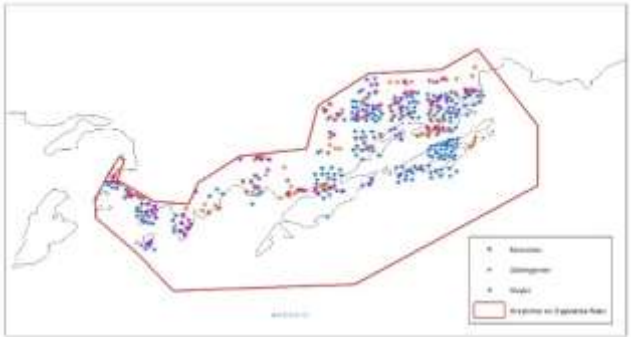


Fig.3. Visualization of endemic fauna data.

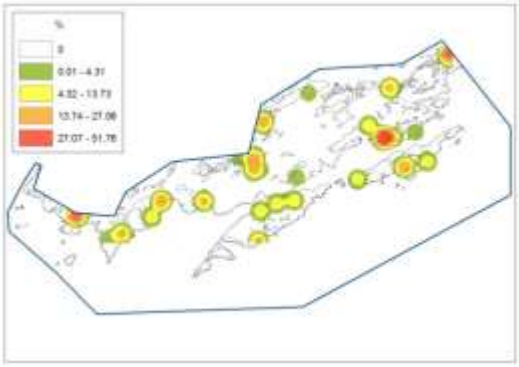
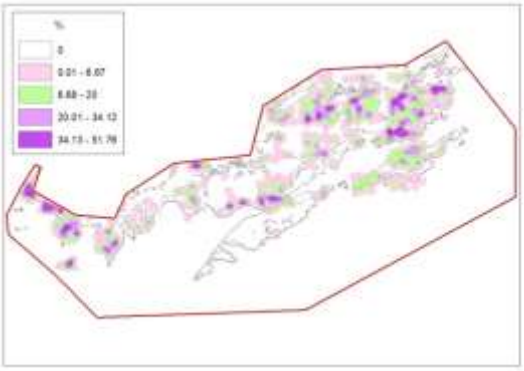
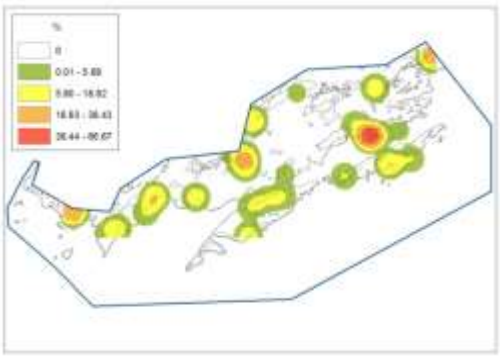
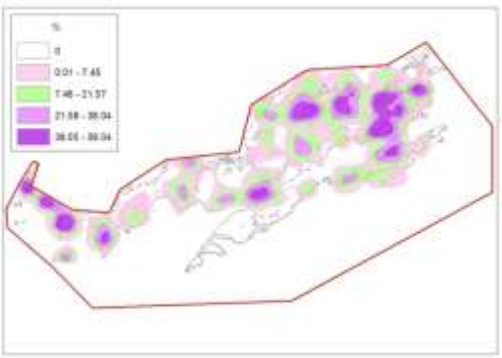
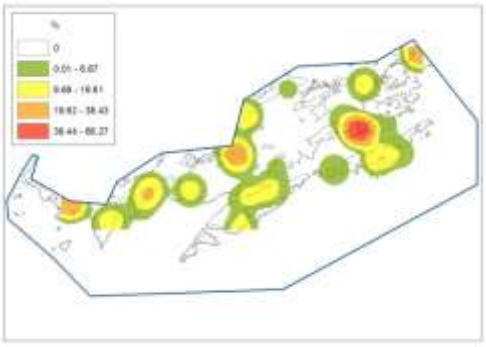
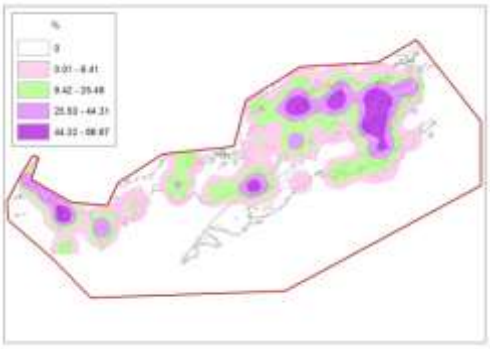
Fixed Kernel Estimation (FKE) for Flora data (Bandwidth Size: 800, 1200 ve 1500 m)	Fixed Kernel Estimation (FKE) for Fauna data (Bandwidth Size: 400, 800 ve 1200 m)
	
	
	

Table.1. Fixed Kernel Estimation (FKE) for biodiversity data.

In the same way, the Core Density Estimation Method developed for the detection of flora and fauna points was used for the detection of hot spots. The density zones produced in ArcMap at 400m, 800m and 1200m band width of the spatial fauna data, respectively. The percentage of density is classified by natural fracture method.

In this study, it is aimed to process the steps of point analysis in spatial statistics. This aim has been achieved through biodiversity data. In this study, it has been determined that the endemic plant species and ecologically preserve areas in Kaş-Kekova region concentrate in certain

regions. If the areas that are concentrated at the first level are sensitive areas and will explain the general definition; the west of the study area, the area between Surrounding-Üçağız-Kale-İnlidere Mevkii-İnişdibi, the eastern part of the surrounding area, the east part of Kapaklı, the Üzümiskelesi-Barakiskelesi areas, the Sıcak peninsula and the northern part of the peninsula, and the northern part of Sahilkılınçlı.

It has been demonstrated and verified here that the point deconstruction analyzes of data expressed in discrete points in plant ecology and the phenomena related to each other represent a meaningful relationship, basically indicating the cluster of points corresponding to the complete spatial randomness hypothesis.

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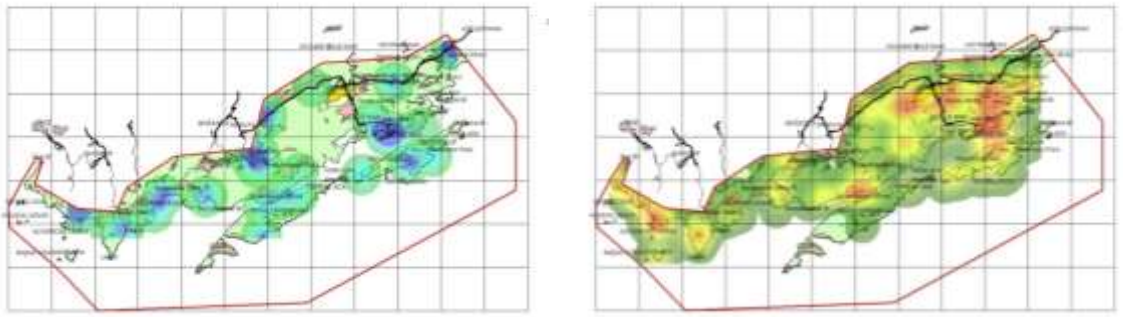

Fig.4. Hotspots for flora and fauna data.

3.3.Determination of Plant Sensitivity And Ecological Corridors

The plant susceptibility maps obtained by spatial analyzes are obtained from the Kaş-Kekova Special Environmental Protection Area Biodiversity Detection Project (2008-2010); the results obtained in the study were compared to sensitive zone boundaries, IUCN threat categories and land use maps of plant communities in the region, EUNIS habitat classes, plant species, mammalian and bird species and amphibian and reptile species.

Although the preservation of the protected areas is guaranteed by law, estimates should be made taking into consideration some criteria, the situation of protected areas should be analyzed in the future and evaluations should be carried out to sustain the ecological functions. The main purpose of the ecological corridors is to reconnect each other's natural habitats with each other. Thus, the continuity of biodiversity is ensured by reestablishing connections of living communities that are separated from each other. Ecological corridors were determined by evaluating the endemic fauna data and threat categories within the scope of the study area together with the plant susceptibility maps obtained as a result of the spatial analysis.

The density of habitat pattern reflects the degree of spatial clustering of habitats. In order to identify the natural landscape elements and to analyze the spatial configuration of the ecological networks, vector data representing the study area and covering the entire area was used. For spatial analysis, the boundaries of the region were selected from biodiversity-based classifications and remote sensing techniques and selected from the forest, maquis, halophyte and frigana vegetation databases.

Table 2. Plant Communities of Kaş-Kekova Region

Plant Community	Community Name
Forest vegetation	Aetheorhizo Bulbosae-Pinetum Brutiae
Maquis vegetation	Quercus aucheri-Oleetum europaeae
Furigana vegetation	Alysso-Genistetum acanthocladae
Halofit vegetation	Salicornietum ramosissimae

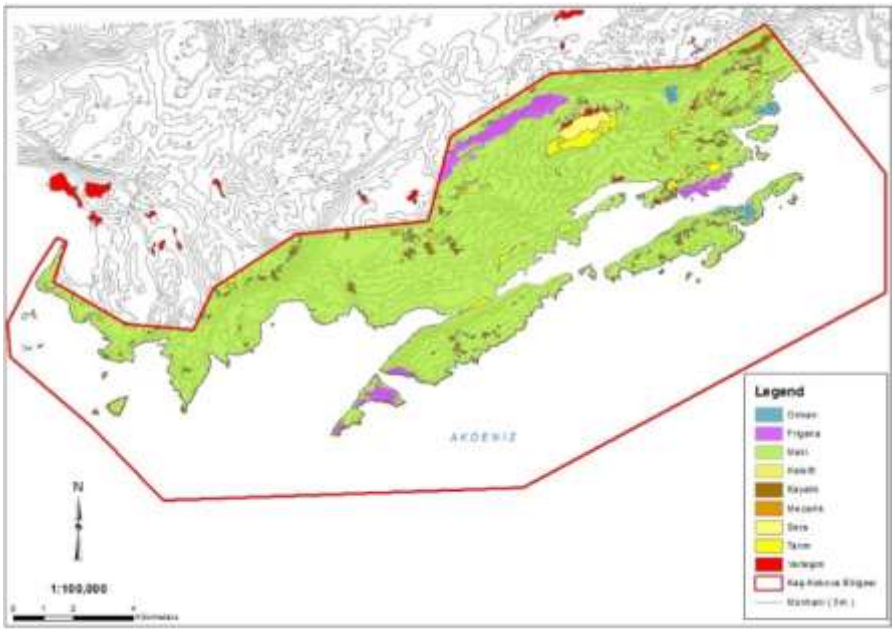

Fig.5. Landuse of Kaş-Kekova Region.

Table.3. Kaş-Kekova Region Landuse Ratio

Landuse	Area (ha)	Ratio (%)
Forest	8.229,5	82,4
Olive groves	533,8	5,3
Frigana	343,6	3,4
Rocky places	404,4	4,0
Bataklık	2,0	0,0
Sand	0,3	0,0
Agriculture fields	317,6	3,2
Greenhouses	120,7	1,2
Settlement	36,8	0,4
Graveyard	0,6	0,0
Toplam	**9.989**	**100**

The size of terrestrial area is 9,989 hectares. 73.9% of this area is the status of the State Forest, 14.5% private land, 6.1% treasure land and 5.5% 2-B land.

Looking at the current land use situation of the region, forests with a share of 82.4% area occupy very large portion. Forests are followed by olive groves, phrygana, rocky places, agricultural fields and greenhouses.

There are fourteen different EUNIS habitat classes in the area. F5.2-Maquis habitat is the most common habitat of the area. F7.3-East Mediterranean phrygana, G5.6-Early-stage natural and semi-natural woodlands and regrowth, G3.7-Lowland to montane mediterranean pine woodland (excluding black pine Pinus nigra), B3.2-Unvegetated rock cliffs, ledges, shores and islets and A2.54-Low-mid saltmarshes are other important habitats.

The density of landscape reflects the spatial aggregation degree of habitats. To identify the landscape elements and analyse the spatial configuration of the ecological networks, forest, maquis, halophyte and frigana vegetation were selected from the landscape type database of the

Kaş-Kekova region. The density of landscapes was calculated using the Kernel Density Estimation(KDE) method. The KDE results were divided into five levels by the natural break classification method. The landscapes with high density were regarded as core habitats, the landscapes with medium-high density were regarded as buffer habitats, the landscapes with medium density were regarded as ecological corridors, the landscapes with medium-low density were regarded as stepping stones, and the landscapes with low density were regarded as isolated elements. Then, the landscape elements of the ecological network were identified to analyse their spatial characteristics in the region. The integrated density index (Landscape Density Index, LDI) was calculated by overlaying the above four landscape density maps and was applied to divide different ecological areas by the natural breaks method. The core area, buffer zone, corridor, and isolated area made up the spatial configuration of the ecological networks. Then, the characteristics of the spatial configuration were analysed by overlaying the current landscape, topography, road density and population density data. Finally, several suggestions for the protection and planning of ecological networks were made based on the results of the above analysis. Maquis plant community, especially the main habitat and buffer patterns, supports the entire ecological network in Kaş-Kekova region and links ecological corridors. (Fig.7).Higher density values and better natural landscape spatial continuity can be found in the north-eastern part of the study area. In the western and southern-western regions, small-core habitats and buffer patterns lead to partial breakage in ecological corridors. The smallest intensity values and isolated maquis patterns are scattered in the middle of the study area. Maquis vegetation is the transition area of forest, frigana, halophyte and maquis core living areas. As ecological corridors, maquis connects different patterns.

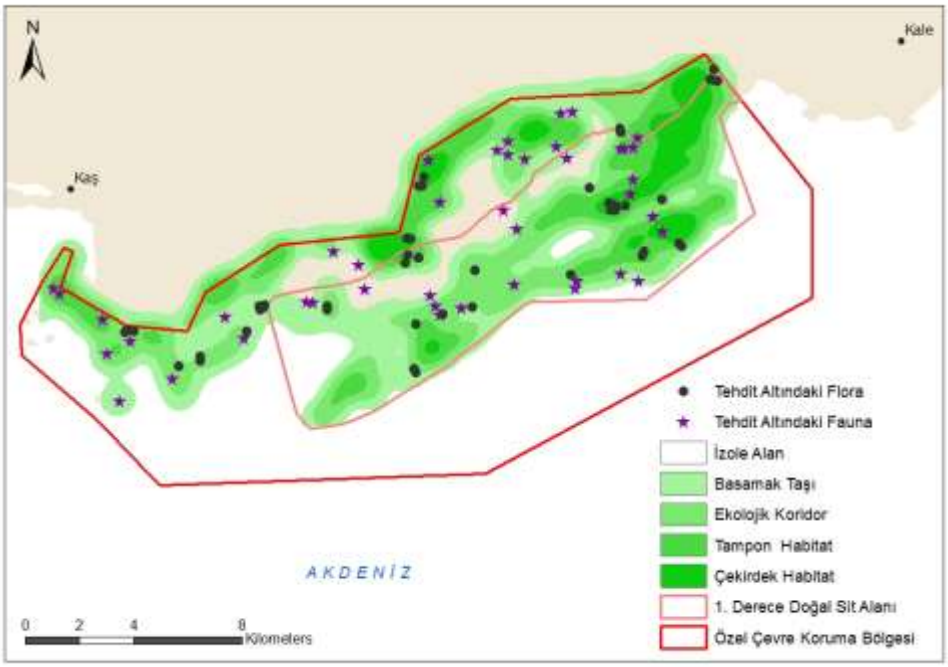

Fig.7. Results of representative landscapes based on kernel density estimations and IUCN Categories of Critical and Endangered Species.

4-RESULTS

Suggestions for the protection of core areas, buffer zones, ecological corridors and isolated elements are made according to the spatial characteristics of the landscapes by analysing the spatial configuration of the ecological networks in the Kaş-Kekova Region.

Considering the Kas-Kekova Conservation Synthesis Map, protected area boundaries should be extended according to ecological corridors with endangered species and habitats. According to the results of spatial analysis, spatial interpretation and protection strategy were developed and results were obtained for effective land management.

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BIOGRAPHICAL NOTES

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